

# THE COMET HANDBOOK FOR 2019

# 彗星年表 2019

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## Index to Ephemerides:

Comet 95P/(2060) Chiron	1
Comet 174P/(60558) Echeclus	2
Comet C/2011 KP36 (Spacewatch)	3
Comet C/2014 R3 (PANSTARRS)	4
Comet C/2014 OE4 (PANSTARRS)	5
Comet C/2014 B1 (Schwartz)	6
Comet C/2016 N4 (MASTER)	7
Comet 65P/Gunn	8
Comet C/2016 A1 (PANSTARRS)	9
Comet C/2015 V1 (PANSTARRS)	10
Comet C/2017 K6 (Jacques)	11
Comet C/2017 K4 (ATLAS)	12
Comet 130P/McNaught-Hughes	13
Comet 74P/Smirnova-Chernykh	14
Comet C/2015 O1 (PANSTARRS)	15
Comet C/2018 E1 (ATLAS)	16
Comet C/2015 XY1 (Lemmon)	17
Comet 37P/Forbes	18
Comet C/2016 R2 (PANSTARRS)	19
Comet 240P/NEAT	20
Comet 159P/LONEOS	21
Comet 164P/Christensen	22
Comet C/2017 M5 (TOTAS)	23
Comet 370P/NEAT	24
Comet P/2017 TW13 (Lemmon)	25
Comet 361P/Spacewatch	26
Comet 49P/Arend-Rigaux	27
Comet C/2016 N6 (PANSTARRS)	28
Comet C/2016 M1 (PANSTARRS)	29
Comet 48P/Johnson	30
Comet 243P/NEAT	31
Comet 21P/Giacobini-Zinner	32
Comet 368P/NEAT	33
Comet 59P/Kearns-Kwee	34
Comet 371P/LINEAR-Skiff	35
Comet P/2018 P3 (PANSTARRS)	36
Comet 369P/Hill	37
Comet 300P/Catalina	38
Comet 64P/Swift-Gehrels	39
Comet 38P/Stephan-Oterma	40
Comet P/2019 A2 (ATLAS)	41

Comet 247P/LINEAR	42
Comet C/2018 L2 (ATLAS)	43
Comet C/2018 V1 (Machholz-Fujikawa-Iwamoto)	44
Comet 60P/Tsuchinshan	45
Comet 46P/Wirtanen	46
Comet 137P/Shoemaker-Levy	47
Comet 375P/Hill	48
Comet C/2018 X3 (PANSTARRS)	49
Comet P/2018 Y2 (Africano)	50
Comet 239P/LINEAR	51
Comet 374P/Larson	52
Comet C/2018 A3 (ATLAS)	53
Comet 171P/Spahr	54
Comet C/2017 M4 (ATLAS)	55
Comet 131P/Mueller	56
Comet 223P/Skiff	57
Comet C/2017 B3 (LINEAR)	58
Comet 123P/West-Hartley	59
Comet C/2018 Y1 (Iwamoto)	60
Comet P/1996 R2 (Lagerkvist)	61
Comet 149P/Mueller	62
Comet C/2018 P5 (PANSTARRS)	63
Comet C/2010 U3 (Boattini)	64
Comet C/2018 V4 (Africano)	65
Comet P/2012 O1 (McNaught)	66
Comet 29P/Schwassmann-Wachmann	67
Comet C/2019 B1 (Africano)	68
Comet 78P/Gehrels	69
Comet 232P/Hill	70
Comet 373P/Rinner	71
Comet P/2014 C1 (TOTAS)	72
Comet P/2017 U3 (PANSTARRS)	73
Comet C/2016 X1 (Lemmon)	74
Comet 186P/Garradd	75
Comet P/2012 O2 (McNaught)	76
Comet C/2018 W1 (Catalina)	77
Comet 222P/LINEAR	78
Comet C/2018 R3 (Lemmon)	79
Comet 209P/LINEAR	80
Comet 231P/LINEAR-NEAT	81
Comet P/2000 R2 (LINEAR)	82
Comet 261P/Larson	83
Comet P/1999 R028 (LONEOS)	84

Comet 31P/Schwassmann–Wachmann	85
Comet C/2018 X2 (Fitzsimmons)	86
Comet C/2018 A6 (Gibbs)	87
Comet P/2007 T4 (Gibbs)	88
Comet 200P/Larsen	89
Comet P/2006 F4 (Spacewatch)	90
Comet 264P/Larsen	91
Comet 163P/NEAT	92
Comet 168P/Hergenrother	93
Comet P/2012 K3 (Gibbs)	94
Comet 25D/Neujmin	95
Comet C/2018 W2 (Africano)	96
Comet C/2018 KJ3 (Lemmon)	97
Comet 260P/McNaught	98
Comet P/2008 Y1 (Boattini)	99
Comet P/2010 U2 (Hill)	100
Comet P/2000 S4 (LINEAR–Spacewatch)	101
Comet P/2005 GF8 = 2018 X1 (LONEOS)	102
Comet 175P/Hergenrother	103
Comet P/2014 U2 (Kowalski)	104
Comet P/2009 SK280 (Spacewatch–Hill)	105
Comet P/2006 S1 (Christensen)	106
Comet 76P/West–Kohoutek–Ikemura	107
Comet 68P/Klemola	108
Comet C/2018 N2 (ASASSN)	109
Comet P/2003 F2 (NEAT)	110
Comet 155P/Shoemaker	111
Comet 215P/NEAT	112
Comet 294P/LINEAR	113
Comet P/2013 T2 (Schwartz)	114
Comet 160P/LINEAR	115
Comet C/2018 F4 (PANSTARRS)	116
Comet P/2006 H1 (McNaught)	117
Comet 289P/Blanpain	118
Comet P/2006 R1 (Siding Spring)	119
Minor Planet (6478) Gault	120
Comet 101P/Chernykh	121
Comet C/2017 T2 (PANSTARRS)	122
Comet 246P/NEAT	123
Comet C/2018 U1 (Lemmon)	124
Comet C/2017 K2 (PANSTARRS)	125

Comet 95P/(2060) Chiron

Epoch = 2019 July 16.0 TT  
 T = 1996 Feb. 21.28082 TT  
 Peri. = 339.82020  
 Node = 209.21970 2000.0  
 Incl. = 6.94545  
 q = 8.4752936 AU  
 e = 0.3801195  
 a = 13.6724636 AU  
 n = 0.01949548  
 P = 50.56 years

H = 5.8 , G = 0.15

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		V	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	23 47.52	+02 12.1	19.030	18.748	+0.10	+0.4	18.9	71.9
Jan. 17	23 48.67	+02 17.2	19.192	18.751	+0.13	+0.6	18.9	62.1
Jan. 27	23 50.10	+02 24.2	19.340	18.754	+0.16	+0.8	18.9	52.3
Feb. 6	23 51.75	+02 33.0	19.470	18.756	+0.18	+1.0	18.9	42.6
Feb. 16	23 53.61	+02 43.3	19.580	18.759	+0.19	+1.1	18.8	33.0
Feb. 26	23 55.61	+02 54.8	19.665	18.761	+0.21	+1.2	18.8	23.5
Mar. 8	23 57.72	+03 07.3	19.725	18.764	+0.22	+1.3	18.8	14.2
Mar. 18	23 59.89	+03 20.5	19.757	18.767	+0.22	+1.3	18.7	5.4
Mar. 28	00 02.08	+03 34.0	19.762	18.769	+0.22	+1.4	18.7	5.8
Apr. 7	00 04.24	+03 47.7	19.739	18.772	+0.21	+1.4	18.8	14.5
Apr. 17	00 06.31	+04 01.1	19.690	18.774	+0.20	+1.3	18.8	23.6
Apr. 27	00 08.28	+04 13.9	19.615	18.777	+0.19	+1.2	18.8	32.7
May 7	00 10.08	+04 26.0	19.518	18.779	+0.17	+1.2	18.9	41.9
May 17	00 11.69	+04 37.1	19.400	18.781	+0.15	+1.0	18.9	51.1
May 27	00 13.07	+04 46.8	19.265	18.784	+0.12	+0.9	18.9	60.3
June 6	00 14.20	+04 55.0	19.116	18.786	+0.10	+0.7	18.9	69.6
June 16	00 15.04	+05 01.5	18.957	18.788	+0.07	+0.5	18.9	78.9
June 26	00 15.57	+05 06.1	18.794	18.791	+0.04	+0.4	18.9	88.3
July 6	00 15.80	+05 08.7	18.629	18.793	0.00	+0.1	18.8	97.7
July 16	00 15.70	+05 09.2	18.468	18.795	-0.03	-0.1	18.8	107.3
July 26	00 15.29	+05 07.7	18.316	18.797	-0.06	-0.3	18.8	116.9
Aug. 5	00 14.58	+05 04.0	18.176	18.799	-0.09	-0.5	18.7	126.6
Aug. 15	00 13.60	+04 58.4	18.054	18.801	-0.11	-0.7	18.7	136.4
Aug. 25	00 12.38	+04 51.0	17.953	18.803	-0.13	-0.8	18.7	146.4
Sept. 4	00 10.97	+04 42.0	17.877	18.805	-0.15	-1.0	18.6	156.3
Sept. 14	00 09.42	+04 31.8	17.828	18.807	-0.16	-1.1	18.6	166.3
Sept. 24	00 07.79	+04 20.8	17.809	18.809	-0.16	-1.1	18.5	175.5
Oct. 4	00 06.15	+04 09.3	17.820	18.811	-0.16	-1.2	18.5	172.2
Oct. 14	00 04.57	+03 57.9	17.861	18.813	-0.15	-1.1	18.6	162.3
Oct. 24	00 03.11	+03 46.9	17.931	18.815	-0.14	-1.1	18.6	152.0
Nov. 3	00 01.84	+03 36.8	18.028	18.817	-0.12	-0.9	18.7	141.8
Nov. 13	00 00.80	+03 28.0	18.149	18.819	-0.09	-0.8	18.7	131.5
Nov. 23	00 00.04	+03 20.9	18.290	18.821	-0.06	-0.6	18.8	121.2
Dec. 3	23 59.60	+03 15.6	18.447	18.822	-0.03	-0.4	18.8	110.9
Dec. 13	23 59.49	+03 12.4	18.615	18.824	+0.01	-0.2	18.8	100.8
Dec. 23	23 59.71	+03 11.4	18.789	18.826	+0.04	0.0	18.8	90.6
Jan. 2	00 00.27	+03 12.6	18.963	18.827	+0.07	+0.2	18.9	80.6
Jan. 12	00 01.15	+03 16.0	19.132	18.829	+0.10	+0.5	18.9	70.6
Jan. 22	00 02.33	+03 21.4	19.291	18.831	+0.13	+0.7	18.9	60.8
Feb. 1	00 03.77	+03 28.7	19.437	18.832	+0.16	+0.8	18.9	51.0
Feb. 11	00 05.44	+03 37.8	19.563	18.834	+0.18	+1.0	18.9	41.3
Feb. 21	00 07.31	+03 48.3	19.669	18.835	+0.20	+1.1	18.8	31.8
Mar. 2	00 09.32	+03 59.9	19.750	18.837	+0.21	+1.2	18.8	22.3
Mar. 12	00 11.43	+04 12.5	19.805	18.838	+0.21	+1.3	18.8	13.0
Mar. 22	00 13.59	+04 25.6	19.833	18.839	+0.22	+1.3	18.7	4.3

## Comet 174P/(60558) Echeclus

Epoch = 2019 July 16.0 TT  
 T = 2015 Apr. 21.92482 TT  
 Peri. = 162.82605  
 Node = 173.29641 2000.0  
 Incl. = 4.34322  
 q = 5.8109040 AU

e = 0.4565848  
 a = 10.6933041 AU  
 n = 0.02818618  
 P = 34.97 years

H = 9.1 , G = 0.15

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		V	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	03 51.92	+15 36.0	7.635	8.336	-0.18	-0.2	18.5	132.9
Jan. 17	03 50.50	+15 35.6	7.794	8.363	-0.10	+0.1	18.6	122.4
Jan. 27	03 49.88	+15 38.1	7.969	8.390	-0.02	+0.4	18.7	112.2
Feb. 6	03 50.08	+15 43.3	8.155	8.417	+0.07	+0.7	18.8	102.1
Feb. 16	03 51.10	+15 51.2	8.347	8.444	+0.15	+0.9	18.8	92.3
Feb. 26	03 52.89	+16 01.2	8.540	8.471	+0.22	+1.1	18.9	82.7
Mar. 8	03 55.41	+16 13.1	8.729	8.498	+0.29	+1.3	18.9	73.3
Mar. 18	03 58.58	+16 26.5	8.912	8.525	+0.35	+1.4	19.0	64.2
Mar. 28	04 02.34	+16 40.8	9.082	8.552	+0.40	+1.5	19.0	55.2
Apr. 7	04 06.59	+16 55.6	9.238	8.579	+0.45	+1.5	19.0	46.4
Apr. 17	04 11.26	+17 10.6	9.377	8.606	+0.49	+1.5	19.0	37.8
Apr. 27	04 16.27	+17 25.4	9.496	8.633	+0.52	+1.5	19.0	29.3
May 7	04 21.53	+17 39.7	9.594	8.660	+0.54	+1.4	19.0	21.0
May 17	04 26.97	+17 53.1	9.670	8.687	+0.55	+1.3	18.9	12.9
May 27	04 32.51	+18 05.5	9.722	8.714	+0.56	+1.2	18.9	5.5
June 6	04 38.08	+18 16.6	9.750	8.741	+0.55	+1.0	18.9	5.7
June 16	04 43.59	+18 26.4	9.754	8.768	+0.55	+0.9	19.0	13.0
June 26	04 48.97	+18 34.6	9.736	8.795	+0.53	+0.7	19.0	21.1
July 6	04 54.15	+18 41.3	9.694	8.821	+0.50	+0.6	19.1	29.3
July 16	04 59.05	+18 46.4	9.632	8.848	+0.47	+0.4	19.1	37.6
July 26	05 03.60	+18 49.9	9.551	8.875	+0.43	+0.3	19.1	46.0
Aug. 5	05 07.72	+18 51.8	9.452	8.902	+0.38	+0.1	19.2	54.5
Aug. 15	05 11.33	+18 52.3	9.339	8.929	+0.33	0.0	19.2	63.2
Aug. 25	05 14.36	+18 51.5	9.214	8.956	+0.27	-0.2	19.2	72.1
Sept. 4	05 16.75	+18 49.4	9.081	8.982	+0.20	-0.3	19.1	81.2
Sept. 14	05 18.44	+18 46.2	8.944	9.009	+0.13	-0.4	19.1	90.5
Sept. 24	05 19.39	+18 42.1	8.807	9.036	+0.05	-0.5	19.1	100.0
Oct. 4	05 19.56	+18 37.2	8.675	9.063	-0.03	-0.5	19.0	109.8
Oct. 14	05 18.95	+18 31.6	8.553	9.089	-0.10	-0.6	19.0	119.7
Oct. 24	05 17.59	+18 25.7	8.445	9.116	-0.18	-0.6	18.9	129.9
Nov. 3	05 15.54	+18 19.4	8.357	9.143	-0.24	-0.6	18.9	140.3
Nov. 13	05 12.90	+18 13.2	8.292	9.169	-0.29	-0.6	18.8	150.9
Nov. 23	05 09.81	+18 07.1	8.254	9.196	-0.33	-0.6	18.7	161.5
Dec. 3	05 06.42	+18 01.4	8.246	9.223	-0.35	-0.5	18.7	171.5
Dec. 13	05 02.93	+17 56.4	8.270	9.249	-0.35	-0.4	18.6	173.7
Dec. 23	04 59.53	+17 52.4	8.325	9.276	-0.33	-0.3	18.7	164.3
Jan. 2	04 56.40	+17 49.6	8.411	9.302	-0.29	-0.2	18.9	153.7
Jan. 12	04 53.72	+17 48.2	8.525	9.329	-0.24	-0.1	18.9	143.0
Jan. 22	04 51.61	+17 48.3	8.663	9.355	-0.18	+0.1	19.0	132.4
Feb. 1	04 50.18	+17 50.0	8.823	9.381	-0.10	+0.3	19.1	121.9
Feb. 11	04 49.47	+17 53.4	8.998	9.408	-0.03	+0.4	19.2	111.7
Feb. 21	04 49.53	+17 58.1	9.185	9.434	+0.05	+0.6	19.3	101.6
Mar. 2	04 50.33	+18 04.2	9.377	9.460	+0.12	+0.7	19.3	91.8
Mar. 12	04 51.86	+18 11.3	9.570	9.487	+0.19	+0.8	19.4	82.2
Mar. 22	04 54.05	+18 19.2	9.759	9.513	+0.25	+0.8	19.4	72.8

## Comet C/2011 KP36 (Spacewatch)

Epoch = 2019 July 16.0 TT  
 T = 2016 May 26.76119 TT  
 Peri. = 180.56833 e = 0.8735967  
 Node = 173.35285 2000.0 a = 38.6026781 AU  
 Incl. = 18.98178 n = 0.00410940  
 q = 4.8795059 AU P = 239.84 years

$$m_1 = 4.6 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	04 49.61	+01 24.6	7.356	8.133	-0.25	+1.1	18.0	139.9
Jan. 17	04 47.44	+01 37.5	7.506	8.183	-0.18	+1.5	18.1	130.8
Jan. 27	04 45.97	+01 54.5	7.676	8.232	-0.10	+1.9	18.2	121.4
Feb. 6	04 45.28	+02 14.7	7.861	8.281	-0.03	+2.2	18.3	112.0
Feb. 16	04 45.39	+02 37.4	8.058	8.330	+0.06	+2.4	18.3	102.6
Feb. 26	04 46.29	+03 01.5	8.262	8.380	+0.13	+2.5	18.4	93.4
Mar. 8	04 47.96	+03 26.3	8.468	8.429	+0.21	+2.5	18.5	84.4
Mar. 18	04 50.33	+03 51.1	8.671	8.479	+0.27	+2.5	18.6	75.6
Mar. 28	04 53.34	+04 15.2	8.869	8.528	+0.33	+2.3	18.6	67.0
Apr. 7	04 56.92	+04 38.1	9.056	8.578	+0.39	+2.2	18.7	58.6
Apr. 17	05 00.99	+04 59.1	9.231	8.627	+0.43	+2.0	18.8	50.5
Apr. 27	05 05.46	+05 18.0	9.390	8.677	+0.47	+1.8	18.8	42.7
May 7	05 10.26	+05 34.4	9.532	8.727	+0.49	+1.5	18.9	35.2
May 17	05 15.30	+05 48.1	9.654	8.776	+0.51	+1.2	19.0	28.3
May 27	05 20.51	+05 58.8	9.755	8.826	+0.53	+0.9	19.0	22.3
June 6	05 25.81	+06 06.6	9.834	8.876	+0.53	+0.6	19.0	18.2
June 16	05 31.12	+06 11.1	9.891	8.925	+0.53	+0.3	19.1	17.2
June 26	05 36.37	+06 12.5	9.925	8.975	+0.52	0.0	19.1	19.7
July 6	05 41.50	+06 10.8	9.937	9.025	+0.50	-0.3	19.1	24.8
July 16	05 46.41	+06 06.1	9.928	9.074	+0.48	-0.6	19.2	31.3
July 26	05 51.06	+05 58.4	9.898	9.124	+0.45	-0.9	19.2	38.4
Aug. 5	05 55.36	+05 48.0	9.849	9.174	+0.41	-1.2	19.2	46.1
Aug. 15	05 59.25	+05 35.0	9.783	9.223	+0.36	-1.4	19.2	54.0
Aug. 25	06 02.66	+05 19.9	9.702	9.273	+0.31	-1.6	19.2	62.2
Sept. 4	06 05.52	+05 02.9	9.610	9.323	+0.25	-1.8	19.2	70.6
Sept. 14	06 07.78	+04 44.4	9.509	9.373	+0.19	-1.9	19.2	79.2
Sept. 24	06 09.39	+04 25.0	9.403	9.422	+0.12	-2.0	19.2	88.0
Oct. 4	06 10.32	+04 05.2	9.297	9.472	+0.05	-2.0	19.2	97.1
Oct. 14	06 10.53	+03 45.6	9.194	9.522	-0.02	-1.9	19.2	106.3
Oct. 24	06 10.04	+03 26.9	9.099	9.571	-0.09	-1.8	19.2	115.6
Nov. 3	06 08.86	+03 09.8	9.018	9.621	-0.15	-1.6	19.2	125.0
Nov. 13	06 07.07	+02 55.1	8.954	9.670	-0.21	-1.3	19.2	134.2
Nov. 23	06 04.73	+02 43.2	8.911	9.720	-0.26	-1.0	19.2	143.2
Dec. 3	06 01.98	+02 34.9	8.894	9.770	-0.29	-0.6	19.2	151.2
Dec. 13	05 58.97	+02 30.4	8.904	9.819	-0.31	-0.2	19.3	157.2
Dec. 23	05 55.84	+02 30.1	8.944	9.869	-0.31	+0.2	19.3	159.0
Jan. 2	05 52.76	+02 33.9	9.014	9.918	-0.30	+0.6	19.3	155.7
Jan. 12	05 49.91	+02 41.6	9.112	9.968	-0.27	+1.0	19.4	149.0
Jan. 22	05 47.43	+02 52.8	9.238	10.017	-0.22	+1.3	19.4	140.5
Feb. 1	05 45.44	+03 07.1	9.388	10.067	-0.17	+1.6	19.5	131.4
Feb. 11	05 44.02	+03 23.8	9.558	10.116	-0.11	+1.8	19.6	122.0
Feb. 21	05 43.24	+03 42.2	9.745	10.165	-0.04	+1.9	19.6	112.5
Mar. 2	05 43.12	+04 01.6	9.944	10.215	+0.03	+2.0	19.7	103.1
Mar. 12	05 43.67	+04 21.3	10.149	10.264	+0.09	+2.0	19.7	93.9
Mar. 22	05 44.85	+04 40.8	10.357	10.313	+0.15	+1.9	19.8	84.8

## Comet C/2014 R3 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2016 Aug. 8.65256 TT  
 Peri. = 113.40108  
 Node = 334.11219 2000.0  
 Incl. = 90.83745  
 q = 7.2754000 AU  
 e = 0.9998985

$$m1 = -1.1 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	11 06.39	+21 02.4	8.515	9.121	-0.34	+0.4	18.0	125.4
Jan. 17	11 02.66	+21 06.9	8.424	9.157	-0.41	+0.5	18.0	136.0
Jan. 27	10 58.24	+21 12.3	8.357	9.194	-0.48	+0.6	18.0	146.4
Feb. 6	10 53.26	+21 17.6	8.318	9.231	-0.52	+0.5	18.0	156.4
Feb. 16	10 47.89	+21 21.5	8.311	9.267	-0.55	+0.3	18.0	164.8
Feb. 26	10 42.34	+21 23.0	8.336	9.305	-0.56	0.0	18.0	167.5
Mar. 8	10 36.80	+21 21.2	8.394	9.342	-0.54	-0.4	18.1	161.8
Mar. 18	10 31.51	+21 15.4	8.485	9.379	-0.51	-0.8	18.1	152.6
Mar. 28	10 26.63	+21 05.3	8.605	9.417	-0.46	-1.2	18.2	142.6
Apr. 7	10 22.32	+20 51.0	8.752	9.455	-0.39	-1.7	18.2	132.3
Apr. 17	10 18.69	+20 32.5	8.921	9.493	-0.32	-2.1	18.3	122.1
Apr. 27	10 15.81	+20 10.2	9.107	9.531	-0.25	-2.4	18.4	112.1
May 7	10 13.70	+19 44.6	9.305	9.570	-0.17	-2.7	18.5	102.2
May 17	10 12.36	+19 16.0	9.510	9.608	-0.09	-3.0	18.5	92.5
May 27	10 11.75	+18 44.9	9.717	9.647	-0.02	-3.2	18.6	83.1
June 6	10 11.83	+18 11.7	9.921	9.686	+0.04	-3.4	18.7	73.7
June 16	10 12.51	+17 36.7	10.118	9.725	+0.10	-3.6	18.7	64.6
June 26	10 13.74	+17 00.4	10.303	9.764	+0.15	-3.7	18.8	55.6
July 6	10 15.44	+16 23.0	10.473	9.804	+0.19	-3.8	18.9	46.7
July 16	10 17.51	+15 44.8	10.626	9.843	+0.23	-3.9	18.9	37.9
July 26	10 19.90	+15 06.1	10.758	9.883	+0.25	-3.9	19.0	29.1
Aug. 5	10 22.51	+14 27.1	10.867	9.923	+0.27	-3.9	19.0	20.5
Aug. 15	10 25.27	+13 48.2	10.952	9.963	+0.28	-3.9	19.1	11.9
Aug. 25	10 28.11	+13 09.5	11.011	10.003	+0.29	-3.8	19.1	4.2
Sept. 4	10 30.95	+12 31.3	11.044	10.043	+0.28	-3.8	19.1	6.8
Sept. 14	10 33.72	+11 54.0	11.051	10.083	+0.27	-3.7	19.2	15.2
Sept. 24	10 36.33	+11 17.8	11.032	10.124	+0.25	-3.6	19.2	24.0
Oct. 4	10 38.73	+10 43.0	10.989	10.164	+0.22	-3.4	19.2	33.0
Oct. 14	10 40.83	+10 09.9	10.922	10.205	+0.19	-3.2	19.2	42.2
Oct. 24	10 42.56	+09 38.9	10.835	10.246	+0.15	-3.0	19.2	51.5
Nov. 3	10 43.86	+09 10.2	10.731	10.287	+0.10	-2.7	19.2	61.0
Nov. 13	10 44.64	+08 44.1	10.613	10.328	+0.05	-2.4	19.2	70.7
Nov. 23	10 44.87	+08 21.0	10.485	10.369	-0.01	-2.1	19.2	80.6
Dec. 3	10 44.48	+08 01.1	10.352	10.411	-0.07	-1.8	19.2	90.7
Dec. 13	10 43.45	+07 44.5	10.220	10.452	-0.14	-1.5	19.2	101.0
Dec. 23	10 41.76	+07 31.3	10.094	10.494	-0.21	-1.1	19.2	111.5
Jan. 2	10 39.42	+07 21.4	9.980	10.535	-0.27	-0.8	19.2	122.1
Jan. 12	10 36.48	+07 14.7	9.883	10.577	-0.33	-0.5	19.2	132.9
Jan. 22	10 33.00	+07 10.8	9.808	10.619	-0.37	-0.2	19.2	143.9
Feb. 1	10 29.09	+07 09.5	9.761	10.661	-0.41	0.0	19.3	154.9
Feb. 11	10 24.88	+07 09.9	9.743	10.703	-0.43	+0.1	19.3	165.9
Feb. 21	10 20.52	+07 11.6	9.758	10.745	-0.44	+0.2	19.3	176.0
Mar. 2	10 16.17	+07 13.8	9.807	10.787	-0.43	+0.2	19.4	171.1
Mar. 12	10 11.99	+07 15.9	9.888	10.830	-0.40	+0.2	19.4	160.4
Mar. 22	10 08.11	+07 17.1	10.001	10.872	-0.37	+0.1	19.4	149.6



Comet C/2014 OE4 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2016 Dec. 12.00133 TT  
 Peri. = 65.83226  
 Node = 240.39168 2000.0  
 Incl. = 81.34510  
 q = 6.2465418 AU  
 e = 1.0019139

$$m1 = -0.9 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	23 20.69	+64 45.2	7.832	8.053	+1.03	-6.6	17.2	99.5
Jan. 17	23 31.22	+63 42.7	7.956	8.094	+1.08	-5.9	17.2	94.5
Jan. 27	23 42.15	+62 47.5	8.087	8.135	+1.11	-5.1	17.3	89.3
Feb. 6	23 53.38	+62 00.1	8.224	8.176	+1.13	-4.3	17.4	83.8
Feb. 16	00 04.79	+61 20.7	8.362	8.217	+1.15	-3.5	17.4	78.2
Feb. 26	00 16.28	+60 49.1	8.500	8.259	+1.15	-2.7	17.5	72.7
Mar. 8	00 27.79	+60 25.1	8.634	8.301	+1.15	-2.0	17.6	67.3
Mar. 18	00 39.23	+60 08.3	8.761	8.343	+1.14	-1.3	17.6	62.2
Mar. 28	00 50.54	+59 58.3	8.879	8.386	+1.12	-0.7	17.7	57.5
Apr. 7	01 01.67	+59 54.5	8.987	8.428	+1.10	-0.1	17.8	53.4
Apr. 17	01 12.53	+59 56.3	9.082	8.471	+1.07	+0.5	17.8	50.0
Apr. 27	01 23.07	+60 03.1	9.162	8.514	+1.03	+0.9	17.9	47.5
May 7	01 33.22	+60 14.5	9.227	8.557	+0.99	+1.4	17.9	46.0
May 17	01 42.90	+60 29.9	9.276	8.600	+0.94	+1.7	18.0	45.7
May 27	01 52.04	+60 48.6	9.308	8.644	+0.88	+2.0	18.0	46.6
June 6	02 00.53	+61 10.3	9.324	8.688	+0.81	+2.3	18.0	48.7
June 16	02 08.28	+61 34.5	9.323	8.732	+0.73	+2.5	18.1	51.8
June 26	02 15.17	+62 00.4	9.308	8.776	+0.64	+2.7	18.1	55.7
July 6	02 21.09	+62 27.6	9.277	8.820	+0.53	+2.8	18.1	60.4
July 16	02 25.90	+62 55.4	9.234	8.864	+0.41	+2.8	18.1	65.7
July 26	02 29.46	+63 23.1	9.181	8.909	+0.28	+2.7	18.2	71.4
Aug. 5	02 31.65	+63 49.6	9.118	8.953	+0.14	+2.6	18.2	77.5
Aug. 15	02 32.36	+64 14.0	9.050	8.998	-0.01	+2.3	18.2	83.9
Aug. 25	02 31.51	+64 34.9	8.978	9.043	-0.17	+1.9	18.2	90.5
Sept. 4	02 29.07	+64 51.0	8.907	9.088	-0.33	+1.3	18.2	97.2
Sept. 14	02 25.12	+65 00.5	8.840	9.134	-0.47	+0.5	18.2	103.9
Sept. 24	02 19.81	+65 02.1	8.780	9.179	-0.60	-0.3	18.3	110.5
Oct. 4	02 13.43	+64 54.2	8.730	9.224	-0.68	-1.4	18.3	116.8
Oct. 14	02 06.36	+64 35.7	8.696	9.270	-0.73	-2.4	18.3	122.5
Oct. 24	01 59.05	+64 06.4	8.679	9.316	-0.73	-3.5	18.3	127.4
Nov. 3	01 51.97	+63 26.2	8.682	9.362	-0.68	-4.6	18.4	130.9
Nov. 13	01 45.55	+62 36.3	8.707	9.408	-0.59	-5.5	18.4	132.8
Nov. 23	01 40.13	+61 38.3	8.756	9.454	-0.48	-6.2	18.4	132.7
Dec. 3	01 35.93	+60 34.1	8.829	9.500	-0.35	-6.7	18.5	130.6
Dec. 13	01 33.09	+59 26.3	8.925	9.546	-0.21	-6.9	18.6	126.7
Dec. 23	01 31.62	+58 17.1	9.043	9.593	-0.07	-6.9	18.6	121.4
Jan. 2	01 31.47	+57 08.8	9.180	9.639	+0.05	-6.7	18.7	115.1
Jan. 12	01 32.54	+56 03.4	9.333	9.686	+0.17	-6.3	18.7	108.2
Jan. 22	01 34.71	+55 02.2	9.499	9.732	+0.27	-5.8	18.8	100.9
Feb. 1	01 37.85	+54 06.5	9.673	9.779	+0.36	-5.2	18.9	93.3
Feb. 11	01 41.81	+53 17.0	9.852	9.826	+0.44	-4.6	19.0	85.6
Feb. 21	01 46.47	+52 34.0	10.031	9.873	+0.50	-3.9	19.0	78.0
Mar. 2	01 51.69	+51 57.7	10.207	9.920	+0.55	-3.3	19.1	70.5
Mar. 12	01 57.37	+51 27.9	10.376	9.967	+0.59	-2.6	19.2	63.2
Mar. 22	02 03.38	+51 04.4	10.534	10.014	+0.62	-2.0	19.2	56.2

Comet C/2014 B1 (Schwartz)

Epoch = 2019 July 16.0 TT  
 T = 2017 Sept. 10.73711 TT  
 Peri. = 345.86103  
 Node = 161.39764 2000.0  
 Incl. = 28.39082  
 q = 9.5569175 AU  
 e = 1.0010887

$$m1 = 2.0 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	11 43.59	+06 08.4	9.512	9.926	+0.04	+1.6	16.9	112.3
Jan. 17	11 43.71	+06 26.1	9.378	9.941	-0.02	+2.0	16.8	122.5
Jan. 27	11 43.24	+06 47.6	9.260	9.956	-0.08	+2.3	16.8	132.9
Feb. 6	11 42.22	+07 12.3	9.164	9.972	-0.13	+2.6	16.8	143.3
Feb. 16	11 40.74	+07 39.5	9.092	9.988	-0.17	+2.8	16.8	153.7
Feb. 26	11 38.90	+08 08.2	9.049	10.004	-0.20	+2.9	16.8	164.0
Mar. 8	11 36.84	+08 37.2	9.035	10.020	-0.21	+2.9	16.8	172.9
Mar. 18	11 34.69	+09 05.5	9.052	10.037	-0.21	+2.7	16.8	171.5
Mar. 28	11 32.59	+09 32.0	9.099	10.054	-0.20	+2.5	16.8	162.1
Apr. 7	11 30.69	+09 55.9	9.176	10.071	-0.18	+2.2	16.8	152.1
Apr. 17	11 29.10	+10 16.3	9.279	10.089	-0.14	+1.8	16.9	141.9
Apr. 27	11 27.93	+10 32.7	9.406	10.106	-0.09	+1.4	16.9	131.9
May 7	11 27.25	+10 44.8	9.552	10.124	-0.04	+1.0	17.0	122.1
May 17	11 27.11	+10 52.6	9.714	10.143	+0.02	+0.5	17.0	112.4
May 27	11 27.55	+10 55.9	9.886	10.161	+0.07	+0.1	17.0	102.9
June 6	11 28.55	+10 55.2	10.065	10.180	+0.13	-0.3	17.1	93.7
June 16	11 30.12	+10 50.5	10.245	10.199	+0.19	-0.7	17.1	84.6
June 26	11 32.22	+10 42.4	10.423	10.218	+0.24	-1.0	17.2	75.6
July 6	11 34.82	+10 31.1	10.595	10.238	+0.29	-1.3	17.2	66.8
July 16	11 37.86	+10 17.2	10.757	10.257	+0.33	-1.5	17.3	58.2
July 26	11 41.30	+10 01.1	10.906	10.277	+0.36	-1.7	17.3	49.6
Aug. 5	11 45.09	+09 43.2	11.039	10.297	+0.40	-1.9	17.3	41.2
Aug. 15	11 49.16	+09 24.0	11.154	10.318	+0.42	-2.0	17.4	32.9
Aug. 25	11 53.47	+09 04.1	11.248	10.339	+0.44	-2.0	17.4	24.8
Sept. 4	11 57.95	+08 43.8	11.320	10.360	+0.46	-2.0	17.4	17.0
Sept. 14	12 02.55	+08 23.6	11.369	10.381	+0.46	-2.0	17.4	10.3
Sept. 24	12 07.20	+08 04.1	11.394	10.402	+0.47	-1.9	17.5	8.3
Oct. 4	12 11.85	+07 45.7	11.394	10.424	+0.46	-1.8	17.5	13.4
Oct. 14	12 16.44	+07 28.9	11.371	10.446	+0.45	-1.6	17.5	21.0
Oct. 24	12 20.90	+07 14.2	11.324	10.468	+0.44	-1.3	17.5	29.3
Nov. 3	12 25.17	+07 01.9	11.255	10.490	+0.41	-1.1	17.5	37.9
Nov. 13	12 29.19	+06 52.7	11.165	10.512	+0.39	-0.7	17.5	46.8
Nov. 23	12 32.89	+06 46.8	11.059	10.535	+0.35	-0.4	17.4	55.8
Dec. 3	12 36.21	+06 44.6	10.937	10.558	+0.31	0.0	17.4	65.0
Dec. 13	12 39.09	+06 46.5	10.804	10.581	+0.26	+0.4	17.4	74.4
Dec. 23	12 41.47	+06 52.4	10.665	10.605	+0.21	+0.8	17.4	83.9
Jan. 2	12 43.32	+07 02.7	10.522	10.628	+0.15	+1.3	17.4	93.5
Jan. 12	12 44.59	+07 17.1	10.382	10.652	+0.09	+1.7	17.4	103.3
Jan. 22	12 45.27	+07 35.4	10.249	10.676	+0.04	+2.0	17.3	113.2
Feb. 1	12 45.37	+07 57.2	10.129	10.700	-0.02	+2.3	17.3	123.2
Feb. 11	12 44.90	+08 21.7	10.025	10.725	-0.08	+2.6	17.3	133.2
Feb. 21	12 43.92	+08 48.4	9.942	10.749	-0.12	+2.7	17.3	143.1
Mar. 2	12 42.49	+09 16.1	9.885	10.774	-0.16	+2.8	17.3	152.6
Mar. 12	12 40.73	+09 43.8	9.854	10.799	-0.19	+2.7	17.3	161.1
Mar. 22	12 38.74	+10 10.5	9.853	10.825	-0.21	+2.6	17.3	166.4

## Comet C/2016 N4 (MASTER)

Epoch = 2019 July 16.0 TT  
 T = 2017 Sept. 16.47642 TT  
 Peri. = 55.94520  
 Node = 354.01370 2000.0  
 Incl. = 72.56982  
 q = 3.1989185 AU  
 e = 0.9986935

$$m1 = 8.4 + 5 \log(\Delta) + 7.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	12 59.61	+45 18.6	5.005	5.383	-0.25	+4.4	17.4	107.5
Jan. 17	12 56.20	+46 04.5	4.966	5.450	-0.45	+4.7	17.4	114.6
Jan. 27	12 50.80	+46 52.0	4.941	5.517	-0.65	+4.7	17.4	121.3
Feb. 6	12 43.43	+47 36.7	4.934	5.584	-0.84	+4.1	17.5	127.1
Feb. 16	12 34.27	+48 13.7	4.947	5.651	-1.00	+3.1	17.5	131.6
Feb. 26	12 23.74	+48 38.5	4.985	5.719	-1.11	+1.7	17.6	134.2
Mar. 8	12 12.35	+48 47.7	5.047	5.786	-1.16	0.0	17.6	134.5
Mar. 18	12 00.76	+48 39.1	5.135	5.854	-1.14	-1.9	17.7	132.5
Mar. 28	11 49.65	+48 12.4	5.248	5.922	-1.06	-3.6	17.8	128.5
Apr. 7	11 39.57	+47 29.0	5.385	5.989	-0.93	-5.2	17.9	123.0
Apr. 17	11 30.94	+46 31.2	5.542	6.057	-0.77	-6.5	18.0	116.6
Apr. 27	11 23.98	+45 22.0	5.716	6.125	-0.60	-7.4	18.1	109.5
May 7	11 18.76	+44 04.5	5.904	6.193	-0.43	-8.1	18.2	102.0
May 17	11 15.23	+42 41.6	6.101	6.261	-0.26	-8.5	18.3	94.4
May 27	11 13.26	+41 15.5	6.304	6.329	-0.12	-8.7	18.4	86.8
June 6	11 12.66	+39 48.3	6.509	6.397	+0.01	-8.7	18.5	79.2
June 16	11 13.28	+38 21.3	6.712	6.465	+0.12	-8.6	18.6	71.7
June 26	11 14.91	+36 55.7	6.910	6.533	+0.21	-8.5	18.7	64.3
July 6	11 17.40	+35 32.2	7.099	6.600	+0.29	-8.2	18.8	57.0
July 16	11 20.60	+34 11.6	7.276	6.668	+0.35	-7.9	18.9	50.0
July 26	11 24.34	+32 54.2	7.440	6.736	+0.40	-7.5	19.0	43.2
Aug. 5	11 28.53	+31 40.5	7.587	6.804	+0.44	-7.2	19.0	37.0
Aug. 15	11 33.03	+30 30.7	7.716	6.872	+0.46	-6.7	19.1	31.4
Aug. 25	11 37.76	+29 25.1	7.826	6.940	+0.48	-6.3	19.2	27.0
Sept. 4	11 42.61	+28 24.1	7.914	7.007	+0.49	-5.8	19.2	24.4
Sept. 14	11 47.49	+27 28.0	7.980	7.075	+0.49	-5.3	19.3	24.3
Sept. 24	11 52.31	+26 37.0	8.023	7.143	+0.48	-4.8	19.3	26.9
Oct. 4	11 57.00	+25 51.4	8.045	7.210	+0.46	-4.2	19.4	31.5
Oct. 14	12 01.45	+25 11.6	8.044	7.278	+0.43	-3.7	19.4	37.5
Oct. 24	12 05.58	+24 37.8	8.022	7.345	+0.39	-3.0	19.4	44.4
Nov. 3	12 09.30	+24 10.4	7.982	7.412	+0.35	-2.4	19.4	52.0
Nov. 13	12 12.51	+23 49.7	7.924	7.480	+0.29	-1.7	19.4	60.1
Nov. 23	12 15.12	+23 35.6	7.852	7.547	+0.22	-1.0	19.5	68.5
Dec. 3	12 17.04	+23 28.2	7.769	7.614	+0.15	-0.4	19.5	77.3
Dec. 13	12 18.18	+23 27.5	7.679	7.681	+0.07	+0.3	19.5	86.4
Dec. 23	12 18.45	+23 33.0	7.587	7.748	-0.02	+0.9	19.5	95.8
Jan. 2	12 17.80	+23 44.1	7.498	7.815	-0.12	+1.4	19.5	105.3
Jan. 12	12 16.20	+23 59.8	7.416	7.881	-0.21	+1.8	19.5	114.9
Jan. 22	12 13.63	+24 18.8	7.348	7.948	-0.31	+2.0	19.5	124.6
Feb. 1	12 10.16	+24 39.5	7.298	8.015	-0.39	+2.1	19.5	134.1
Feb. 11	12 05.87	+25 00.3	7.270	8.081	-0.47	+2.0	19.5	143.1
Feb. 21	12 00.91	+25 19.1	7.269	8.148	-0.52	+1.7	19.5	150.9
Mar. 2	11 55.49	+25 34.3	7.297	8.214	-0.56	+1.3	19.6	156.2
Mar. 12	11 49.83	+25 44.4	7.356	8.280	-0.57	+0.7	19.6	157.0
Mar. 22	11 44.18	+25 48.2	7.446	8.346	-0.56	0.0	19.7	153.1

Comet 65P/Gunn

Epoch = 2019 July 16.0 TT  
 T = 2017 Oct. 17.40239 TT  
 Peri. = 213.68116 e = 0.2500672  
 Node = 62.01880 2000.0 a = 3.8822428 AU  
 Incl. = 9.18501 n = 0.12884870  
 q = 2.9114212 AU P = 7.65 years

$$m1 = 5.8 + 5 \log(\Delta) + 15.0 \log(r(t+90))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	23 24.77	-11 42.6	3.932	3.568	+0.93	+8.1	17.4	61.4
Jan. 17	23 34.31	-10 20.8	4.079	3.590	+0.99	+8.3	17.5	54.0
Jan. 27	23 44.39	-08 57.1	4.216	3.613	+1.03	+8.4	17.6	46.7
Feb. 6	23 54.89	-07 32.4	4.340	3.635	+1.07	+8.5	17.7	39.6
Feb. 16	00 05.73	-06 07.1	4.451	3.658	+1.10	+8.5	17.8	32.6
Feb. 26	00 16.80	-04 42.1	4.546	3.680	+1.12	+8.5	17.9	25.8
Mar. 8	00 28.03	-03 17.8	4.626	3.703	+1.13	+8.4	18.0	19.1
Mar. 18	00 39.37	-01 54.8	4.689	3.725	+1.14	+8.2	18.1	12.8
Mar. 28	00 50.73	+00 33.7	4.736	3.748	+1.14	+8.0	18.1	7.2
Apr. 7	01 02.07	+00 45.0	4.764	3.770	+1.13	+7.7	18.2	5.8
Apr. 17	01 13.32	+02 00.9	4.776	3.792	+1.12	+7.4	18.2	10.2
Apr. 27	01 24.43	+03 13.4	4.770	3.815	+1.10	+7.1	18.2	16.3
May 7	01 35.34	+04 22.2	4.747	3.837	+1.08	+6.7	18.3	22.8
May 17	01 45.97	+05 26.8	4.707	3.859	+1.05	+6.2	18.3	29.4
May 27	01 56.26	+06 26.9	4.652	3.881	+1.01	+5.7	18.3	36.2
June 6	02 06.14	+07 22.1	4.582	3.902	+0.96	+5.2	18.3	43.1
June 16	02 15.49	+08 12.2	4.497	3.924	+0.90	+4.7	18.3	50.1
June 26	02 24.22	+08 56.7	4.401	3.946	+0.84	+4.1	18.3	57.3
July 6	02 32.22	+09 35.6	4.293	3.967	+0.75	+3.6	18.2	64.7
July 16	02 39.34	+10 08.5	4.176	3.988	+0.66	+3.0	18.2	72.4
July 26	02 45.47	+10 35.2	4.053	4.009	+0.55	+2.3	18.2	80.3
Aug. 5	02 50.44	+10 55.6	3.926	4.030	+0.43	+1.7	18.1	88.6
Aug. 15	02 54.08	+11 09.6	3.797	4.051	+0.29	+1.0	18.1	97.2
Aug. 25	02 56.28	+11 17.2	3.671	4.071	+0.13	+0.4	18.0	106.2
Sept. 4	02 56.89	+11 18.3	3.552	4.092	-0.03	-0.2	18.0	115.7
Sept. 14	02 55.84	+11 13.2	3.444	4.112	-0.20	-0.8	18.0	125.6
Sept. 24	02 53.15	+11 02.4	3.351	4.132	-0.36	-1.4	17.9	136.0
Oct. 4	02 48.92	+10 46.7	3.278	4.151	-0.50	-1.8	17.9	146.8
Oct. 14	02 43.41	+10 27.5	3.230	4.171	-0.61	-2.1	17.9	157.8
Oct. 24	02 37.00	+10 06.4	3.210	4.190	-0.67	-2.1	17.9	168.8
Nov. 3	02 30.17	+09 45.6	3.220	4.209	-0.69	-2.0	17.9	174.9
Nov. 13	02 23.46	+09 27.4	3.261	4.228	-0.64	-1.6	18.0	165.9
Nov. 23	02 17.40	+09 13.9	3.333	4.247	-0.55	-1.0	18.1	154.7
Dec. 3	02 12.39	+09 06.8	3.432	4.265	-0.43	-0.3	18.2	143.6
Dec. 13	02 08.76	+09 07.3	3.555	4.283	-0.28	+0.5	18.3	132.6
Dec. 23	02 06.67	+09 15.6	3.697	4.301	-0.12	+1.3	18.4	122.1
Jan. 2	02 06.16	+09 31.8	3.855	4.319	+0.04	+2.0	18.5	111.9
Jan. 12	02 07.21	+09 55.3	4.022	4.336	+0.19	+2.7	18.6	102.1
Jan. 22	02 09.71	+10 25.3	4.195	4.353	+0.32	+3.3	18.7	92.7
Feb. 1	02 13.53	+11 00.8	4.369	4.370	+0.45	+3.8	18.8	83.6
Feb. 11	02 18.53	+11 40.7	4.540	4.387	+0.56	+4.2	18.9	74.8
Feb. 21	02 24.56	+12 24.1	4.705	4.403	+0.65	+4.5	19.0	66.4
Mar. 2	02 31.49	+13 10.1	4.861	4.419	+0.74	+4.7	19.1	58.2
Mar. 12	02 39.19	+13 57.7	5.005	4.435	+0.81	+4.8	19.2	50.2
Mar. 22	02 47.52	+14 46.2	5.136	4.451	+0.87	+4.9	19.3	42.4

## Comet C/2016 A1 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2017 Nov. 23.25837 TT  
 Peri. = 10.31268  
 Node = 128.19237 2000.0  
 Incl. = 121.20252  
 q = 5.3270130 AU  
 e = 1.0022667

$$m1 = 5.2 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	06 07.10	+73 02.2	5.460	6.123	-3.36	+1.5	16.8	128.7
Jan. 17	05 34.54	+73 02.2	5.549	6.159	-3.07	-1.7	16.8	124.4
Jan. 27	05 06.18	+72 33.8	5.663	6.195	-2.52	-4.0	16.9	118.6
Feb. 6	04 43.75	+71 46.5	5.798	6.232	-1.90	-5.4	17.0	111.8
Feb. 16	04 27.46	+70 49.9	5.949	6.269	-1.31	-5.9	17.0	104.5
Feb. 26	04 16.60	+69 51.5	6.111	6.307	-0.83	-5.7	17.1	96.9
Mar. 8	04 10.19	+68 56.7	6.278	6.346	-0.43	-5.2	17.2	89.4
Mar. 18	04 07.33	+68 08.6	6.446	6.385	-0.12	-4.3	17.3	82.0
Mar. 28	04 07.19	+67 29.1	6.611	6.424	+0.11	-3.4	17.4	75.0
Apr. 7	04 09.18	+66 59.0	6.767	6.464	+0.30	-2.5	17.5	68.3
Apr. 17	04 12.81	+66 38.5	6.913	6.505	+0.44	-1.5	17.5	62.1
Apr. 27	04 17.67	+66 27.4	7.045	6.546	+0.54	-0.6	17.6	56.6
May 7	04 23.48	+66 25.4	7.160	6.587	+0.62	+0.3	17.7	52.0
May 17	04 29.98	+66 32.1	7.258	6.629	+0.68	+1.1	17.7	48.3
May 27	04 36.93	+66 47.2	7.338	6.671	+0.71	+1.9	17.8	45.8
June 6	04 44.17	+67 10.2	7.397	6.713	+0.73	+2.7	17.8	44.6
June 16	04 51.48	+67 41.0	7.438	6.756	+0.73	+3.5	17.9	44.9
June 26	04 58.68	+68 19.3	7.459	6.799	+0.71	+4.2	17.9	46.5
July 6	05 05.58	+69 05.0	7.462	6.843	+0.66	+5.0	17.9	49.3
July 16	05 11.89	+69 57.9	7.448	6.887	+0.59	+5.7	17.9	53.2
July 26	05 17.35	+70 58.0	7.419	6.931	+0.48	+6.4	18.0	57.8
Aug. 5	05 21.56	+72 05.1	7.377	6.976	+0.33	+7.1	18.0	63.0
Aug. 15	05 23.98	+73 18.7	7.325	7.021	+0.12	+7.7	18.0	68.7
Aug. 25	05 23.88	+74 38.2	7.265	7.066	-0.18	+8.2	18.0	74.7
Sept. 4	05 20.22	+76 02.1	7.201	7.112	-0.62	+8.6	18.0	80.9
Sept. 14	05 11.44	+77 28.3	7.137	7.158	-1.23	+8.6	18.0	87.1
Sept. 24	04 55.41	+78 52.7	7.077	7.204	-2.11	+8.1	18.0	93.3
Oct. 4	04 29.35	+80 09.1	7.023	7.251	-3.26	+6.8	18.0	99.2
Oct. 14	03 50.93	+81 07.4	6.980	7.297	-4.53	+4.4	18.1	104.7
Oct. 24	03 01.17	+81 35.7	6.952	7.344	-5.37	+0.8	18.1	109.5
Nov. 3	02 07.45	+81 24.6	6.942	7.392	-5.17	-3.4	18.1	113.4
Nov. 13	01 20.18	+80 34.7	6.951	7.439	-4.09	-6.8	18.1	116.0
Nov. 23	00 44.98	+79 15.3	6.982	7.487	-2.84	-9.1	18.2	117.3
Dec. 3	00 21.58	+77 38.3	7.035	7.535	-1.79	-10.3	18.2	117.1
Dec. 13	00 07.35	+75 53.4	7.109	7.583	-1.03	-10.6	18.3	115.3
Dec. 23	23 59.65	+74 07.8	7.203	7.631	-0.49	-10.4	18.3	112.3
Jan. 2	23 56.51	+72 26.3	7.316	7.680	-0.12	-9.8	18.4	108.2
Jan. 12	23 56.54	+70 52.4	7.443	7.729	+0.14	-8.9	18.4	103.3
Jan. 22	23 58.80	+69 28.2	7.582	7.777	+0.32	-7.8	18.5	97.8
Feb. 1	00 02.63	+68 15.2	7.729	7.827	+0.45	-6.7	18.6	92.1
Feb. 11	00 07.56	+67 13.9	7.880	7.876	+0.54	-5.5	18.6	86.2
Feb. 21	00 13.24	+66 24.7	8.031	7.925	+0.60	-4.3	18.7	80.4
Mar. 2	00 19.41	+65 47.2	8.178	7.975	+0.64	-3.1	18.8	74.7
Mar. 12	00 25.86	+65 21.2	8.319	8.025	+0.65	-2.0	18.8	69.5
Mar. 22	00 32.40	+65 05.9	8.451	8.075	+0.65	-1.0	18.9	64.7

## Comet C/2015 V1 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2017 Dec. 17.50619 TT  
 Peri. = 179.61252  
 Node = 197.18675 2000.0  
 Incl. = 139.22338  
 q = 4.2667569 AU  
 e = 0.9995503

$$m1 = 4.2 + 5 \log(\Delta) + 12.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	22 35.51	-38 35.2	5.930	5.300	+0.23	+1.8	17.1	46.4
Jan. 17	22 38.24	-38 18.4	6.070	5.347	+0.32	+1.5	17.2	39.4
Jan. 27	22 41.72	-38 04.6	6.187	5.395	+0.38	+1.2	17.3	33.6
Feb. 6	22 45.76	-37 54.9	6.279	5.443	+0.43	+0.7	17.4	29.6
Feb. 16	22 50.19	-37 50.3	6.344	5.492	+0.46	+0.1	17.5	28.0
Feb. 26	22 54.86	-37 51.7	6.384	5.541	+0.47	-0.5	17.5	29.2
Mar. 8	22 59.62	-38 00.1	6.398	5.591	+0.48	-1.3	17.6	32.9
Mar. 18	23 04.33	-38 16.6	6.387	5.641	+0.46	-2.1	17.6	38.4
Mar. 28	23 08.86	-38 41.9	6.354	5.692	+0.44	-3.1	17.7	44.9
Apr. 7	23 13.07	-39 17.0	6.301	5.743	+0.40	-4.1	17.7	52.2
Apr. 17	23 16.81	-40 02.8	6.232	5.795	+0.34	-5.2	17.7	60.0
Apr. 27	23 19.92	-41 00.0	6.149	5.847	+0.27	-6.4	17.7	68.0
May 7	23 22.23	-42 09.1	6.056	5.899	+0.18	-7.6	17.7	76.3
May 17	23 23.53	-43 30.2	5.959	5.952	+0.07	-8.8	17.8	84.7
May 27	23 23.62	-45 03.1	5.863	6.005	-0.07	-9.9	17.8	93.2
June 6	23 22.24	-46 46.7	5.772	6.059	-0.23	-10.9	17.8	101.6
June 16	23 19.12	-48 39.3	5.692	6.113	-0.42	-11.6	17.8	109.9
June 26	23 14.00	-50 37.7	5.629	6.167	-0.63	-12.0	17.8	117.7
July 6	23 06.62	-52 38.3	5.586	6.222	-0.87	-12.0	17.9	124.7
July 16	22 56.80	-54 35.8	5.569	6.276	-1.12	-11.4	17.9	130.5
July 26	22 44.52	-56 24.8	5.579	6.331	-1.36	-10.2	18.0	134.4
Aug. 5	22 29.99	-57 59.6	5.620	6.387	-1.56	-8.5	18.0	135.8
Aug. 15	22 13.74	-59 15.4	5.692	6.442	-1.69	-6.4	18.1	134.5
Aug. 25	21 56.58	-60 09.2	5.792	6.498	-1.73	-4.1	18.2	130.8
Sept. 4	21 39.53	-60 40.2	5.921	6.554	-1.66	-1.9	18.3	125.2
Sept. 14	21 23.59	-60 49.8	6.072	6.610	-1.50	+0.1	18.4	118.4
Sept. 24	21 09.58	-60 41.3	6.243	6.667	-1.27	+1.7	18.5	110.8
Oct. 4	20 57.98	-60 18.8	6.429	6.723	-1.02	+2.9	18.6	102.9
Oct. 14	20 49.02	-59 46.6	6.624	6.780	-0.75	+3.6	18.7	94.7
Oct. 24	20 42.61	-59 08.4	6.824	6.837	-0.51	+4.0	18.8	86.6
Nov. 3	20 38.57	-58 27.4	7.023	6.894	-0.28	+4.2	18.9	78.5
Nov. 13	20 36.62	-57 46.1	7.217	6.951	-0.09	+4.1	19.0	70.6
Nov. 23	20 36.44	-57 06.1	7.402	7.009	+0.07	+3.9	19.1	63.0
Dec. 3	20 37.75	-56 29.0	7.573	7.066	+0.20	+3.5	19.2	55.8
Dec. 13	20 40.27	-55 55.6	7.727	7.124	+0.31	+3.1	19.3	49.3
Dec. 23	20 43.73	-55 26.7	7.862	7.182	+0.39	+2.6	19.4	43.6
Jan. 2	20 47.93	-55 02.8	7.976	7.240	+0.45	+2.1	19.5	39.1
Jan. 12	20 52.63	-54 44.5	8.066	7.297	+0.49	+1.5	19.5	36.4
Jan. 22	20 57.67	-54 32.1	8.133	7.356	+0.52	+0.9	19.6	35.6
Feb. 1	21 02.88	-54 26.2	8.176	7.414	+0.52	+0.2	19.6	37.1
Feb. 11	21 08.07	-54 27.2	8.195	7.472	+0.51	-0.5	19.7	40.4
Feb. 21	21 13.11	-54 35.5	8.193	7.530	+0.49	-1.2	19.7	45.3
Mar. 2	21 17.84	-54 51.5	8.170	7.589	+0.45	-2.0	19.8	51.2
Mar. 12	21 22.09	-55 15.4	8.129	7.647	+0.39	-2.8	19.8	57.9
Mar. 22	21 25.71	-55 47.7	8.073	7.706	+0.32	-3.7	19.8	65.1

## Comet C/2017 K6 (Jacques)

Epoch = 2019 July 16.0 TT  
 T = 2018 Jan. 3.13022 TT  
 Peri. = 303.80271  
 Node = 85.05666 2000.0  
 Incl. = 57.25647  
 q = 2.0015734 AU  
 e = 0.9981452

$$m1 = 8.9 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .8			m	'		°
Jan. 7	08 19.71	+62 03.8	3.716	4.501	-1.37	+8.2	18.3	138.6
Jan. 17	08 05.43	+63 14.0	3.811	4.586	-1.47	+5.5	18.4	137.6
Jan. 27	07 50.84	+63 57.1	3.932	4.671	-1.42	+2.9	18.6	134.1
Feb. 6	07 37.40	+64 14.9	4.077	4.756	-1.23	+0.5	18.7	128.7
Feb. 16	07 26.35	+64 11.3	4.241	4.841	-0.94	-1.3	18.9	122.3
Feb. 26	07 18.40	+63 51.7	4.421	4.925	-0.61	-2.6	19.1	115.2
Mar. 8	07 13.75	+63 21.2	4.614	5.009	-0.28	-3.5	19.2	107.9
Mar. 18	07 12.32	+62 44.1	4.816	5.093	+0.02	-3.9	19.4	100.6
Mar. 28	07 13.74	+62 03.8	5.023	5.177	+0.28	-4.1	19.5	93.3
Apr. 7	07 17.61	+61 22.4	5.231	5.260	+0.51	-4.1	19.7	86.2
Apr. 17	07 23.54	+60 41.4	5.438	5.344	+0.69	-4.1	19.9	79.3
Apr. 27	07 31.14	+60 01.5	5.640	5.427	+0.84	-3.9	20.0	72.7
May 7	07 40.07	+59 23.1	5.835	5.509	+0.96	-3.7	20.1	66.4
May 17	07 50.07	+58 46.6	6.020	5.592	+1.05	-3.5	20.3	60.5
May 27	08 00.88	+58 12.0	6.195	5.674	+1.12	-3.4	20.4	54.9
June 6	08 12.32	+57 39.4	6.357	5.756	+1.17	-3.1	20.5	49.9
June 16	08 24.20	+57 09.0	6.505	5.837	+1.21	-2.9	20.6	45.5
June 26	08 36.38	+56 40.9	6.637	5.919	+1.23	-2.7	20.7	41.8
July 6	08 48.76	+56 15.3	6.754	6.000	+1.24	-2.4	20.8	39.1
July 16	09 01.22	+55 52.6	6.854	6.080	+1.25	-2.1	20.9	37.6
July 26	09 13.67	+55 33.1	6.937	6.161	+1.24	-1.8	21.0	37.4
Aug. 5	09 26.04	+55 17.2	7.003	6.241	+1.23	-1.4	21.1	38.5
Aug. 15	09 38.26	+55 05.6	7.053	6.321	+1.21	-0.9	21.1	40.8
Aug. 25	09 50.25	+54 58.7	7.087	6.401	+1.18	-0.4	21.2	44.2
Sept. 4	10 01.96	+54 57.1	7.105	6.480	+1.15	+0.2	21.3	48.4
Sept. 14	10 13.30	+55 01.6	7.110	6.559	+1.11	+0.8	21.3	53.4
Sept. 24	10 24.22	+55 12.6	7.102	6.638	+1.07	+1.5	21.4	58.8
Oct. 4	10 34.62	+55 30.9	7.083	6.717	+1.01	+2.2	21.4	64.7
Oct. 14	10 44.42	+55 56.8	7.056	6.795	+0.94	+3.0	21.5	70.9
Oct. 24	10 53.51	+56 30.8	7.023	6.873	+0.87	+3.8	21.5	77.3
Nov. 3	11 01.77	+57 12.9	6.986	6.951	+0.77	+4.7	21.5	83.9
Nov. 13	11 09.04	+58 03.1	6.950	7.029	+0.67	+5.4	21.6	90.5
Nov. 23	11 15.17	+59 00.8	6.916	7.106	+0.54	+6.2	21.6	97.1
Dec. 3	11 19.97	+60 05.2	6.889	7.183	+0.40	+6.8	21.7	103.5
Dec. 13	11 23.22	+61 14.7	6.872	7.260	+0.23	+7.2	21.7	109.5
Dec. 23	11 24.73	+62 27.4	6.867	7.337	+0.05	+7.4	21.7	115.0
Jan. 2	11 24.29	+63 40.8	6.878	7.413	-0.16	+7.3	21.8	119.6
Jan. 12	11 21.76	+64 51.9	6.906	7.489	-0.37	+6.9	21.8	123.1
Jan. 22	11 17.11	+65 57.5	6.954	7.565	-0.58	+6.1	21.9	125.3
Feb. 1	11 10.44	+66 54.4	7.021	7.640	-0.77	+5.1	22.0	125.9
Feb. 11	11 02.09	+67 39.8	7.109	7.716	-0.91	+3.8	22.0	124.8
Feb. 21	10 52.58	+68 11.5	7.216	7.791	-0.99	+2.4	.	122.4
Mar. 2	10 42.61	+68 28.3	7.341	7.865	-0.99	+0.9	.	118.7
Mar. 12	10 32.98	+68 30.4	7.482	7.940	-0.92	-0.6	.	114.1
Mar. 22	10 24.36	+68 18.7	7.636	8.014	-0.78	-1.9	.	108.9

## Comet C/2017 K4 (ATLAS)

Epoch = 2019 July 16.0 TT  
 T = 2018 Jan. 8.18197 TT  
 Peri. = 15.15702 e = 0.9064559  
 Node = 298.87975 2000.0 a = 28.3133688 AU  
 Incl. = 16.67860 n = 0.00654209  
 q = 2.6485486 AU P = 150.66 years

$$m_1 = 8.0 + 5 \log(\Delta) + 12.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .			m	'		°
Jan. 7	00 46.83	+23 55.9	4.164	4.345	+0.61	-0.6	19.1	94.0
Jan. 17	00 53.41	+23 54.1	4.378	4.413	+0.71	+0.3	19.3	85.6
Jan. 27	01 00.86	+24 00.8	4.592	4.482	+0.79	+1.1	19.5	77.5
Feb. 6	01 09.04	+24 15.0	4.802	4.551	+0.85	+1.8	19.6	69.5
Feb. 16	01 17.82	+24 35.9	5.005	4.620	+0.91	+2.4	19.8	61.7
Feb. 26	01 27.08	+25 02.3	5.200	4.689	+0.95	+2.9	20.0	54.1
Mar. 8	01 36.70	+25 33.1	5.383	4.758	+0.98	+3.3	20.1	46.7
Mar. 18	01 46.61	+26 07.6	5.553	4.827	+1.00	+3.6	20.3	39.5
Mar. 28	01 56.69	+26 44.7	5.708	4.897	+1.02	+3.8	20.4	32.6
Apr. 7	02 06.89	+27 23.7	5.846	4.966	+1.02	+4.0	20.5	26.0
Apr. 17	02 17.13	+28 04.1	5.966	5.035	+1.02	+4.1	20.7	20.1
Apr. 27	02 27.31	+28 45.1	6.068	5.105	+1.01	+4.1	20.8	15.4
May 7	02 37.39	+29 26.3	6.150	5.174	+1.00	+4.1	20.9	13.4
May 17	02 47.29	+30 07.3	6.213	5.243	+0.98	+4.1	21.0	15.1
May 27	02 56.92	+30 47.7	6.256	5.313	+0.95	+4.0	21.0	19.6
June 6	03 06.21	+31 27.4	6.280	5.382	+0.91	+3.9	21.1	25.5
June 16	03 15.07	+32 06.2	6.285	5.451	+0.86	+3.8	21.2	32.1
June 26	03 23.42	+32 43.7	6.272	5.520	+0.80	+3.7	21.3	39.1
July 6	03 31.16	+33 20.1	6.241	5.589	+0.74	+3.6	21.3	46.4
July 16	03 38.18	+33 55.0	6.196	5.658	+0.66	+3.4	21.4	54.0
July 26	03 44.38	+34 28.5	6.137	5.727	+0.57	+3.3	21.4	61.8
Aug. 5	03 49.65	+35 00.3	6.066	5.796	+0.47	+3.1	21.5	69.9
Aug. 15	03 53.86	+35 30.3	5.987	5.865	+0.36	+2.9	21.5	78.2
Aug. 25	03 56.92	+35 58.0	5.903	5.933	+0.24	+2.6	21.5	86.8
Sept. 4	03 58.72	+36 23.1	5.817	6.002	+0.11	+2.3	21.6	95.7
Sept. 14	03 59.20	+36 44.7	5.734	6.070	-0.03	+1.9	21.6	104.8
Sept. 24	03 58.33	+37 02.2	5.658	6.138	-0.16	+1.5	21.6	114.2
Oct. 4	03 56.14	+37 14.5	5.593	6.206	-0.29	+0.9	21.6	123.8
Oct. 14	03 52.74	+37 20.7	5.544	6.274	-0.40	+0.3	21.7	133.6
Oct. 24	03 48.32	+37 20.0	5.516	6.341	-0.49	-0.5	21.7	143.2
Nov. 3	03 43.13	+37 11.9	5.513	6.409	-0.55	-1.2	21.8	152.4
Nov. 13	03 37.53	+36 56.3	5.538	6.476	-0.57	-1.9	21.9	159.9
Nov. 23	03 31.88	+36 34.0	5.593	6.544	-0.55	-2.6	21.9	163.0
Dec. 3	03 26.54	+36 06.2	5.678	6.611	-0.50	-3.0	22.0	159.6
Dec. 13	03 21.86	+35 34.7	5.793	6.678	-0.42	-3.3	.	151.9
Dec. 23	03 18.08	+35 01.3	5.936	6.744	-0.32	-3.4	.	142.6
Jan. 2	03 15.38	+34 28.1	6.105	6.811	-0.21	-3.2	.	132.8
Jan. 12	03 13.85	+33 56.8	6.294	6.877	-0.09	-3.0	.	122.9
Jan. 22	03 13.49	+33 28.7	6.499	6.944	+0.03	-2.6	.	113.0
Feb. 1	03 14.29	+33 04.7	6.717	7.010	+0.14	-2.2	.	103.3
Feb. 11	03 16.17	+32 45.2	6.941	7.076	+0.24	-1.7	.	93.8
Feb. 21	03 19.01	+32 30.5	7.168	7.141	+0.33	-1.2	.	84.5
Mar. 2	03 22.73	+32 20.3	7.392	7.207	+0.42	-0.8	.	75.4
Mar. 12	03 27.20	+32 14.4	7.610	7.272	+0.48	-0.4	.	66.6
Mar. 22	03 32.31	+32 12.3	7.818	7.338	+0.54	0.0	.	57.9



## Comet 130P/McNaught-Hughes

Epoch = 2019 July 16.0 TT  
 T = 2018 Jan. 21.88320 TT  
 Peri. = 245.93157 e = 0.4610911  
 Node = 70.25476 2000.0 a = 3.3836159 AU  
 Incl. = 6.06513 n = 0.15835526  
 q = 1.8234607 AU P = 6.22 years

$$m_1 = 9.1 + 5 \log(\Delta) + 15.0 \log(r(t-30))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	03 15.47	+17 28.9	2.486	3.155	-0.05	+1.3	18.3	125.0
Jan. 17	03 16.04	+17 45.5	2.658	3.201	+0.18	+2.0	18.5	115.0
Jan. 27	03 18.73	+18 08.5	2.839	3.246	+0.38	+2.6	18.8	105.6
Feb. 6	03 23.30	+18 36.8	3.028	3.290	+0.55	+3.1	19.0	96.6
Feb. 16	03 29.51	+19 09.1	3.219	3.334	+0.70	+3.4	19.2	88.0
Feb. 26	03 37.10	+19 44.0	3.409	3.378	+0.83	+3.6	19.4	79.8
Mar. 8	03 45.85	+20 20.4	3.595	3.420	+0.93	+3.7	19.6	71.9
Mar. 18	03 55.58	+20 57.2	3.776	3.463	+1.02	+3.7	19.8	64.3
Mar. 28	04 06.11	+21 33.3	3.948	3.505	+1.09	+3.5	20.0	56.9
Apr. 7	04 17.30	+22 07.9	4.110	3.546	+1.15	+3.4	20.2	49.7
Apr. 17	04 29.01	+22 40.4	4.259	3.586	+1.20	+3.1	20.3	42.7
Apr. 27	04 41.13	+23 10.1	4.395	3.626	+1.23	+2.8	20.5	35.7
May 7	04 53.56	+23 36.7	4.516	3.666	+1.26	+2.5	20.6	28.9
May 17	05 06.20	+23 59.8	4.621	3.705	+1.27	+2.1	20.7	22.2
May 27	05 18.94	+24 19.2	4.709	3.743	+1.28	+1.7	20.9	15.5
June 6	05 31.72	+24 34.9	4.780	3.781	+1.28	+1.4	21.0	8.9
June 16	05 44.43	+24 46.7	4.832	3.818	+1.27	+1.0	21.1	2.5
June 26	05 57.01	+24 54.9	4.866	3.854	+1.25	+0.6	21.1	4.8
July 6	06 09.37	+24 59.7	4.881	3.890	+1.22	+0.3	21.2	11.4
July 16	06 21.43	+25 01.3	4.878	3.925	+1.19	0.0	21.3	18.2
July 26	06 33.09	+25 00.2	4.856	3.960	+1.14	-0.2	21.3	25.1
Aug. 5	06 44.28	+24 56.8	4.817	3.993	+1.09	-0.4	21.4	32.1
Aug. 15	06 54.89	+24 51.7	4.760	4.027	+1.03	-0.6	21.4	39.2
Aug. 25	07 04.82	+24 45.6	4.687	4.059	+0.95	-0.6	21.4	46.6
Sept. 4	07 13.96	+24 39.2	4.599	4.092	+0.87	-0.6	21.4	54.2
Sept. 14	07 22.18	+24 33.5	4.498	4.123	+0.77	-0.5	21.4	62.0
Sept. 24	07 29.36	+24 29.1	4.386	4.154	+0.65	-0.3	21.4	70.2
Oct. 4	07 35.33	+24 27.0	4.265	4.184	+0.53	0.0	21.4	78.6
Oct. 14	07 39.95	+24 28.2	4.139	4.214	+0.38	+0.3	21.4	87.4
Oct. 24	07 43.06	+24 33.3	4.011	4.243	+0.22	+0.7	21.4	96.7
Nov. 3	07 44.51	+24 42.8	3.885	4.271	+0.05	+1.2	21.4	106.3
Nov. 13	07 44.17	+24 57.1	3.766	4.299	-0.13	+1.7	21.3	116.5
Nov. 23	07 41.99	+25 15.8	3.659	4.326	-0.32	+2.1	21.3	127.0
Dec. 3	07 37.98	+25 38.1	3.569	4.353	-0.50	+2.4	21.3	138.1
Dec. 13	07 32.32	+26 02.4	3.502	4.379	-0.65	+2.5	21.3	149.4
Dec. 23	07 25.31	+26 26.9	3.462	4.404	-0.76	+2.4	21.3	161.0
Jan. 2	07 17.41	+26 49.5	3.453	4.429	-0.82	+2.1	21.4	172.1
Jan. 12	07 09.23	+27 08.4	3.476	4.453	-0.81	+1.6	21.4	172.8
Jan. 22	07 01.38	+27 22.6	3.531	4.477	-0.74	+1.1	21.5	161.9
Feb. 1	06 54.43	+27 31.6	3.616	4.499	-0.63	+0.6	21.6	150.4
Feb. 11	06 48.84	+27 35.9	3.729	4.522	-0.47	+0.2	21.7	139.2
Feb. 21	06 44.90	+27 36.3	3.864	4.544	-0.30	-0.2	21.8	128.3
Mar. 2	06 42.73	+27 33.5	4.018	4.565	-0.12	-0.4	21.9	117.8
Mar. 12	06 42.35	+27 28.4	4.184	4.585	+0.06	-0.6	22.0	107.8
Mar. 22	06 43.66	+27 21.5	4.358	4.605	+0.22	-0.8	.	98.1

## Comet 74P/Smirnova-Chernykh

Epoch = 2019 July 16.0 TT  
 T = 2018 Feb. 1.51828 TT  
 Peri. = 88.02575 e = 0.1513868  
 Node = 77.04963 2000.0 a = 4.1717552 AU  
 Incl. = 6.65352 n = 0.11567136  
 q = 3.5402065 AU P = 8.52 years

$$m_1 = 5.6 + 5 \log(\Delta) + 15.0 \log(r(t-90))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	15 14.27	-14 03.9	4.184	3.729	+1.01	-4.0	17.1	56.2
Jan. 17	15 23.99	-14 41.2	4.065	3.739	+0.93	-3.4	17.1	64.0
Jan. 27	15 32.83	-15 12.8	3.936	3.749	+0.83	-2.9	17.0	71.9
Feb. 6	15 40.60	-15 38.8	3.801	3.760	+0.71	-2.3	17.0	80.1
Feb. 16	15 47.12	-15 59.1	3.663	3.771	+0.58	-1.7	16.9	88.6
Feb. 26	15 52.22	-16 14.1	3.524	3.782	+0.42	-1.2	16.8	97.4
Mar. 8	15 55.71	-16 24.0	3.389	3.793	+0.26	-0.7	16.8	106.6
Mar. 18	15 57.46	-16 28.9	3.260	3.804	+0.07	-0.2	16.7	116.1
Mar. 28	15 57.38	-16 29.3	3.143	3.816	-0.11	+0.2	16.6	126.0
Apr. 7	15 55.46	-16 25.6	3.041	3.827	-0.29	+0.6	16.6	136.3
Apr. 17	15 51.83	-16 18.3	2.959	3.839	-0.45	+0.9	16.5	146.9
Apr. 27	15 46.74	-16 08.3	2.900	3.851	-0.57	+1.1	16.5	157.8
May 7	15 40.60	-15 56.5	2.868	3.863	-0.65	+1.2	16.5	168.7
May 17	15 33.94	-15 44.5	2.865	3.875	-0.67	+1.2	16.5	176.6
May 27	15 27.34	-15 33.8	2.891	3.887	-0.64	+0.9	16.6	167.8
June 6	15 21.34	-15 26.1	2.945	3.899	-0.55	+0.5	16.6	157.0
June 16	15 16.42	-15 22.9	3.025	3.912	-0.42	0.0	16.7	146.4
June 26	15 12.90	-15 25.2	3.128	3.924	-0.27	-0.6	16.8	136.1
July 6	15 10.98	-15 33.5	3.250	3.937	-0.10	-1.2	16.9	126.1
July 16	15 10.73	-15 48.0	3.388	3.949	+0.07	-1.8	17.0	116.6
July 26	15 12.12	-16 08.1	3.536	3.962	+0.23	-2.3	17.1	107.5
Aug. 5	15 15.08	-16 33.4	3.692	3.974	+0.38	-2.8	17.2	98.7
Aug. 15	15 19.48	-17 03.0	3.851	3.987	+0.51	-3.2	17.4	90.3
Aug. 25	15 25.19	-17 36.0	4.011	4.000	+0.64	-3.4	17.5	82.1
Sept. 4	15 32.08	-18 11.5	4.168	4.013	+0.75	-3.6	17.6	74.2
Sept. 14	15 40.02	-18 48.5	4.320	4.026	+0.85	-3.8	17.7	66.5
Sept. 24	15 48.88	-19 26.2	4.464	4.038	+0.93	-3.8	17.8	58.9
Oct. 4	15 58.55	-20 03.8	4.599	4.051	+1.01	-3.7	17.8	51.4
Oct. 14	16 08.93	-20 40.5	4.721	4.064	+1.07	-3.6	17.9	44.1
Oct. 24	16 19.90	-21 15.6	4.830	4.077	+1.13	-3.4	18.0	36.8
Nov. 3	16 31.38	-21 48.6	4.924	4.090	+1.17	-3.2	18.1	29.5
Nov. 13	16 43.25	-22 18.9	5.002	4.103	+1.21	-2.9	18.1	22.3
Nov. 23	16 55.43	-22 46.1	5.062	4.116	+1.23	-2.5	18.2	15.0
Dec. 3	17 07.83	-23 09.9	5.103	4.129	+1.25	-2.2	18.2	7.8
Dec. 13	17 20.32	-23 30.1	5.126	4.142	+1.25	-1.8	18.2	0.6
Dec. 23	17 32.83	-23 46.6	5.129	4.154	+1.25	-1.4	18.2	6.8
Jan. 2	17 45.24	-23 59.5	5.114	4.167	+1.23	-1.1	18.3	14.1
Jan. 12	17 57.44	-24 08.8	5.079	4.180	+1.20	-0.8	18.3	21.5
Jan. 22	18 09.32	-24 15.0	5.026	4.193	+1.17	-0.5	18.3	29.0
Feb. 1	18 20.78	-24 18.3	4.955	4.205	+1.12	-0.2	18.3	36.6
Feb. 11	18 31.69	-24 19.4	4.868	4.218	+1.06	0.0	18.2	44.2
Feb. 21	18 41.94	-24 18.8	4.767	4.230	+0.98	+0.1	18.2	52.0
Mar. 2	18 51.40	-24 17.3	4.652	4.243	+0.90	+0.2	18.2	59.9
Mar. 12	18 59.93	-24 15.7	4.527	4.255	+0.80	+0.1	18.1	68.0
Mar. 22	19 07.40	-24 14.7	4.394	4.268	+0.68	0.0	18.1	76.2

## Comet C/2015 01 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2018 Feb. 19.19432 TT  
 Peri. = 89.61965  
 Node = 299.85313 2000.0  
 Incl. = 127.21741  
 q = 3.7301864 AU  
 e = 1.0002386

$$m1 = 5.0 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .5			m	'		°
Jan. 7	11 28.44	+40 25.5	4.055	4.668	-1.30	+8.2	14.7	123.3
Jan. 17	11 14.19	+41 45.5	3.992	4.719	-1.58	+7.6	14.7	133.1
Jan. 27	10 57.32	+42 56.0	3.960	4.770	-1.81	+6.2	14.8	141.5
Feb. 6	10 38.41	+43 48.8	3.965	4.823	-1.97	+4.0	14.8	147.1
Feb. 16	10 18.51	+44 17.7	4.010	4.876	-2.00	+1.4	14.9	147.9
Feb. 26	09 58.84	+44 19.9	4.095	4.929	-1.91	-1.2	15.0	143.8
Mar. 8	09 40.60	+43 56.6	4.218	4.984	-1.71	-3.6	15.1	136.4
Mar. 18	09 24.67	+43 12.1	4.374	5.039	-1.44	-5.4	15.2	127.2
Mar. 28	09 11.52	+42 12.3	4.557	5.094	-1.16	-6.6	15.4	117.4
Apr. 7	09 01.24	+41 02.9	4.761	5.150	-0.87	-7.3	15.5	107.4
Apr. 17	08 53.68	+39 48.5	4.979	5.207	-0.62	-7.6	15.7	97.5
Apr. 27	08 48.54	+38 32.7	5.204	5.264	-0.39	-7.6	15.8	87.9
May 7	08 45.47	+37 17.7	5.431	5.321	-0.21	-7.4	15.9	78.4
May 17	08 44.11	+36 04.8	5.654	5.379	-0.05	-7.1	16.1	69.2
May 27	08 44.16	+34 54.9	5.868	5.437	+0.07	-6.8	16.2	60.3
June 6	08 45.32	+33 48.2	6.069	5.496	+0.17	-6.5	16.3	51.6
June 16	08 47.35	+32 44.9	6.254	5.555	+0.24	-6.2	16.4	43.0
June 26	08 50.05	+31 44.8	6.419	5.614	+0.30	-5.8	16.5	34.8
July 6	08 53.22	+30 47.9	6.563	5.674	+0.34	-5.5	16.6	26.8
July 16	08 56.70	+29 54.2	6.683	5.734	+0.36	-5.2	16.7	19.4
July 26	09 00.36	+29 03.5	6.778	5.794	+0.37	-4.9	16.8	13.3
Aug. 5	09 04.06	+28 15.9	6.847	5.855	+0.37	-4.6	16.9	11.2
Aug. 15	09 07.67	+27 31.5	6.889	5.915	+0.35	-4.3	16.9	14.8
Aug. 25	09 11.07	+26 50.3	6.905	5.976	+0.32	-3.9	17.0	21.5
Sept. 4	09 14.16	+26 12.5	6.896	6.037	+0.29	-3.6	17.0	29.4
Sept. 14	09 16.79	+25 38.4	6.861	6.099	+0.24	-3.2	17.0	37.9
Sept. 24	09 18.87	+25 08.2	6.805	6.160	+0.17	-2.8	17.1	46.7
Oct. 4	09 20.26	+24 42.2	6.728	6.222	+0.10	-2.4	17.1	55.9
Oct. 14	09 20.84	+24 20.6	6.634	6.284	+0.01	-1.9	17.1	65.3
Oct. 24	09 20.47	+24 03.5	6.528	6.346	-0.09	-1.4	17.1	75.1
Nov. 3	09 19.04	+23 51.2	6.413	6.408	-0.21	-1.0	17.1	85.2
Nov. 13	09 16.43	+23 43.5	6.296	6.470	-0.33	-0.5	17.1	95.7
Nov. 23	09 12.58	+23 40.0	6.182	6.532	-0.46	-0.1	17.1	106.5
Dec. 3	09 07.44	+23 40.2	6.078	6.595	-0.58	+0.2	17.1	117.7
Dec. 13	09 01.04	+23 43.1	5.991	6.657	-0.70	+0.4	17.1	129.2
Dec. 23	08 53.50	+23 47.6	5.927	6.720	-0.81	+0.5	17.1	141.0
Jan. 2	08 45.02	+23 52.2	5.892	6.782	-0.89	+0.4	17.2	152.9
Jan. 12	08 35.89	+23 55.6	5.891	6.845	-0.93	+0.2	17.2	164.8
Jan. 22	08 26.47	+23 56.4	5.927	6.908	-0.94	-0.1	17.3	175.0
Feb. 1	08 17.16	+23 54.0	6.001	6.971	-0.91	-0.5	17.3	169.0
Feb. 11	08 08.33	+23 47.8	6.112	7.033	-0.84	-0.8	17.4	157.4
Feb. 21	08 00.32	+23 37.9	6.257	7.096	-0.75	-1.2	17.5	145.7
Mar. 2	07 53.36	+23 24.7	6.433	7.159	-0.63	-1.5	17.6	134.2
Mar. 12	07 47.61	+23 08.7	6.633	7.222	-0.51	-1.7	17.7	123.0
Mar. 22	07 43.12	+22 50.6	6.852	7.285	-0.38	-1.9	17.8	112.1

Comet C/2018 E1 (ATLAS)

Epoch = 2019 July 16.0 TT  
 T = 2018 Apr. 17.29180 TT  
 Peri. = 299.46610 e = 0.9501099  
 Node = 146.84127 2000.0 a = 54.2256019 AU  
 Incl. = 72.49142 n = 0.00246830  
 q = 2.7053207 AU P = 399.31 years

$$m_1 = 11.8 + 5 \log(\Delta) + 7.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	10 55.40	+12 13.1	3.099	3.756	-0.27	+15.0	18.6	125.5
Jan. 17	10 51.87	+14 49.3	3.040	3.821	-0.45	+16.3	18.6	137.2
Jan. 27	10 46.58	+17 35.7	3.010	3.887	-0.62	+16.9	18.6	148.9
Feb. 6	10 39.82	+20 25.1	3.013	3.953	-0.74	+16.8	18.7	159.7
Feb. 16	10 32.08	+23 09.1	3.053	4.020	-0.81	+15.8	18.8	166.4
Feb. 26	10 23.96	+25 39.6	3.130	4.087	-0.81	+14.1	18.9	163.2
Mar. 8	10 16.11	+27 50.8	3.242	4.155	-0.75	+11.9	19.0	153.8
Mar. 18	10 09.13	+29 39.5	3.386	4.224	-0.63	+9.6	19.1	143.1
Mar. 28	10 03.49	+31 05.2	3.556	4.293	-0.48	+7.4	19.3	132.3
Apr. 7	09 59.49	+32 09.7	3.749	4.362	-0.30	+5.4	19.5	122.0
Apr. 17	09 57.24	+32 55.4	3.956	4.431	-0.13	+3.7	19.6	112.0
Apr. 27	09 56.73	+33 25.7	4.174	4.501	+0.04	+2.3	19.8	102.5
May 7	09 57.85	+33 43.3	4.397	4.571	+0.20	+1.2	20.0	93.5
May 17	10 00.45	+33 50.8	4.621	4.642	+0.33	+0.3	20.1	84.9
May 27	10 04.34	+33 50.6	4.841	4.712	+0.45	-0.4	20.3	76.7
June 6	10 09.34	+33 44.3	5.055	4.783	+0.55	-0.9	20.4	68.8
June 16	10 15.27	+33 33.6	5.259	4.854	+0.64	-1.3	20.6	61.3
June 26	10 21.98	+33 19.7	5.451	4.924	+0.71	-1.5	20.7	54.1
July 6	10 29.32	+33 03.7	5.629	4.995	+0.76	-1.7	20.8	47.3
July 16	10 37.16	+32 46.7	5.791	5.066	+0.81	-1.7	20.9	40.9
July 26	10 45.40	+32 29.5	5.935	5.138	+0.84	-1.7	21.0	35.1
Aug. 5	10 53.94	+32 13.0	6.061	5.209	+0.87	-1.6	21.1	30.2
Aug. 15	11 02.68	+31 58.1	6.167	5.280	+0.88	-1.4	21.2	26.5
Aug. 25	11 11.56	+31 45.6	6.253	5.351	+0.89	-1.1	21.2	24.7
Sept. 4	11 20.49	+31 36.3	6.318	5.422	+0.89	-0.7	21.3	25.2
Sept. 14	11 29.40	+31 31.2	6.363	5.493	+0.89	-0.2	21.4	27.8
Sept. 24	11 38.23	+31 31.2	6.388	5.564	+0.88	+0.3	21.4	32.1
Oct. 4	11 46.91	+31 37.1	6.394	5.635	+0.86	+1.0	21.5	37.6
Oct. 14	11 55.34	+31 49.9	6.383	5.706	+0.83	+1.7	21.5	43.9
Oct. 24	12 03.46	+32 10.4	6.355	5.777	+0.79	+2.5	21.5	50.7
Nov. 3	12 11.18	+32 39.6	6.314	5.848	+0.75	+3.4	21.6	58.0
Nov. 13	12 18.38	+33 18.1	6.260	5.919	+0.69	+4.4	21.6	65.5
Nov. 23	12 24.98	+34 06.4	6.199	5.989	+0.62	+5.4	21.6	73.2
Dec. 3	12 30.84	+35 04.9	6.133	6.060	+0.54	+6.4	21.6	81.1
Dec. 13	12 35.84	+36 13.4	6.066	6.130	+0.45	+7.4	21.6	89.1
Dec. 23	12 39.85	+37 31.4	6.001	6.201	+0.34	+8.3	21.6	97.1
Jan. 2	12 42.73	+38 57.7	5.944	6.271	+0.22	+9.0	21.7	105.0
Jan. 12	12 44.35	+40 30.6	5.899	6.341	+0.09	+9.6	21.7	112.5
Jan. 22	12 44.62	+42 07.5	5.869	6.411	-0.05	+9.8	21.7	119.5
Feb. 1	12 43.47	+43 45.3	5.859	6.481	-0.19	+9.7	21.7	125.5
Feb. 11	12 40.91	+45 20.4	5.870	6.551	-0.33	+9.2	21.8	130.2
Feb. 21	12 37.03	+46 49.1	5.905	6.620	-0.45	+8.4	21.8	133.1
Mar. 2	12 32.01	+48 08.0	5.964	6.690	-0.55	+7.2	21.9	133.9
Mar. 12	12 26.15	+49 14.0	6.048	6.759	-0.62	+5.8	21.9	132.5
Mar. 22	12 19.82	+50 05.3	6.154	6.828	-0.64	+4.3	22.0	129.2

## Comet C/2015 XY1 (Lemmon)

Epoch = 2019 July 16.0 TT  
 T = 2018 Apr. 29.16389 TT  
 Peri. = 196.31029  
 Node = 281.62391 2000.0  
 Incl. = 148.85485  
 q = 7.9271743 AU  
 e = 1.0043752

$$m1 = -4.6 + 5 \log(\Delta) + 20.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .8			m	'		°
Jan. 7	04 40.62	+04 24.8	7.302	8.076	-0.66	-1.6	17.9	139.6
Jan. 17	04 34.34	+04 10.6	7.434	8.088	-0.58	-1.2	17.9	128.9
Jan. 27	04 28.97	+04 01.1	7.590	8.101	-0.49	-0.7	18.0	118.1
Feb. 6	04 24.56	+03 55.7	7.763	8.113	-0.38	-0.3	18.0	107.5
Feb. 16	04 21.17	+03 53.9	7.947	8.127	-0.28	0.0	18.1	97.0
Feb. 26	04 18.75	+03 54.7	8.135	8.140	-0.19	+0.2	18.2	86.8
Mar. 8	04 17.27	+03 57.6	8.322	8.154	-0.10	+0.4	18.2	76.9
Mar. 18	04 16.63	+04 01.5	8.502	8.169	-0.02	+0.4	18.3	67.2
Mar. 28	04 16.74	+04 05.9	8.670	8.184	+0.05	+0.4	18.3	57.9
Apr. 7	04 17.49	+04 10.1	8.822	8.199	+0.11	+0.4	18.4	48.9
Apr. 17	04 18.80	+04 13.3	8.955	8.215	+0.16	+0.3	18.5	40.3
Apr. 27	04 20.54	+04 15.1	9.065	8.231	+0.19	+0.1	18.5	32.2
May 7	04 22.61	+04 15.0	9.150	8.247	+0.22	-0.1	18.5	25.0
May 17	04 24.91	+04 12.5	9.210	8.264	+0.24	-0.4	18.6	19.6
May 27	04 27.33	+04 07.2	9.243	8.281	+0.25	-0.7	18.6	17.4
June 6	04 29.79	+03 58.7	9.249	8.299	+0.24	-1.0	18.6	19.5
June 16	04 32.18	+03 46.8	9.229	8.317	+0.23	-1.4	18.6	24.8
June 26	04 34.41	+03 31.3	9.183	8.336	+0.21	-1.8	18.6	31.7
July 6	04 36.39	+03 11.7	9.114	8.355	+0.18	-2.2	18.6	39.5
July 16	04 38.00	+02 48.1	9.023	8.374	+0.14	-2.6	18.6	47.8
July 26	04 39.17	+02 20.3	8.914	8.394	+0.09	-3.0	18.6	56.4
Aug. 5	04 39.79	+01 48.2	8.789	8.414	+0.03	-3.4	18.6	65.2
Aug. 15	04 39.78	+01 11.9	8.652	8.434	-0.04	-3.8	18.6	74.3
Aug. 25	04 39.04	+00 31.7	8.508	8.455	-0.12	-4.2	18.6	83.5
Sept. 4	04 37.51	+00 12.2	8.363	8.476	-0.20	-4.6	18.6	93.0
Sept. 14	04 35.12	+00 59.2	8.220	8.497	-0.29	-4.8	18.6	102.7
Sept. 24	04 31.85	-01 48.6	8.086	8.519	-0.38	-5.0	18.5	112.4
Oct. 4	04 27.69	-02 39.3	7.967	8.541	-0.46	-5.1	18.5	122.1
Oct. 14	04 22.69	-03 30.1	7.869	8.564	-0.54	-5.0	18.5	131.6
Oct. 24	04 16.94	-04 19.6	7.795	8.587	-0.61	-4.8	18.5	140.6
Nov. 3	04 10.57	-05 06.3	7.751	8.610	-0.66	-4.5	18.5	148.2
Nov. 13	04 03.78	-05 48.6	7.740	8.634	-0.69	-3.9	18.6	153.0
Nov. 23	03 56.78	-06 25.2	7.763	8.658	-0.70	-3.3	18.6	153.4
Dec. 3	03 49.83	-06 55.2	7.821	8.682	-0.68	-2.6	18.6	149.1
Dec. 13	03 43.15	-07 17.9	7.912	8.706	-0.64	-1.9	18.7	141.7
Dec. 23	03 36.96	-07 33.2	8.032	8.731	-0.58	-1.1	18.7	132.8
Jan. 2	03 31.44	-07 41.5	8.179	8.756	-0.51	-0.5	18.8	123.2
Jan. 12	03 26.71	-07 43.3	8.345	8.782	-0.43	+0.1	18.9	113.4
Jan. 22	03 22.84	-07 39.6	8.527	8.808	-0.34	+0.6	19.0	103.4
Feb. 1	03 19.87	-07 31.5	8.717	8.834	-0.25	+1.0	19.0	93.6
Feb. 11	03 17.77	-07 20.1	8.909	8.860	-0.16	+1.3	19.1	84.0
Feb. 21	03 16.50	-07 06.4	9.099	8.887	-0.08	+1.5	19.2	74.6
Mar. 2	03 16.00	-06 51.5	9.281	8.914	-0.01	+1.5	19.2	65.4
Mar. 12	03 16.18	-06 36.3	9.450	8.941	+0.05	+1.5	19.3	56.6
Mar. 22	03 16.95	-06 21.6	9.602	8.969	+0.11	+1.4	19.4	48.2

Comet 37P/Forbes

Epoch = 2019 July 16.0 TT  
 T = 2018 May 4.18271 TT  
 Peri. = 330.02545 e = 0.5341946  
 Node = 314.57742 2000.0 a = 3.4578500 AU  
 Incl. = 8.95608 n = 0.15328330  
 q = 1.6106852 AU P = 6.43 years

$$m1 = 10.5 + 5 \log(\Delta) + 17.5 \log(r(t-30))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	23 56.80	+08 37.1	2.755	2.704	+1.23	+6.3	19.8	76.7
Jan. 17	00 09.34	+09 41.9	2.941	2.762	+1.28	+6.7	20.1	69.9
Jan. 27	00 22.30	+10 50.8	3.122	2.819	+1.32	+7.1	20.4	63.2
Feb. 6	00 35.59	+12 02.8	3.298	2.876	+1.34	+7.3	20.7	56.6
Feb. 16	00 49.14	+13 16.9	3.465	2.932	+1.37	+7.5	20.9	50.1
Feb. 26	01 02.86	+14 32.0	3.623	2.987	+1.38	+7.5	21.2	43.7
Mar. 8	01 16.71	+15 47.5	3.771	3.042	+1.39	+7.5	21.4	37.4
Mar. 18	01 30.65	+17 02.4	3.905	3.097	+1.40	+7.4	21.6	31.1
Mar. 28	01 44.61	+18 16.1	4.027	3.151	+1.40	+7.3	21.8	25.0
Apr. 7	01 58.57	+19 28.0	4.134	3.204	+1.39	+7.1	22.0	19.0
Apr. 17	02 12.47	+20 37.6	4.225	3.256	+1.39	+6.8	.	13.3
Apr. 27	02 26.28	+21 44.5	4.300	3.308	+1.37	+6.5	.	8.5
May 7	02 39.94	+22 48.3	4.358	3.359	+1.36	+6.2	.	7.0
May 17	02 53.41	+23 48.8	4.400	3.410	+1.33	+5.9	.	10.3
May 27	03 06.61	+24 45.7	4.424	3.459	+1.30	+5.5	.	15.7
June 6	03 19.49	+25 39.1	4.431	3.508	+1.27	+5.1	.	21.7
June 16	03 31.97	+26 28.9	4.421	3.557	+1.22	+4.8	.	28.1
June 26	03 43.95	+27 15.0	4.394	3.604	+1.17	+4.4	.	34.6
July 6	03 55.35	+27 57.8	4.351	3.651	+1.10	+4.1	.	41.4
July 16	04 06.03	+28 37.3	4.293	3.698	+1.02	+3.8	.	48.4
July 26	04 15.87	+29 13.8	4.222	3.743	+0.93	+3.5	.	55.6
Aug. 5	04 24.74	+29 47.6	4.138	3.788	+0.83	+3.2	.	63.1
Aug. 15	04 32.45	+30 18.9	4.043	3.832	+0.70	+3.0	.	70.8
Aug. 25	04 38.83	+30 48.1	3.940	3.875	+0.56	+2.8	.	78.9
Sept. 4	04 43.70	+31 15.1	3.832	3.918	+0.40	+2.6	.	87.4
Sept. 14	04 46.85	+31 39.9	3.722	3.960	+0.21	+2.3	.	96.2
Sept. 24	04 48.12	+32 02.1	3.613	4.001	+0.02	+2.1	.	105.5
Oct. 4	04 47.35	+32 21.0	3.511	4.041	-0.19	+1.7	.	115.3
Oct. 14	04 44.49	+32 35.4	3.420	4.081	-0.40	+1.1	.	125.5
Oct. 24	04 39.61	+32 43.7	3.345	4.120	-0.59	+0.4	.	136.1
Nov. 3	04 32.92	+32 44.3	3.292	4.158	-0.75	-0.4	.	146.9
Nov. 13	04 24.87	+32 36.0	3.264	4.196	-0.86	-1.3	.	157.6
Nov. 23	04 16.05	+32 18.3	3.266	4.233	-0.90	-2.3	.	166.7
Dec. 3	04 07.14	+31 52.1	3.299	4.269	-0.87	-3.0	.	168.4
Dec. 13	03 58.85	+31 19.3	3.364	4.305	-0.77	-3.5	.	160.6
Dec. 23	03 51.76	+30 42.9	3.459	4.340	-0.63	-3.7	.	150.1
Jan. 2	03 46.30	+30 06.1	3.582	4.374	-0.45	-3.6	.	139.3
Jan. 12	03 42.68	+29 31.7	3.727	4.408	-0.26	-3.2	.	128.6
Jan. 22	03 40.96	+29 01.8	3.891	4.441	-0.07	-2.7	.	118.1
Feb. 1	03 41.09	+28 37.6	4.068	4.473	+0.11	-2.1	.	108.1
Feb. 11	03 42.93	+28 19.6	4.253	4.505	+0.27	-1.5	.	98.4
Feb. 21	03 46.30	+28 07.6	4.442	4.535	+0.41	-0.9	.	89.1
Mar. 2	03 51.03	+28 01.1	4.630	4.566	+0.54	-0.4	.	80.1
Mar. 12	03 56.92	+27 59.4	4.814	4.595	+0.65	0.0	.	71.5
Mar. 22	04 03.80	+28 01.4	4.989	4.624	+0.74	+0.4	.	63.1

## Comet C/2016 R2 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2018 May 9.53348 TT  
 Peri. = 33.19214  
 Node = 80.56990 2000.0  
 Incl. = 58.22448  
 q = 2.6026762 AU  
 e = 0.9958528

$$m1 = 5.4 + 5 \log(\Delta) + 12.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	15 31.41	+40 46.7	3.626	3.606	+1.17	+2.2	15.2	81.1
Jan. 17	15 42.31	+41 14.4	3.626	3.674	+0.99	+3.5	15.3	85.0
Jan. 27	15 51.30	+41 54.4	3.626	3.743	+0.79	+4.6	15.4	89.1
Feb. 6	15 58.20	+42 44.9	3.627	3.813	+0.57	+5.5	15.5	93.3
Feb. 16	16 02.82	+43 43.3	3.630	3.883	+0.33	+6.1	15.6	97.4
Feb. 26	16 05.03	+44 46.1	3.636	3.954	+0.08	+6.4	15.7	101.5
Mar. 8	16 04.68	+45 49.2	3.647	4.026	-0.18	+6.1	15.8	105.4
Mar. 18	16 01.75	+46 47.6	3.667	4.098	-0.43	+5.4	15.9	108.9
Mar. 28	15 56.35	+47 36.1	3.695	4.170	-0.67	+4.1	16.0	111.8
Apr. 7	15 48.76	+48 09.6	3.735	4.243	-0.86	+2.3	16.1	114.1
Apr. 17	15 39.48	+48 23.3	3.788	4.317	-0.99	+0.1	16.2	115.6
Apr. 27	15 29.20	+48 14.2	3.855	4.391	-1.05	-2.2	16.4	116.0
May 7	15 18.67	+47 40.7	3.937	4.465	-1.04	-4.7	16.5	115.5
May 17	15 08.65	+46 43.3	4.034	4.539	-0.95	-7.0	16.6	113.9
May 27	14 59.76	+45 24.5	4.147	4.613	-0.81	-8.9	16.8	111.4
June 6	14 52.40	+43 47.8	4.274	4.688	-0.64	-10.5	16.9	108.0
June 16	14 46.80	+41 57.3	4.414	4.763	-0.46	-11.6	17.1	104.0
June 26	14 43.01	+39 57.1	4.566	4.838	-0.28	-12.4	17.3	99.4
July 6	14 40.96	+37 51.2	4.728	4.913	-0.11	-12.8	17.4	94.5
July 16	14 40.51	+35 42.7	4.897	4.988	+0.04	-12.9	17.6	89.2
July 26	14 41.49	+33 34.5	5.072	5.063	+0.17	-12.7	17.7	83.8
Aug. 5	14 43.72	+31 28.6	5.249	5.138	+0.29	-12.4	17.9	78.2
Aug. 15	14 47.04	+29 26.8	5.427	5.213	+0.38	-11.9	18.0	72.5
Aug. 25	14 51.27	+27 30.3	5.603	5.288	+0.47	-11.3	18.2	66.9
Sept. 4	14 56.27	+25 40.1	5.774	5.363	+0.54	-10.7	18.3	61.3
Sept. 14	15 01.92	+23 56.8	5.939	5.438	+0.59	-9.9	18.5	55.9
Sept. 24	15 08.08	+22 21.1	6.094	5.514	+0.64	-9.1	18.6	50.7
Oct. 4	15 14.66	+20 53.2	6.239	5.589	+0.68	-8.3	18.7	45.9
Oct. 14	15 21.54	+19 33.6	6.370	5.663	+0.70	-7.5	18.8	41.6
Oct. 24	15 28.62	+18 22.5	6.487	5.738	+0.72	-6.6	18.9	38.2
Nov. 3	15 35.83	+17 20.0	6.587	5.813	+0.72	-5.8	19.0	36.0
Nov. 13	15 43.05	+16 26.3	6.670	5.888	+0.72	-4.9	19.1	35.1
Nov. 23	15 50.19	+15 41.4	6.735	5.962	+0.71	-4.0	19.2	35.9
Dec. 3	15 57.17	+15 05.4	6.781	6.037	+0.68	-3.1	19.3	38.2
Dec. 13	16 03.87	+14 38.1	6.809	6.111	+0.65	-2.2	19.4	41.9
Dec. 23	16 10.21	+14 19.5	6.819	6.185	+0.61	-1.4	19.5	46.7
Jan. 2	16 16.08	+14 09.3	6.812	6.260	+0.56	-0.6	19.5	52.4
Jan. 12	16 21.37	+14 07.1	6.789	6.334	+0.49	+0.2	19.6	58.7
Jan. 22	16 25.98	+14 12.5	6.753	6.407	+0.42	+0.9	19.6	65.5
Feb. 1	16 29.81	+14 24.8	6.705	6.481	+0.34	+1.6	19.7	72.7
Feb. 11	16 32.77	+14 43.0	6.650	6.555	+0.24	+2.1	19.7	80.2
Feb. 21	16 34.77	+15 06.3	6.589	6.628	+0.14	+2.6	19.8	88.0
Mar. 2	16 35.74	+15 33.2	6.528	6.701	+0.04	+2.8	19.8	95.8
Mar. 12	16 35.64	+16 02.2	6.469	6.775	-0.07	+3.0	19.8	103.8
Mar. 22	16 34.46	+16 31.6	6.417	6.848	-0.18	+2.9	19.9	111.6

## Comet 240P/NEAT

Epoch = 2019 July 16.0 TT  
 T = 2018 May 15.76262 TT  
 Peri. = 352.06023 e = 0.4487483  
 Node = 74.92556 2000.0 a = 3.8702807 AU  
 Incl. = 23.50457 n = 0.12944652  
 q = 2.1334988 AU P = 7.61 years

$$m_1 = 7.9 + 5 \log(\Delta) + 15.0 \log(r(t-90))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m <sub>1</sub>	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	11 25.89	+35 22.0	2.096	2.763	+0.17	+10.6	15.2	123.5
Jan. 17	11 26.16	+37 10.9	2.056	2.805	-0.15	+11.1	15.3	131.4
Jan. 27	11 23.29	+39 00.2	2.035	2.848	-0.45	+10.6	15.4	138.5
Feb. 6	11 17.50	+40 40.4	2.036	2.892	-0.72	+9.1	15.5	143.9
Feb. 16	11 09.40	+42 01.5	2.060	2.935	-0.90	+6.7	15.6	146.5
Feb. 26	10 59.97	+42 55.6	2.109	2.979	-0.97	+3.7	15.7	145.6
Mar. 8	10 50.41	+43 18.6	2.181	3.023	-0.92	+0.5	15.9	141.6
Mar. 18	10 41.88	+43 10.3	2.276	3.066	-0.76	-2.4	16.1	135.5
Mar. 28	10 35.27	+42 34.6	2.390	3.110	-0.53	-4.9	16.3	128.4
Apr. 7	10 31.04	+41 36.7	2.521	3.154	-0.28	-6.8	16.5	120.9
Apr. 17	10 29.34	+40 22.0	2.666	3.198	-0.04	-8.2	16.7	113.3
Apr. 27	10 30.01	+38 55.5	2.821	3.242	+0.19	-9.1	17.0	105.7
May 7	10 32.79	+37 21.1	2.983	3.285	+0.38	-9.8	17.2	98.4
May 17	10 37.38	+35 41.7	3.150	3.329	+0.55	-10.1	17.4	91.2
May 27	10 43.46	+33 59.3	3.319	3.372	+0.68	-10.4	17.6	84.3
June 6	10 50.73	+32 15.2	3.487	3.415	+0.79	-10.5	17.8	77.5
June 16	10 58.98	+30 30.6	3.653	3.458	+0.87	-10.5	18.0	71.0
June 26	11 07.99	+28 46.2	3.814	3.500	+0.94	-10.4	18.2	64.6
July 6	11 17.59	+27 02.6	3.969	3.543	+0.99	-10.3	18.4	58.3
July 16	11 27.65	+25 20.3	4.117	3.585	+1.03	-10.1	18.5	52.2
July 26	11 38.06	+23 39.6	4.254	3.626	+1.06	-10.0	18.7	46.2
Aug. 5	11 48.74	+22 01.1	4.381	3.668	+1.08	-9.7	18.9	40.4
Aug. 15	11 59.60	+20 25.0	4.496	3.708	+1.09	-9.4	19.0	34.7
Aug. 25	12 10.58	+18 51.9	4.597	3.749	+1.10	-9.1	19.1	29.4
Sept. 4	12 21.64	+17 22.1	4.684	3.789	+1.11	-8.8	19.3	24.5
Sept. 14	12 32.71	+15 56.1	4.755	3.829	+1.11	-8.4	19.4	20.5
Sept. 24	12 43.74	+14 34.4	4.810	3.869	+1.10	-7.9	19.5	18.1
Oct. 4	12 54.69	+13 17.4	4.848	3.908	+1.09	-7.4	19.6	17.8
Oct. 14	13 05.51	+12 05.8	4.869	3.946	+1.07	-6.9	19.7	20.1
Oct. 24	13 16.12	+10 59.9	4.872	3.985	+1.05	-6.2	19.7	24.1
Nov. 3	13 26.47	+10 00.5	4.857	4.022	+1.02	-5.6	19.8	29.4
Nov. 13	13 36.49	+09 08.0	4.825	4.060	+0.98	-4.8	19.9	35.5
Nov. 23	13 46.08	+08 23.0	4.776	4.097	+0.93	-4.1	19.9	42.1
Dec. 3	13 55.15	+07 46.1	4.711	4.133	+0.87	-3.2	19.9	49.1
Dec. 13	14 03.58	+07 17.8	4.632	4.169	+0.80	-2.3	20.0	56.4
Dec. 23	14 11.26	+06 58.4	4.541	4.205	+0.72	-1.4	20.0	64.1
Jan. 2	14 18.06	+06 48.3	4.439	4.240	+0.62	-0.5	20.0	72.1
Jan. 12	14 23.81	+06 47.8	4.329	4.275	+0.51	-0.5	20.0	80.3
Jan. 22	14 28.39	+06 56.7	4.215	4.309	+0.39	+1.4	20.0	88.9
Feb. 1	14 31.63	+07 14.7	4.100	4.343	+0.25	+2.3	20.0	97.7
Feb. 11	14 33.41	+07 41.0	3.988	4.377	+0.09	+3.0	20.0	106.8
Feb. 21	14 33.63	+08 14.3	3.884	4.410	-0.07	+3.7	20.0	116.1
Mar. 2	14 32.23	+08 52.9	3.792	4.442	-0.23	+4.0	20.0	125.5
Mar. 12	14 29.25	+09 34.1	3.717	4.474	-0.38	+4.2	20.1	134.9
Mar. 22	14 24.83	+10 14.9	3.664	4.506	-0.51	+3.9	20.1	143.7



Comet 159P/LONEOS

Epoch = 2019 July 16.0 TT  
 T = 2018 May 22.41397 TT  
 Peri. = 4.69949 e = 0.3814677  
 Node = 55.02043 2000.0 a = 5.8599160 AU  
 Incl. = 23.46136 n = 0.06948115  
 q = 3.6245473 AU P = 14.19 years

$$m1 = 0.6 + 5 \log(\Delta) + 25.0 \log(r(t-330))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	06 00.81	+43 46.9	2.929	3.839	-0.78	+1.7	17.0	154.4
Jan. 17	05 53.65	+43 57.6	3.001	3.857	-0.62	+0.4	17.1	146.1
Jan. 27	05 48.31	+43 56.5	3.097	3.875	-0.42	-0.7	17.1	136.9
Feb. 6	05 45.19	+43 46.4	3.215	3.894	-0.18	-1.4	17.2	127.5
Feb. 16	05 44.50	+43 30.6	3.349	3.914	+0.06	-1.8	17.3	118.2
Feb. 26	05 46.19	+43 11.8	3.496	3.934	+0.29	-2.0	17.3	109.2
Mar. 8	05 50.10	+42 51.5	3.651	3.955	+0.51	-2.1	17.4	100.6
Mar. 18	05 56.02	+42 30.9	3.811	3.976	+0.69	-2.1	17.5	92.3
Mar. 28	06 03.68	+42 10.3	3.972	3.998	+0.85	-2.1	17.6	84.3
Apr. 7	06 12.83	+41 49.7	4.132	4.020	+0.99	-2.1	17.7	76.6
Apr. 17	06 23.23	+41 28.9	4.288	4.043	+1.10	-2.1	17.7	69.3
Apr. 27	06 34.65	+41 07.4	4.437	4.066	+1.19	-2.2	17.8	62.2
May 7	06 46.91	+40 44.9	4.578	4.090	+1.26	-2.3	17.9	55.4
May 17	06 59.81	+40 21.1	4.708	4.114	+1.32	-2.5	18.0	48.8
May 27	07 13.21	+39 55.7	4.827	4.138	+1.36	-2.6	18.0	42.5
June 6	07 26.96	+39 28.6	4.934	4.163	+1.39	-2.8	18.1	36.5
June 16	07 40.93	+38 59.6	5.027	4.188	+1.41	-3.0	18.1	30.9
June 26	07 55.02	+38 28.9	5.105	4.213	+1.41	-3.2	18.2	25.8
July 6	08 09.14	+37 56.8	5.168	4.238	+1.41	-3.3	18.2	21.5
July 16	08 23.19	+37 23.4	5.216	4.264	+1.40	-3.4	18.3	18.5
July 26	08 37.09	+36 49.3	5.247	4.291	+1.38	-3.4	18.3	17.7
Aug. 5	08 50.78	+36 15.0	5.263	4.317	+1.35	-3.4	18.3	19.1
Aug. 15	09 04.19	+35 41.1	5.262	4.344	+1.32	-3.3	18.4	22.6
Aug. 25	09 17.25	+35 08.4	5.245	4.371	+1.29	-3.2	18.4	27.3
Sept. 4	09 29.90	+34 37.6	5.212	4.398	+1.24	-2.9	18.4	32.8
Sept. 14	09 42.08	+34 09.6	5.164	4.426	+1.19	-2.6	18.4	38.8
Sept. 24	09 53.71	+33 45.4	5.102	4.453	+1.13	-2.2	18.4	45.2
Oct. 4	10 04.73	+33 26.0	5.027	4.481	+1.06	-1.6	18.4	52.0
Oct. 14	10 15.04	+33 12.4	4.939	4.509	+0.99	-1.0	18.4	59.1
Oct. 24	10 24.54	+33 05.8	4.842	4.537	+0.90	-0.3	18.4	66.5
Nov. 3	10 33.13	+33 06.9	4.736	4.565	+0.80	+0.6	18.4	74.1
Nov. 13	10 40.67	+33 16.8	4.625	4.594	+0.69	+1.5	18.4	82.0
Nov. 23	10 47.04	+33 36.1	4.512	4.622	+0.57	+2.5	18.4	90.2
Dec. 3	10 52.07	+34 04.9	4.399	4.651	+0.42	+3.4	18.4	98.7
Dec. 13	10 55.62	+34 43.0	4.292	4.680	+0.27	+4.3	18.4	107.3
Dec. 23	10 57.57	+35 29.5	4.193	4.709	+0.10	+5.0	18.4	116.1
Jan. 2	10 57.79	+36 22.4	4.107	4.738	-0.07	+5.5	18.4	124.8
Jan. 12	10 56.27	+37 19.0	4.038	4.767	-0.25	+5.7	18.4	133.3
Jan. 22	10 53.05	+38 15.5	3.991	4.796	-0.41	+5.5	18.5	141.0
Feb. 1	10 48.34	+39 07.9	3.968	4.825	-0.54	+4.8	18.5	147.2
Feb. 11	10 42.47	+39 51.8	3.971	4.854	-0.63	+3.8	18.6	150.6
Feb. 21	10 35.90	+40 23.7	4.001	4.883	-0.67	+2.4	18.7	150.1
Mar. 2	10 29.19	+40 41.1	4.059	4.913	-0.66	+0.9	18.7	146.1
Mar. 12	10 22.89	+40 42.9	4.142	4.942	-0.59	-0.7	18.9	139.7
Mar. 22	10 17.49	+40 29.7	4.248	4.971	-0.48	-2.1	19.0	132.1

Comet 164P/Christensen

Epoch = 2019 July 16.0 TT  
 T = 2018 June 2.34894 TT  
 Peri. = 325.84921 e = 0.5414072  
 Node = 88.32771 2000.0 a = 3.6531930 AU  
 Incl. = 16.26086 n = 0.14115464  
 q = 1.6753280 AU P = 6.98 years

$$m_1 = 14.0 + 5 \log(\Delta) + 7.5 \log(r(t-200))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	11 21.40	+23 56.4	1.903	2.571	+0.05	+9.1	17.1	122.7
Jan. 17	11 20.54	+25 32.6	1.863	2.629	-0.26	+10.1	17.1	132.4
Jan. 27	11 16.66	+27 15.7	1.841	2.687	-0.54	+10.4	17.1	142.1
Feb. 6	11 10.09	+28 56.8	1.842	2.744	-0.78	+9.6	17.1	150.7
Feb. 16	11 01.52	+30 25.7	1.868	2.802	-0.93	+7.9	17.2	156.6
Feb. 26	10 51.98	+31 33.8	1.921	2.859	-0.96	+5.4	17.3	157.1
Mar. 8	10 42.58	+32 15.9	2.002	2.916	-0.89	+2.7	17.5	152.1
Mar. 18	10 34.41	+32 30.9	2.108	2.972	-0.72	+0.1	17.7	144.2
Mar. 28	10 28.19	+32 21.2	2.236	3.028	-0.50	-2.2	17.9	135.4
Apr. 7	10 24.29	+31 51.1	2.383	3.084	-0.26	-4.0	18.1	126.4
Apr. 17	10 22.80	+31 05.0	2.545	3.139	-0.02	-5.3	18.3	117.6
Apr. 27	10 23.57	+30 07.2	2.719	3.193	+0.19	-6.3	18.5	109.1
May 7	10 26.32	+29 00.9	2.900	3.247	+0.37	-7.0	18.8	101.0
May 17	10 30.79	+27 48.5	3.086	3.301	+0.53	-7.5	19.0	93.2
May 27	10 36.65	+26 31.9	3.274	3.353	+0.65	-7.8	19.2	85.7
June 6	10 43.67	+25 12.4	3.461	3.406	+0.76	-8.1	19.4	78.4
June 16	10 51.60	+23 50.9	3.645	3.457	+0.84	-8.2	19.6	71.4
June 26	11 00.27	+22 28.3	3.823	3.508	+0.90	-8.3	19.8	64.5
July 6	11 09.51	+21 05.0	3.994	3.558	+0.95	-8.3	19.9	57.8
July 16	11 19.19	+19 41.7	4.156	3.608	+0.99	-8.3	20.1	51.3
July 26	11 29.21	+18 18.8	4.307	3.657	+1.02	-8.2	20.2	44.8
Aug. 5	11 39.48	+16 56.8	4.445	3.705	+1.04	-8.1	20.4	38.5
Aug. 15	11 49.93	+15 36.1	4.570	3.753	+1.05	-8.0	20.5	32.3
Aug. 25	12 00.48	+14 17.3	4.679	3.800	+1.06	-7.8	20.6	26.4
Sept. 4	12 11.09	+13 00.6	4.773	3.846	+1.06	-7.5	20.7	20.8
Sept. 14	12 21.70	+11 46.8	4.849	3.892	+1.06	-7.2	20.9	16.1
Sept. 24	12 32.26	+10 36.3	4.907	3.937	+1.05	-6.9	20.9	13.2
Oct. 4	12 42.71	+09 29.5	4.947	3.982	+1.04	-6.4	21.0	13.6
Oct. 14	12 53.00	+08 27.1	4.968	4.025	+1.02	-6.0	21.1	17.1
Oct. 24	13 03.07	+07 29.7	4.970	4.069	+0.99	-5.4	21.2	22.5
Nov. 3	13 12.84	+06 37.9	4.953	4.111	+0.96	-4.9	21.2	28.8
Nov. 13	13 22.24	+05 52.2	4.917	4.153	+0.92	-4.2	21.2	35.6
Nov. 23	13 31.17	+05 13.3	4.864	4.194	+0.86	-3.5	21.3	42.9
Dec. 3	13 39.55	+04 41.9	4.794	4.234	+0.80	-2.7	21.3	50.4
Dec. 13	13 47.25	+04 18.4	4.709	4.274	+0.73	-1.9	21.3	58.3
Dec. 23	13 54.15	+04 03.4	4.612	4.314	+0.64	-1.0	21.3	66.4
Jan. 2	14 00.11	+03 57.4	4.505	4.352	+0.54	-0.1	21.3	74.8
Jan. 12	14 04.99	+04 00.6	4.391	4.390	+0.42	+0.8	21.3	83.5
Jan. 22	14 08.65	+04 13.1	4.273	4.427	+0.29	+1.8	21.3	92.6
Feb. 1	14 10.95	+04 34.7	4.156	4.464	+0.15	+2.6	21.3	101.9
Feb. 11	14 11.78	+05 04.7	4.045	4.500	0.00	+3.4	21.3	111.5
Feb. 21	14 11.08	+05 42.0	3.943	4.536	-0.16	+4.1	21.2	121.3
Mar. 2	14 08.82	+06 24.9	3.857	4.570	-0.31	+4.5	21.2	131.2
Mar. 12	14 05.11	+07 10.8	3.790	4.605	-0.44	+4.6	21.2	141.0
Mar. 22	14 00.13	+07 56.8	3.747	4.638	-0.56	+4.5	21.3	150.2

Comet C/2017 M5 (TOTAS)

Epoch = 2019 July 16.0 TT  
 T = 2018 June 3.38975 TT  
 Peri. = 92.69369  
 Node = 216.26721 2000.0  
 Incl. = 15.88415  
 q = 5.9901546 AU  
 e = 1.0045658

$$m1 = 6.8 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	21 28.95	-01 07.0	6.904	6.182	+0.77	+2.3	18.9	40.0
Jan. 17	21 36.80	+00 42.1	7.008	6.200	+0.80	+2.7	19.0	32.3
Jan. 27	21 44.84	+00 12.8	7.096	6.218	+0.81	+3.2	19.0	25.1
Feb. 6	21 52.97	+00 20.6	7.164	6.237	+0.82	+3.5	19.0	18.5
Feb. 16	22 01.13	+00 57.4	7.213	6.257	+0.81	+3.8	19.1	13.6
Feb. 26	22 09.21	+01 37.1	7.241	6.277	+0.80	+4.1	19.1	12.3
Mar. 8	22 17.17	+02 19.1	7.249	6.299	+0.79	+4.3	19.1	15.5
Mar. 18	22 24.91	+03 02.7	7.237	6.320	+0.76	+4.4	19.1	21.3
Mar. 28	22 32.37	+03 47.5	7.206	6.343	+0.73	+4.5	19.1	28.1
Apr. 7	22 39.49	+04 32.7	7.156	6.366	+0.69	+4.5	19.1	35.3
Apr. 17	22 46.18	+05 17.7	7.089	6.390	+0.64	+4.5	19.1	42.8
Apr. 27	22 52.40	+06 01.8	7.007	6.414	+0.59	+4.3	19.1	50.5
May 7	22 58.06	+06 44.4	6.911	6.439	+0.53	+4.1	19.1	58.4
May 17	23 03.09	+07 24.7	6.804	6.465	+0.47	+3.9	19.1	66.3
May 27	23 07.44	+08 02.1	6.689	6.491	+0.40	+3.5	19.1	74.5
June 6	23 11.05	+08 35.8	6.568	6.518	+0.32	+3.1	19.0	82.8
June 16	23 13.85	+09 05.0	6.444	6.546	+0.23	+2.6	19.0	91.3
June 26	23 15.82	+09 29.0	6.321	6.574	+0.15	+2.1	19.0	100.0
July 6	23 16.92	+09 47.1	6.203	6.603	+0.06	+1.5	19.0	108.9
July 16	23 17.15	+09 58.7	6.094	6.632	-0.02	+0.8	18.9	117.9
July 26	23 16.56	+10 03.3	5.998	6.661	-0.10	+0.1	18.9	127.2
Aug. 5	23 15.21	+10 00.5	5.919	6.692	-0.17	-0.7	18.9	136.6
Aug. 15	23 13.22	+09 50.5	5.860	6.722	-0.23	-1.4	18.9	145.9
Aug. 25	23 10.74	+09 33.7	5.824	6.754	-0.27	-2.0	18.9	154.9
Sept. 4	23 07.97	+09 10.7	5.816	6.786	-0.29	-2.6	18.9	162.7
Sept. 14	23 05.12	+08 42.8	5.835	6.818	-0.28	-3.0	19.0	166.6
Sept. 24	23 02.41	+08 11.5	5.884	6.851	-0.25	-3.3	19.0	163.2
Oct. 4	23 00.06	+07 38.5	5.961	6.884	-0.21	-3.3	19.1	155.5
Oct. 14	22 58.24	+07 05.7	6.065	6.918	-0.15	-3.2	19.1	146.3
Oct. 24	22 57.11	+06 34.6	6.195	6.952	-0.07	-3.0	19.2	136.7
Nov. 3	22 56.75	+06 06.8	6.346	6.986	+0.01	-2.6	19.3	126.9
Nov. 13	22 57.24	+05 43.3	6.514	7.021	+0.10	-2.1	19.3	117.2
Nov. 23	22 58.58	+05 25.1	6.696	7.057	+0.18	-1.5	19.4	107.5
Dec. 3	23 00.75	+05 12.7	6.888	7.093	+0.26	-0.9	19.5	98.0
Dec. 13	23 03.71	+05 06.3	7.083	7.129	+0.34	-0.3	19.6	88.7
Dec. 23	23 07.39	+05 05.8	7.279	7.166	+0.40	+0.3	19.7	79.5
Jan. 2	23 11.71	+05 11.0	7.472	7.203	+0.46	+0.8	19.7	70.5
Jan. 12	23 16.60	+05 21.7	7.656	7.240	+0.52	+1.3	19.8	61.6
Jan. 22	23 21.96	+05 37.3	7.829	7.278	+0.56	+1.8	19.9	52.9
Feb. 1	23 27.70	+05 57.3	7.989	7.316	+0.59	+2.2	20.0	44.3
Feb. 11	23 33.75	+06 21.1	8.131	7.355	+0.62	+2.6	20.0	35.9
Feb. 21	23 40.01	+06 48.2	8.255	7.394	+0.64	+2.9	20.1	27.8
Mar. 2	23 46.42	+07 17.9	8.358	7.433	+0.65	+3.1	20.1	19.9
Mar. 12	23 52.89	+07 49.6	8.439	7.473	+0.65	+3.3	20.2	12.6
Mar. 22	23 59.36	+08 22.8	8.498	7.513	+0.64	+3.4	20.2	7.9

## Comet 370P/NEAT

Epoch = 2019 July 16.0 TT  
 T = 2018 June 9.41467 TT  
 Peri. = 356.75224 e = 0.6141859  
 Node = 55.15922 2000.0 a = 6.4403390 AU  
 Incl. = 19.39730 n = 0.06030329  
 q = 2.4847736 AU P = 16.34 years

$$m_1 = 7.4 + 5 \log(\Delta) + 22.5 \log(r(t-40))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	07 47.91	+44 42.7	2.114	3.041	-0.90	+5.2	19.3	156.4
Jan. 17	07 38.80	+45 24.3	2.165	3.087	-0.90	+2.9	19.5	155.3
Jan. 27	07 30.32	+45 42.4	2.243	3.133	-0.77	+0.6	19.7	149.8
Feb. 6	07 23.54	+45 38.7	2.345	3.180	-0.55	-1.4	20.0	142.0
Feb. 16	07 19.20	+45 17.3	2.469	3.229	-0.28	-2.9	20.2	133.4
Feb. 26	07 17.61	+44 43.0	2.611	3.277	-0.01	-4.0	20.5	124.7
Mar. 8	07 18.73	+43 59.9	2.768	3.327	+0.25	-4.7	20.8	116.1
Mar. 18	07 22.35	+43 11.0	2.937	3.377	+0.49	-5.1	21.0	107.8
Mar. 28	07 28.13	+42 18.6	3.114	3.427	+0.68	-5.4	21.3	99.8
Apr. 7	07 35.71	+41 23.9	3.295	3.478	+0.84	-5.6	21.6	92.1
Apr. 17	07 44.76	+40 27.5	3.479	3.529	+0.97	-5.7	21.9	84.6
Apr. 27	07 54.96	+39 29.8	3.662	3.581	+1.07	-5.8	.	77.5
May 7	08 06.04	+38 30.8	3.842	3.633	+1.15	-6.0	.	70.6
May 17	08 17.79	+37 30.7	4.017	3.685	+1.20	-6.1	.	63.8
May 27	08 30.00	+36 29.4	4.186	3.737	+1.24	-6.2	.	57.3
June 6	08 42.53	+35 27.0	4.347	3.790	+1.26	-6.3	.	50.9
June 16	08 55.24	+34 23.6	4.497	3.842	+1.28	-6.4	.	44.7
June 26	09 08.02	+33 19.6	4.637	3.895	+1.28	-6.4	.	38.7
July 6	09 20.80	+32 15.2	4.763	3.948	+1.27	-6.5	.	32.8
July 16	09 33.49	+31 10.7	4.876	4.000	+1.26	-6.4	.	27.3
July 26	09 46.03	+30 06.6	4.974	4.053	+1.24	-6.4	.	22.3
Aug. 5	09 58.38	+29 03.2	5.057	4.106	+1.22	-6.3	.	18.2
Aug. 15	10 10.49	+28 01.3	5.123	4.158	+1.20	-6.1	.	15.9
Aug. 25	10 22.31	+27 01.2	5.173	4.211	+1.16	-5.9	.	16.1
Sept. 4	10 33.79	+26 03.7	5.205	4.264	+1.13	-5.6	.	19.0
Sept. 14	10 44.90	+25 09.5	5.219	4.316	+1.09	-5.2	.	23.6
Sept. 24	10 55.58	+24 19.2	5.217	4.368	+1.04	-4.8	.	29.2
Oct. 4	11 05.78	+23 33.6	5.197	4.421	+0.99	-4.3	.	35.5
Oct. 14	11 15.43	+22 53.5	5.160	4.473	+0.93	-3.7	.	42.3
Oct. 24	11 24.46	+22 19.7	5.108	4.525	+0.87	-3.0	.	49.4
Nov. 3	11 32.78	+21 53.1	5.042	4.576	+0.79	-2.2	.	56.9
Nov. 13	11 40.31	+21 34.5	4.963	4.628	+0.70	-1.4	.	64.7
Nov. 23	11 46.93	+21 24.5	4.875	4.679	+0.61	-0.5	.	72.8
Dec. 3	11 52.52	+21 23.7	4.779	4.731	+0.50	+0.5	.	81.3
Dec. 13	11 56.97	+21 32.6	4.679	4.782	+0.38	+1.4	.	90.0
Dec. 23	12 00.16	+21 51.0	4.580	4.832	+0.24	+2.4	.	99.0
Jan. 2	12 01.96	+22 18.6	4.484	4.883	+0.10	+3.2	.	108.3
Jan. 12	12 02.31	+22 54.1	4.398	4.933	-0.05	+3.9	.	117.8
Jan. 22	12 01.17	+23 36.0	4.325	4.984	-0.20	+4.4	.	127.3
Feb. 1	11 58.57	+24 21.6	4.270	5.033	-0.34	+4.7	.	136.8
Feb. 11	11 54.66	+25 07.8	4.238	5.083	-0.46	+4.5	.	145.6
Feb. 21	11 49.66	+25 51.2	4.232	5.133	-0.55	+4.0	.	153.0
Mar. 2	11 43.90	+26 28.3	4.254	5.182	-0.60	+3.2	.	157.1
Mar. 12	11 37.80	+26 56.3	4.306	5.231	-0.61	+2.2	.	156.3
Mar. 22	11 31.77	+27 13.2	4.386	5.279	-0.58	+1.0	.	151.0

## Comet P/2017 TW13 (Lemmon)

Epoch = 2019 July 16.0 TT  
 T = 2018 June 20.93259 TT  
 Peri. = 120.09273  
 Node = 322.27708 2000.0  
 Incl. = 44.84225  
 q = 2.0786332 AU

e = 0.7095124  
 a = 7.1556693 AU  
 n = 0.05149069  
 P = 19.14 years

$$m1 = 11.6 + 5 \log(\Delta) + 12.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .			m	'		°
Jan. 7	10 57.23	-02 07.5	2.216	2.832	-0.63	-12.3	19.0	119.4
Jan. 17	10 49.70	-04 05.1	2.160	2.893	-0.89	-11.0	19.0	130.1
Jan. 27	10 39.76	-05 48.3	2.125	2.954	-1.11	-9.4	19.1	140.8
Feb. 6	10 27.99	-07 13.7	2.117	3.017	-1.25	-7.5	19.2	150.9
Feb. 16	10 15.29	-08 19.2	2.139	3.080	-1.28	-5.4	19.4	158.5
Feb. 26	10 02.73	-09 04.6	2.193	3.143	-1.21	-3.5	19.5	160.3
Mar. 8	09 51.29	-09 32.1	2.279	3.207	-1.05	-1.9	19.7	155.1
Mar. 18	09 41.77	-09 46.0	2.394	3.271	-0.83	-0.8	19.9	146.6
Mar. 28	09 34.59	-09 51.3	2.534	3.335	-0.58	-0.2	20.2	137.1
Apr. 7	09 29.89	-09 52.7	2.695	3.400	-0.34	-0.1	20.4	127.6
Apr. 17	09 27.59	-09 54.0	2.872	3.464	-0.11	-0.3	20.6	118.4
Apr. 27	09 27.46	-09 58.4	3.061	3.529	+0.10	-0.7	20.9	109.6
May 7	09 29.23	-10 07.5	3.258	3.594	+0.27	-1.2	21.1	101.3
May 17	09 32.61	-10 22.7	3.458	3.659	+0.42	-1.9	21.3	93.3
May 27	09 37.32	-10 44.6	3.659	3.723	+0.54	-2.6	21.6	85.7
June 6	09 43.13	-11 13.5	3.859	3.788	+0.63	-3.3	21.8	78.4
June 16	09 49.83	-11 49.5	4.053	3.852	+0.71	-4.0	22.0	71.4
June 26	09 57.23	-12 32.3	4.241	3.917	+0.77	-4.6	.	64.7
July 6	10 05.18	-13 21.6	4.420	3.981	+0.82	-5.3	.	58.3
July 16	10 13.56	-14 17.4	4.588	4.045	+0.86	-5.9	.	52.1
July 26	10 22.25	-15 19.0	4.745	4.108	+0.88	-6.5	.	46.2
Aug. 5	10 31.16	-16 26.3	4.888	4.172	+0.90	-7.0	.	40.7
Aug. 15	10 40.20	-17 38.9	5.017	4.235	+0.91	-7.5	.	35.6
Aug. 25	10 49.29	-18 56.3	5.130	4.298	+0.91	-8.0	.	31.3
Sept. 4	10 58.36	-20 18.3	5.227	4.360	+0.90	-8.4	.	27.9
Sept. 14	11 07.34	-21 44.6	5.306	4.423	+0.89	-8.8	.	25.8
Sept. 24	11 16.16	-23 14.7	5.369	4.485	+0.87	-9.2	.	25.6
Oct. 4	11 24.74	-24 48.3	5.414	4.547	+0.84	-9.5	.	27.2
Oct. 14	11 32.99	-26 25.1	5.441	4.608	+0.80	-9.8	.	30.4
Oct. 24	11 40.84	-28 04.6	5.451	4.669	+0.76	-10.1	.	34.8
Nov. 3	11 48.16	-29 46.4	5.445	4.730	+0.70	-10.3	.	40.1
Nov. 13	11 54.86	-31 30.1	5.423	4.790	+0.63	-10.4	.	46.1
Nov. 23	12 00.79	-33 15.0	5.387	4.851	+0.55	-10.5	.	52.5
Dec. 3	12 05.82	-35 00.4	5.339	4.910	+0.45	-10.5	.	59.4
Dec. 13	12 09.77	-36 45.2	5.280	4.970	+0.33	-10.4	.	66.5
Dec. 23	12 12.50	-38 28.5	5.214	5.029	+0.20	-10.2	.	73.8
Jan. 2	12 13.80	-40 08.5	5.142	5.088	+0.05	-9.8	.	81.3
Jan. 12	12 13.54	-41 43.5	5.070	5.146	-0.12	-9.1	.	88.9
Jan. 22	12 11.59	-43 11.1	4.999	5.204	-0.29	-8.3	.	96.6
Feb. 1	12 07.89	-44 28.7	4.934	5.262	-0.46	-7.1	.	104.1
Feb. 11	12 02.51	-45 33.5	4.878	5.319	-0.62	-5.7	.	111.5
Feb. 21	11 55.63	-46 22.8	4.836	5.376	-0.76	-4.0	.	118.4
Mar. 2	11 47.59	-46 54.4	4.810	5.433	-0.85	-2.1	.	124.5
Mar. 12	11 38.89	-47 07.0	4.804	5.489	-0.88	-0.2	.	129.5
Mar. 22	11 30.10	-47 00.8	4.818	5.546	-0.86	+1.6	.	133.0

## Comet 361P/Spacewatch

Epoch = 2019 July 16.0 TT  
 T = 2018 July 2.33091 TT  
 Peri. = 219.17695 e = 0.4377019  
 Node = 203.26827 2000.0 a = 4.9436351 AU  
 Incl. = 13.88241 n = 0.08966738  
 q = 2.7797966 AU P = 10.99 years

$$m1 = 10.2 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	07 07.53	+02 11.9	2.112	3.053	-0.68	+1.1	16.7	159.7
Jan. 17	07 01.00	+02 30.0	2.148	3.080	-0.61	+2.6	16.7	157.6
Jan. 27	06 55.40	+03 01.6	2.211	3.109	-0.48	+3.8	16.8	151.0
Feb. 6	06 51.34	+03 43.2	2.298	3.138	-0.30	+4.5	17.0	142.4
Feb. 16	06 49.20	+04 30.7	2.408	3.167	-0.10	+4.9	17.1	133.2
Feb. 26	06 49.15	+05 20.2	2.536	3.198	+0.11	+4.9	17.3	124.1
Mar. 8	06 51.17	+06 08.7	2.679	3.229	+0.31	+4.7	17.4	115.2
Mar. 18	06 55.13	+06 53.6	2.833	3.261	+0.50	+4.2	17.6	106.7
Mar. 28	07 00.82	+07 33.2	2.994	3.294	+0.66	+3.6	17.8	98.5
Apr. 7	07 08.01	+08 06.2	3.160	3.327	+0.79	+2.9	17.9	90.7
Apr. 17	07 16.49	+08 31.9	3.328	3.361	+0.91	+2.1	18.1	83.2
Apr. 27	07 26.03	+08 49.9	3.495	3.395	+1.00	+1.4	18.2	76.0
May 7	07 36.42	+09 00.0	3.659	3.429	+1.08	+0.6	18.4	69.0
May 17	07 47.50	+09 02.2	3.818	3.464	+1.14	-0.2	18.5	62.2
May 27	07 59.09	+08 56.7	3.970	3.500	+1.18	-1.0	18.6	55.6
June 6	08 11.08	+08 43.7	4.114	3.536	+1.22	-1.7	18.8	49.2
June 16	08 23.33	+08 23.6	4.249	3.572	+1.24	-2.4	18.9	42.9
June 26	08 35.74	+07 57.0	4.372	3.608	+1.25	-3.0	19.0	36.7
July 6	08 48.24	+07 24.2	4.483	3.645	+1.25	-3.6	19.1	30.6
July 16	09 00.73	+06 45.7	4.581	3.682	+1.25	-4.1	19.2	24.6
July 26	09 13.14	+06 02.3	4.665	3.719	+1.24	-4.6	19.2	18.9
Aug. 5	09 25.43	+05 14.4	4.734	3.756	+1.22	-5.0	19.3	13.7
Aug. 15	09 37.52	+04 22.6	4.787	3.793	+1.20	-5.4	19.4	9.9
Aug. 25	09 49.36	+03 27.6	4.824	3.831	+1.17	-5.6	19.4	9.6
Sept. 4	10 00.92	+02 30.1	4.844	3.868	+1.14	-5.9	19.5	13.1
Sept. 14	10 12.11	+01 30.7	4.847	3.906	+1.10	-6.0	19.5	18.5
Sept. 24	10 22.89	+00 30.2	4.833	3.943	+1.05	-6.1	19.6	24.6
Oct. 4	10 33.19	+00 30.8	4.802	3.981	+1.00	-6.1	19.6	31.3
Oct. 14	10 42.94	-01 31.3	4.755	4.019	+0.94	-6.0	19.6	38.2
Oct. 24	10 52.07	-02 30.6	4.693	4.056	+0.87	-5.8	19.6	45.4
Nov. 3	11 00.47	-03 27.9	4.615	4.094	+0.80	-5.6	19.6	52.9
Nov. 13	11 08.04	-04 22.0	4.525	4.132	+0.71	-5.2	19.6	60.7
Nov. 23	11 14.69	-05 12.0	4.424	4.169	+0.61	-4.7	19.6	68.8
Dec. 3	11 20.27	-05 56.8	4.314	4.207	+0.49	-4.1	19.6	77.2
Dec. 13	11 24.67	-06 35.2	4.199	4.244	+0.37	-3.4	19.6	85.9
Dec. 23	11 27.77	-07 05.8	4.081	4.281	+0.23	-2.6	19.6	95.1
Jan. 2	11 29.46	-07 27.5	3.965	4.318	+0.09	-1.6	19.5	104.6
Jan. 12	11 29.68	-07 38.9	3.855	4.355	-0.06	-0.5	19.5	114.4
Jan. 22	11 28.43	-07 39.1	3.757	4.392	-0.20	+0.6	19.5	124.7
Feb. 1	11 25.77	-07 27.3	3.675	4.429	-0.34	+1.8	19.5	135.2
Feb. 11	11 21.89	-07 03.8	3.614	4.466	-0.44	+3.0	19.5	146.0
Feb. 21	11 17.08	-06 29.3	3.578	4.502	-0.52	+4.0	19.5	156.6
Mar. 2	11 11.70	-05 45.7	3.570	4.539	-0.55	+4.8	19.5	166.1
Mar. 12	11 06.20	-04 55.7	3.593	4.575	-0.54	+5.2	19.6	169.9
Mar. 22	11 01.02	-04 02.6	3.647	4.611	-0.49	+5.4	19.6	163.5

## Comet 49P/Arend-Rigaux

Epoch = 2019 July 16.0 TT  
 T = 2018 July 15.47534 TT  
 Peri. = 332.91393  
 Node = 118.81706 2000.0  
 Incl. = 19.04320  
 q = 1.4301554 AU

e = 0.5992763  
 a = 3.5689314 AU  
 n = 0.14618297  
 P = 6.74 years

$$m1 = 14.1 + 5 \log(\Delta) + 5.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .			m	'		°
Jan. 7	14 03.30	+05 50.5	2.240	2.285	+1.21	+2.2	17.6	80.0
Jan. 17	14 14.49	+06 20.3	2.184	2.354	+1.00	+3.9	17.7	87.3
Jan. 27	14 23.46	+07 07.5	2.127	2.422	+0.77	+5.7	17.7	95.1
Feb. 6	14 29.96	+08 11.6	2.070	2.489	+0.50	+7.3	17.7	103.3
Feb. 16	14 33.75	+09 30.6	2.018	2.557	+0.22	+8.6	17.7	111.9
Feb. 26	14 34.69	+11 01.1	1.974	2.623	-0.07	+9.5	17.7	120.9
Mar. 8	14 32.73	+12 38.2	1.944	2.690	-0.35	+9.8	17.7	129.9
Mar. 18	14 28.01	+14 14.7	1.930	2.755	-0.61	+9.3	17.7	138.5
Mar. 28	14 21.00	+15 42.4	1.938	2.821	-0.80	+8.0	17.8	145.9
Apr. 7	14 12.35	+16 53.4	1.970	2.885	-0.92	+5.9	17.9	150.7
Apr. 17	14 02.99	+17 41.5	2.028	2.948	-0.94	+3.4	18.0	151.4
Apr. 27	13 53.85	+18 03.4	2.111	3.011	-0.87	+0.7	18.1	147.9
May 7	13 45.76	+17 59.3	2.218	3.073	-0.73	-1.8	18.3	141.6
May 17	13 39.31	+17 31.9	2.347	3.135	-0.54	-3.9	18.4	133.9
May 27	13 34.82	+16 45.4	2.495	3.195	-0.34	-5.5	18.6	125.8
June 6	13 32.37	+15 44.3	2.658	3.255	-0.13	-6.8	18.8	117.6
June 16	13 31.90	+14 32.4	2.833	3.313	+0.05	-7.6	19.0	109.5
June 26	13 33.22	+13 13.5	3.016	3.371	+0.22	-8.2	19.1	101.6
July 6	13 36.13	+11 50.0	3.205	3.428	+0.37	-8.5	19.3	94.0
July 16	13 40.43	+10 24.1	3.395	3.485	+0.50	-8.7	19.5	86.5
July 26	13 45.92	+08 57.5	3.586	3.540	+0.61	-8.7	19.6	79.3
Aug. 5	13 52.41	+07 31.2	3.773	3.595	+0.70	-8.6	19.8	72.2
Aug. 15	13 59.76	+06 06.4	3.955	3.648	+0.78	-8.4	19.9	65.2
Aug. 25	14 07.82	+04 43.7	4.130	3.701	+0.84	-8.1	20.0	58.4
Sept. 4	14 16.49	+03 23.9	4.295	3.753	+0.90	-7.8	20.1	51.6
Sept. 14	14 25.65	+02 07.4	4.449	3.805	+0.94	-7.4	20.2	45.0
Sept. 24	14 35.22	+00 54.8	4.590	3.855	+0.98	-7.0	20.3	38.5
Oct. 4	14 45.12	+00 13.4	4.716	3.905	+1.00	-6.6	20.4	32.1
Oct. 14	14 55.25	-01 16.9	4.826	3.954	+1.02	-6.1	20.5	26.0
Oct. 24	15 05.55	-02 15.3	4.918	4.002	+1.04	-5.5	20.6	20.5
Nov. 3	15 15.95	-03 08.2	4.992	4.049	+1.04	-5.0	20.6	16.2
Nov. 13	15 26.34	-03 55.2	5.047	4.095	+1.04	-4.4	20.7	14.4
Nov. 23	15 36.67	-04 36.1	5.082	4.141	+1.02	-3.7	20.7	16.0
Dec. 3	15 46.83	-05 10.7	5.096	4.186	+1.00	-3.1	20.7	20.4
Dec. 13	15 56.72	-05 38.8	5.091	4.230	+0.97	-2.4	20.8	26.3
Dec. 23	16 06.25	-06 00.2	5.066	4.274	+0.93	-1.8	20.8	32.9
Jan. 2	16 15.31	-06 14.8	5.022	4.316	+0.87	-1.1	20.8	40.1
Jan. 12	16 23.77	-06 22.7	4.960	4.358	+0.81	-0.4	20.8	47.6
Jan. 22	16 31.52	-06 24.1	4.883	4.399	+0.73	+0.2	20.8	55.4
Feb. 1	16 38.41	-06 19.1	4.791	4.440	+0.64	+0.8	20.7	63.5
Feb. 11	16 44.31	-06 08.0	4.688	4.479	+0.53	+1.4	20.7	71.8
Feb. 21	16 49.09	-05 51.3	4.578	4.518	+0.41	+2.0	20.7	80.4
Mar. 2	16 52.60	-05 29.7	4.462	4.557	+0.28	+2.4	20.6	89.2
Mar. 12	16 54.74	-05 03.9	4.345	4.594	+0.13	+2.8	20.6	98.3
Mar. 22	16 55.41	-04 35.0	4.232	4.631	-0.02	+3.0	20.6	107.6

Comet C/2016 N6 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2018 July 18.18474 TT  
 Peri. = 162.79645  
 Node = 298.98107 2000.0  
 Incl. = 105.83865  
 q = 2.6687932 AU  
 e = 0.9987496

$$m1 = 5.8 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	07 07.11	-19 36.2	2.414	3.212	-2.29	-11.3	12.8	137.9
Jan. 17	06 44.77	-21 08.9	2.501	3.269	-2.13	-6.8	12.9	134.8
Jan. 27	06 24.69	-21 59.3	2.626	3.327	-1.84	-3.0	13.1	128.3
Feb. 6	06 07.86	-22 15.5	2.783	3.387	-1.48	-0.1	13.3	120.2
Feb. 16	05 54.68	-22 07.6	2.963	3.449	-1.12	+1.7	13.5	111.5
Feb. 26	05 45.07	-21 45.6	3.158	3.512	-0.78	+2.7	13.8	102.8
Mar. 8	05 38.66	-21 17.1	3.361	3.576	-0.48	+3.0	14.0	94.4
Mar. 18	05 35.03	-20 47.6	3.565	3.641	-0.23	+2.8	14.2	86.4
Mar. 28	05 33.70	-20 21.3	3.766	3.708	-0.02	+2.4	14.4	79.0
Apr. 7	05 34.24	-20 00.5	3.960	3.775	+0.14	+1.7	14.6	72.1
Apr. 17	05 36.31	-19 47.2	4.143	3.843	+0.28	+0.9	14.7	65.8
Apr. 27	05 39.59	-19 42.6	4.313	3.912	+0.38	0.0	14.9	60.2
May 7	05 43.80	-19 47.3	4.467	3.981	+0.47	-1.0	15.1	55.4
May 17	05 48.74	-20 02.3	4.605	4.052	+0.53	-2.1	15.2	51.4
May 27	05 54.20	-20 27.7	4.725	4.123	+0.57	-3.1	15.3	48.4
June 6	06 00.03	-21 04.1	4.827	4.194	+0.60	-4.3	15.4	46.5
June 16	06 06.06	-21 51.7	4.911	4.266	+0.61	-5.4	15.6	45.8
June 26	06 12.15	-22 50.8	4.978	4.338	+0.61	-6.6	15.7	46.2
July 6	06 18.17	-24 01.6	5.029	4.410	+0.59	-7.7	15.8	47.8
July 16	06 23.98	-25 24.3	5.064	4.483	+0.56	-8.9	15.8	50.3
July 26	06 29.44	-26 58.7	5.085	4.556	+0.52	-10.1	15.9	53.6
Aug. 5	06 34.40	-28 44.9	5.094	4.630	+0.46	-11.2	16.0	57.6
Aug. 15	06 38.70	-30 42.4	5.094	4.704	+0.39	-12.3	16.1	62.0
Aug. 25	06 42.17	-32 50.4	5.086	4.777	+0.29	-13.4	16.1	66.7
Sept. 4	06 44.59	-35 08.2	5.074	4.851	+0.18	-14.2	16.2	71.6
Sept. 14	06 45.73	-37 33.9	5.060	4.925	+0.04	-14.9	16.2	76.6
Sept. 24	06 45.36	-40 05.5	5.048	5.000	-0.13	-15.4	16.3	81.5
Oct. 4	06 43.19	-42 40.0	5.040	5.074	-0.33	-15.5	16.4	86.2
Oct. 14	06 38.94	-45 13.6	5.041	5.148	-0.55	-15.1	16.4	90.6
Oct. 24	06 32.37	-47 41.8	5.051	5.222	-0.79	-14.3	16.5	94.4
Nov. 3	06 23.30	-49 59.5	5.074	5.297	-1.05	-13.0	16.6	97.5
Nov. 13	06 11.71	-52 00.9	5.112	5.371	-1.29	-11.0	16.6	99.9
Nov. 23	05 57.84	-53 40.8	5.165	5.446	-1.50	-8.6	16.7	101.3
Dec. 3	05 42.20	-54 54.8	5.234	5.520	-1.63	-5.9	16.8	101.7
Dec. 13	05 25.62	-55 40.4	5.319	5.594	-1.67	-3.0	16.9	101.2
Dec. 23	05 09.11	-55 57.4	5.418	5.669	-1.61	-0.2	17.0	99.8
Jan. 2	04 53.65	-55 47.9	5.529	5.743	-1.45	+2.3	17.1	97.6
Jan. 12	04 40.04	-55 16.0	5.651	5.817	-1.24	+4.2	17.2	94.8
Jan. 22	04 28.75	-54 26.9	5.781	5.891	-0.99	+5.7	17.3	91.6
Feb. 1	04 19.98	-53 25.9	5.917	5.965	-0.74	+6.6	17.4	88.0
Feb. 11	04 13.70	-52 18.2	6.055	6.039	-0.50	+7.0	17.5	84.4
Feb. 21	04 09.69	-51 07.9	6.192	6.113	-0.28	+7.0	17.6	80.8
Mar. 2	04 07.71	-49 58.6	6.327	6.186	-0.10	+6.8	17.7	77.4
Mar. 12	04 07.47	-48 53.1	6.458	6.260	+0.06	+6.2	17.8	74.2
Mar. 22	04 08.69	-47 53.7	6.581	6.334	+0.19	+5.6	17.9	71.4



Comet C/2016 M1 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2018 Aug. 10.19656 TT  
 Peri. = 209.83860  
 Node = 92.20264 2000.0  
 Incl. = 91.00081  
 q = 2.2108119 AU  
 e = 0.9990395

$$m1 = 4.4 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .5			m	'		°
Jan. 7	23 22.21	-85 29.5	3.045	2.785	+19.33	+15.4	11.3	65.6
Jan. 17	01 29.27	-82 01.6	3.063	2.853	+7.23	+24.9	11.4	68.5
Jan. 27	02 22.87	-77 38.7	3.088	2.922	+3.80	+27.5	11.5	71.1
Feb. 6	02 54.56	-72 58.5	3.124	2.993	+2.60	+28.4	11.6	73.3
Feb. 16	03 17.81	-68 13.2	3.173	3.066	+2.06	+28.5	11.8	74.8
Feb. 26	03 36.99	-63 30.3	3.236	3.140	+1.78	+27.9	11.9	75.6
Mar. 8	03 53.93	-58 55.8	3.314	3.215	+1.61	+26.8	12.1	75.6
Mar. 18	04 09.50	-54 34.7	3.407	3.291	+1.50	+25.2	12.2	74.9
Mar. 28	04 24.12	-50 30.9	3.512	3.368	+1.42	+23.3	12.4	73.6
Apr. 7	04 38.04	-46 47.0	3.628	3.446	+1.36	+21.2	12.6	71.6
Apr. 17	04 51.39	-43 25.0	3.753	3.525	+1.31	+19.0	12.7	69.3
Apr. 27	05 04.25	-40 25.5	3.882	3.604	+1.26	+16.7	12.9	66.7
May 7	05 16.64	-37 48.5	4.015	3.684	+1.22	+14.5	13.1	63.9
May 17	05 28.59	-35 33.6	4.146	3.765	+1.17	+12.3	13.2	61.2
May 27	05 40.06	-33 39.8	4.274	3.845	+1.12	+10.3	13.4	58.6
June 6	05 51.06	-32 06.0	4.396	3.926	+1.07	+8.3	13.6	56.3
June 16	06 01.55	-30 51.0	4.510	4.007	+1.02	+6.5	13.7	54.5
June 26	06 11.47	-29 53.6	4.614	4.089	+0.96	+4.8	13.8	53.3
July 6	06 20.80	-29 12.5	4.707	4.170	+0.90	+3.3	14.0	52.7
July 16	06 29.46	-28 46.5	4.786	4.252	+0.83	+1.8	14.1	53.0
July 26	06 37.39	-28 34.2	4.851	4.334	+0.75	+0.5	14.2	54.1
Aug. 5	06 44.51	-28 34.7	4.902	4.415	+0.66	-0.7	14.3	56.0
Aug. 15	06 50.72	-28 46.6	4.939	4.497	+0.57	-1.8	14.4	58.7
Aug. 25	06 55.94	-29 08.5	4.962	4.579	+0.46	-2.7	14.5	62.2
Sept. 4	07 00.03	-29 39.3	4.971	4.661	+0.34	-3.5	14.6	66.4
Sept. 14	07 02.88	-30 17.0	4.970	4.742	+0.21	-4.1	14.6	71.2
Sept. 24	07 04.37	-31 00.0	4.959	4.824	+0.07	-4.5	14.7	76.5
Oct. 4	07 04.36	-31 46.1	4.940	4.905	-0.09	-4.7	14.8	82.2
Oct. 14	07 02.74	-32 32.4	4.917	4.986	-0.25	-4.5	14.8	88.2
Oct. 24	06 59.46	-33 16.1	4.894	5.067	-0.42	-4.1	14.9	94.4
Nov. 3	06 54.49	-33 53.6	4.873	5.148	-0.59	-3.3	15.0	100.6
Nov. 13	06 47.92	-34 21.3	4.860	5.229	-0.74	-2.1	15.0	106.6
Nov. 23	06 39.95	-34 35.5	4.857	5.310	-0.86	-0.6	15.1	112.2
Dec. 3	06 30.89	-34 33.0	4.870	5.390	-0.95	+1.3	15.2	117.1
Dec. 13	06 21.19	-34 11.5	4.901	5.471	-0.99	+3.2	15.2	120.8
Dec. 23	06 11.35	-33 30.4	4.953	5.551	-0.97	+5.2	15.3	123.0
Jan. 2	06 01.88	-32 30.0	5.029	5.631	-0.91	+7.0	15.4	123.5
Jan. 12	05 53.25	-31 12.8	5.127	5.711	-0.80	+8.5	15.5	122.1
Jan. 22	05 45.80	-29 41.9	5.249	5.790	-0.67	+9.7	15.6	119.0
Feb. 1	05 39.77	-28 01.3	5.392	5.869	-0.52	+10.4	15.7	114.5
Feb. 11	05 35.25	-26 15.1	5.554	5.948	-0.37	+10.8	15.9	108.9
Feb. 21	05 32.24	-24 26.9	5.732	6.027	-0.22	+10.8	16.0	102.7
Mar. 2	05 30.66	-22 39.8	5.922	6.106	-0.08	+10.5	16.1	96.0
Mar. 12	05 30.39	-20 56.5	6.120	6.184	+0.04	+10.0	16.2	89.1
Mar. 22	05 31.28	-19 18.8	6.322	6.263	+0.15	+9.4	16.4	82.1

## Comet 48P/Johnson

Epoch = 2019 July 16.0 TT  
 T = 2018 Aug. 12.26635 TT  
 Peri. = 216.58702 e = 0.4271631  
 Node = 110.12876 2000.0 a = 3.4994347 AU  
 Incl. = 12.20731 n = 0.15055918  
 q = 2.0046053 AU P = 6.55 years

$$m_1 = 7.5 + 5 \log(\Delta) + 17.5 \log(r(t-60))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m <sub>1</sub>	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	00 11.09	-11 31.9	2.407	2.305	+1.55	+13.7	15.1	72.2
Jan. 17	00 26.69	-09 15.4	2.551	2.341	+1.58	+13.6	15.3	66.6
Jan. 27	00 42.54	-07 00.4	2.694	2.379	+1.60	+13.4	15.6	61.1
Feb. 6	00 58.60	-04 47.8	2.834	2.418	+1.62	+13.1	15.8	55.6
Feb. 16	01 14.82	-02 38.7	2.970	2.458	+1.63	+12.7	16.0	50.2
Feb. 26	01 31.14	+00 34.2	3.101	2.498	+1.64	+12.2	16.2	44.8
Mar. 8	01 47.54	+01 25.2	3.225	2.539	+1.64	+11.6	16.4	39.5
Mar. 18	02 04.00	+03 18.8	3.343	2.581	+1.65	+11.0	16.6	34.2
Mar. 28	02 20.47	+05 05.8	3.452	2.623	+1.65	+10.3	16.8	28.9
Apr. 7	02 36.94	+06 45.9	3.551	2.666	+1.65	+9.6	17.0	23.7
Apr. 17	02 53.38	+08 18.6	3.640	2.709	+1.64	+8.9	17.1	18.7
Apr. 27	03 09.75	+09 43.6	3.719	2.752	+1.63	+8.1	17.3	13.8
May 7	03 26.01	+11 00.7	3.785	2.795	+1.62	+7.3	17.5	9.6
May 17	03 42.12	+12 09.8	3.839	2.839	+1.60	+6.5	17.6	7.3
May 27	03 58.03	+13 10.8	3.879	2.882	+1.58	+5.7	17.8	8.7
June 6	04 13.68	+14 03.9	3.906	2.926	+1.55	+4.9	17.9	12.8
June 16	04 29.01	+14 49.0	3.920	2.969	+1.51	+4.1	18.0	17.8
June 26	04 43.96	+15 26.5	3.919	3.012	+1.47	+3.3	18.2	23.3
July 6	04 58.44	+15 56.7	3.904	3.055	+1.42	+2.6	18.3	29.0
July 16	05 12.36	+16 20.0	3.875	3.098	+1.36	+2.0	18.4	35.0
July 26	05 25.63	+16 36.9	3.833	3.141	+1.29	+1.4	18.5	41.2
Aug. 5	05 38.16	+16 48.1	3.777	3.183	+1.21	+0.8	18.5	47.7
Aug. 15	05 49.80	+16 54.2	3.708	3.225	+1.11	+0.4	18.6	54.4
Aug. 25	06 00.44	+16 56.2	3.629	3.267	+1.00	0.0	18.7	61.4
Sept. 4	06 09.93	+16 54.9	3.539	3.308	+0.88	-0.3	18.7	68.7
Sept. 14	06 18.10	+16 51.3	3.440	3.349	+0.74	-0.4	18.8	76.4
Sept. 24	06 24.79	+16 46.5	3.336	3.390	+0.58	-0.5	18.8	84.5
Oct. 4	06 29.80	+16 41.8	3.229	3.430	+0.40	-0.4	18.8	93.0
Oct. 14	06 32.95	+16 38.2	3.121	3.470	+0.21	-0.2	18.9	102.1
Oct. 24	06 34.09	+16 37.0	3.018	3.509	0.00	0.0	18.9	111.6
Nov. 3	06 33.10	+16 38.9	2.924	3.548	-0.22	+0.4	18.9	121.8
Nov. 13	06 29.97	+16 44.8	2.843	3.587	-0.43	+0.8	19.0	132.5
Nov. 23	06 24.83	+16 54.8	2.782	3.625	-0.62	+1.2	19.0	143.6
Dec. 3	06 17.97	+17 08.8	2.744	3.662	-0.76	+1.6	19.1	155.2
Dec. 13	06 09.93	+17 26.2	2.735	3.699	-0.85	+1.9	19.1	166.6
Dec. 23	06 01.35	+17 46.2	2.756	3.736	-0.86	+2.1	19.2	174.3
Jan. 2	05 52.97	+18 07.9	2.809	3.772	-0.80	+2.2	19.4	166.5
Jan. 12	05 45.51	+18 30.7	2.893	3.808	-0.67	+2.3	19.5	155.1
Jan. 22	05 39.48	+18 54.1	3.005	3.843	-0.51	+2.4	19.7	143.8
Feb. 1	05 35.26	+19 17.9	3.141	3.877	-0.31	+2.4	19.9	132.7
Feb. 11	05 33.02	+19 41.9	3.296	3.911	-0.12	+2.4	20.0	122.1
Feb. 21	05 32.73	+20 05.7	3.466	3.945	+0.08	+2.4	20.2	112.0
Mar. 2	05 34.32	+20 29.1	3.646	3.978	+0.26	+2.3	20.4	102.4
Mar. 12	05 37.62	+20 51.5	3.831	4.010	+0.42	+2.2	20.6	93.2
Mar. 22	05 42.42	+21 12.5	4.017	4.042	+0.56	+2.0	20.8	84.3

## Comet 243P/NEAT

Epoch = 2019 July 16.0 TT  
 T = 2018 Aug. 26.00118 TT  
 Peri. = 283.54722 e = 0.3595072  
 Node = 87.65769 2000.0 a = 3.8318029 AU  
 Incl. = 7.64167 n = 0.13140120  
 q = 2.4542422 AU P = 7.50 years

$$m_1 = 7.3 + 5 \log(\Delta) + 20.0 \log(r(t-30))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	01 52.58	+05 39.8	2.215	2.604	+0.72	+8.2	17.1	102.0
Jan. 17	02 00.61	+07 03.8	2.363	2.625	+0.89	+8.6	17.3	94.2
Jan. 27	02 10.21	+08 31.1	2.514	2.648	+1.04	+8.8	17.5	86.8
Feb. 6	02 21.17	+09 59.7	2.666	2.672	+1.16	+8.9	17.7	79.7
Feb. 16	02 33.27	+11 28.4	2.817	2.697	+1.27	+8.8	17.9	72.9
Feb. 26	02 46.35	+12 55.5	2.965	2.723	+1.36	+8.6	18.1	66.3
Mar. 8	03 00.25	+14 20.0	3.109	2.750	+1.43	+8.3	18.3	59.9
Mar. 18	03 14.86	+15 40.8	3.248	2.777	+1.49	+7.8	18.5	53.7
Mar. 28	03 30.05	+16 56.9	3.380	2.806	+1.55	+7.3	18.6	47.6
Apr. 7	03 45.73	+18 07.6	3.503	2.835	+1.59	+6.8	18.8	41.7
Apr. 17	04 01.80	+19 12.3	3.618	2.865	+1.63	+6.1	19.0	35.8
Apr. 27	04 18.18	+20 10.5	3.722	2.895	+1.65	+5.4	19.1	30.0
May 7	04 34.78	+21 01.7	3.816	2.926	+1.67	+4.7	19.3	24.3
May 17	04 51.53	+21 45.8	3.898	2.958	+1.68	+4.0	19.4	18.6
May 27	05 08.33	+22 22.5	3.968	2.989	+1.68	+3.3	19.5	12.9
June 6	05 25.11	+22 51.9	4.026	3.022	+1.67	+2.5	19.6	7.2
June 16	05 41.79	+23 14.2	4.069	3.054	+1.66	+1.8	19.8	1.5
June 26	05 58.29	+23 29.6	4.100	3.087	+1.64	+1.2	19.9	4.3
July 6	06 14.53	+23 38.4	4.116	3.120	+1.61	+0.5	20.0	10.1
July 16	06 30.43	+23 41.2	4.118	3.153	+1.57	0.0	20.1	16.0
July 26	06 45.90	+23 38.6	4.106	3.187	+1.52	-0.5	20.2	22.0
Aug. 5	07 00.87	+23 31.3	4.079	3.221	+1.47	-1.0	20.2	28.1
Aug. 15	07 15.24	+23 20.2	4.039	3.254	+1.40	-1.3	20.3	34.4
Aug. 25	07 28.93	+23 06.1	3.985	3.288	+1.33	-1.5	20.4	40.9
Sept. 4	07 41.85	+22 50.1	3.918	3.322	+1.24	-1.7	20.4	47.6
Sept. 14	07 53.88	+22 33.4	3.838	3.356	+1.15	-1.7	20.5	54.5
Sept. 24	08 04.92	+22 17.3	3.748	3.390	+1.04	-1.5	20.5	61.7
Oct. 4	08 14.83	+22 03.0	3.648	3.423	+0.92	-1.3	20.5	69.2
Oct. 14	08 23.45	+21 52.0	3.540	3.457	+0.79	-0.9	20.6	77.1
Oct. 24	08 30.65	+21 45.6	3.427	3.491	+0.63	-0.3	20.6	85.4
Nov. 3	08 36.24	+21 45.3	3.311	3.524	+0.46	+0.3	20.6	94.1
Nov. 13	08 40.05	+21 52.2	3.197	3.558	+0.28	+1.1	20.6	103.3
Nov. 23	08 41.92	+22 07.1	3.088	3.591	+0.07	+1.9	20.6	113.0
Dec. 3	08 41.71	+22 30.3	2.989	3.624	-0.14	+2.8	20.6	123.2
Dec. 13	08 39.42	+23 01.2	2.904	3.657	-0.34	+3.5	20.6	134.0
Dec. 23	08 35.12	+23 38.2	2.840	3.690	-0.53	+3.9	20.7	145.1
Jan. 2	08 29.09	+24 18.6	2.800	3.722	-0.68	+4.1	20.7	156.6
Jan. 12	08 21.80	+24 59.2	2.788	3.755	-0.77	+3.9	20.8	167.8
Jan. 22	08 13.89	+25 36.6	2.806	3.787	-0.80	+3.4	20.9	174.3
Feb. 1	08 06.09	+26 07.9	2.856	3.819	-0.75	+2.7	21.0	165.7
Feb. 11	07 59.11	+26 31.5	2.936	3.850	-0.63	+1.9	21.1	154.5
Feb. 21	07 53.51	+26 46.9	3.043	3.881	-0.47	+1.1	21.3	143.3
Mar. 2	07 49.67	+26 54.2	3.174	3.912	-0.28	+0.3	21.4	132.5
Mar. 12	07 47.78	+26 54.6	3.323	3.943	-0.08	-0.3	21.6	122.2
Mar. 22	07 47.83	+26 49.0	3.487	3.974	+0.11	-0.9	21.8	112.3

## Comet 21P/Giacobini-Zinner

Epoch = 2019 July 16.0 TT  
 T = 2018 Sept. 10.27776 TT  
 Peri. = 172.85217 e = 0.7103758  
 Node = 195.38373 2000.0 a = 3.4962020 AU  
 Incl. = 31.99916 n = 0.15076804  
 q = 1.0125847 AU P = 6.54 years

$$m_1 = 9.6 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	06 17.64	-35 43.7	1.138	1.843	-0.97	+16.8	13.9	120.5
Jan. 17	06 09.67	-32 40.3	1.236	1.935	-0.59	+19.9	14.4	121.0
Jan. 27	06 05.52	-29 13.5	1.346	2.027	-0.21	+21.3	14.8	120.0
Feb. 6	06 04.93	-25 38.9	1.471	2.117	+0.12	+21.4	15.3	117.6
Feb. 16	06 07.47	-22 08.6	1.610	2.206	+0.41	+20.4	15.8	114.1
Feb. 26	06 12.59	-18 51.1	1.762	2.294	+0.63	+18.8	16.2	109.8
Mar. 8	06 19.79	-15 51.2	1.925	2.381	+0.82	+16.9	16.7	104.8
Mar. 18	06 28.65	-13 11.5	2.098	2.466	+0.96	+14.8	17.1	99.5
Mar. 28	06 38.78	-10 52.9	2.278	2.549	+1.07	+12.7	17.5	93.9
Apr. 7	06 49.89	-08 54.9	2.465	2.631	+1.16	+10.7	17.9	88.2
Apr. 17	07 01.74	-07 16.8	2.655	2.712	+1.22	+8.8	18.2	82.4
Apr. 27	07 14.12	-05 57.3	2.847	2.791	+1.26	+7.0	18.6	76.6
May 7	07 26.86	-04 55.0	3.038	2.869	+1.29	+5.3	18.9	70.8
May 17	07 39.84	-04 08.4	3.226	2.945	+1.31	+3.8	19.2	65.0
May 27	07 52.93	-03 36.3	3.410	3.020	+1.31	+2.5	19.5	59.2
June 6	08 06.05	-03 17.1	3.587	3.094	+1.31	+1.2	19.7	53.5
June 16	08 19.11	-03 09.7	3.756	3.166	+1.30	+0.1	20.0	47.9
June 26	08 32.05	-03 12.8	3.915	3.237	+1.29	-0.9	20.2	42.3
July 6	08 44.83	-03 25.4	4.063	3.306	+1.27	-1.7	20.4	36.9
July 16	08 57.38	-03 46.5	4.197	3.375	+1.24	-2.5	20.6	31.7
July 26	09 09.66	-04 15.0	4.317	3.442	+1.21	-3.2	20.8	26.9
Aug. 5	09 21.64	-04 50.2	4.421	3.507	+1.18	-3.8	21.0	22.8
Aug. 15	09 33.27	-05 31.1	4.508	3.572	+1.14	-4.4	21.2	19.8
Aug. 25	09 44.51	-06 16.9	4.578	3.635	+1.10	-4.8	21.3	18.7
Sept. 4	09 55.32	-07 06.9	4.630	3.697	+1.05	-5.2	21.4	19.9
Sept. 14	10 05.64	-08 00.3	4.663	3.758	+1.00	-5.5	21.6	23.1
Sept. 24	10 15.41	-08 56.3	4.677	3.818	+0.95	-5.7	21.7	27.8
Oct. 4	10 24.59	-09 54.2	4.672	3.877	+0.88	-5.9	21.8	33.5
Oct. 14	10 33.07	-10 53.2	4.649	3.935	+0.81	-5.9	21.9	39.8
Oct. 24	10 40.78	-11 52.4	4.608	3.991	+0.72	-5.9	21.9	46.7
Nov. 3	10 47.61	-12 50.8	4.550	4.047	+0.63	-5.8	22.0	54.0
Nov. 13	10 53.45	-13 47.5	4.478	4.102	+0.52	-5.5	22.0	61.6
Nov. 23	10 58.17	-14 41.1	4.393	4.155	+0.41	-5.2	.	69.7
Dec. 3	11 01.65	-15 30.4	4.298	4.208	+0.27	-4.6	.	78.1
Dec. 13	11 03.74	-16 13.7	4.197	4.259	+0.13	-3.9	.	86.9
Dec. 23	11 04.34	-16 49.2	4.094	4.310	-0.03	-3.0	.	96.0
Jan. 2	11 03.36	-17 14.9	3.992	4.359	-0.19	-1.9	.	105.5
Jan. 12	11 00.79	-17 28.7	3.898	4.408	-0.34	-0.7	.	115.3
Jan. 22	10 56.69	-17 28.7	3.815	4.456	-0.49	+0.8	.	125.2
Feb. 1	10 51.26	-17 13.4	3.751	4.503	-0.61	+2.4	.	135.1
Feb. 11	10 44.79	-16 42.1	3.709	4.549	-0.69	+4.0	.	144.5
Feb. 21	10 37.71	-15 55.4	3.694	4.594	-0.72	+5.4	.	152.5
Mar. 2	10 30.49	-14 55.4	3.708	4.638	-0.71	+6.6	.	157.2
Mar. 12	10 23.64	-13 45.3	3.754	4.681	-0.65	+7.4	.	156.4
Mar. 22	10 17.58	-12 29.2	3.830	4.724	-0.55	+7.8	.	150.7

Comet 368P/NEAT

Epoch = 2019 July 16.0 TT  
 T = 2018 Sept. 14.24473 TT  
 Peri. = 118.79561 e = 0.6259257  
 Node = 257.97704 2000.0 a = 5.5272161 AU  
 Incl. = 15.48504 n = 0.07584805  
 q = 2.0675895 AU P = 12.99 years

$$m1 = 10.7 + 5 \log(\Delta) + 17.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	02 19.07	+19 57.9	1.761	2.327	+1.12	-4.0	18.3	112.9
Jan. 17	02 30.95	+19 25.5	1.913	2.369	+1.26	-2.3	18.7	105.2
Jan. 27	02 44.04	+19 08.4	2.072	2.414	+1.37	-1.0	19.0	98.0
Feb. 6	02 58.12	+19 03.0	2.238	2.461	+1.45	0.0	19.3	91.0
Feb. 16	03 12.98	+19 05.8	2.408	2.509	+1.52	+0.6	19.6	84.2
Feb. 26	03 28.44	+19 14.0	2.580	2.559	+1.57	+1.0	19.9	77.7
Mar. 8	03 44.38	+19 24.9	2.752	2.611	+1.61	+1.2	20.2	71.4
Mar. 18	04 00.66	+19 36.5	2.923	2.664	+1.64	+1.1	20.5	65.2
Mar. 28	04 17.17	+19 46.9	3.091	2.718	+1.66	+0.9	20.7	59.1
Apr. 7	04 33.83	+19 54.9	3.254	2.772	+1.67	+0.6	21.0	53.2
Apr. 17	04 50.55	+19 59.2	3.411	2.828	+1.67	+0.2	21.3	47.3
Apr. 27	05 07.23	+19 59.2	3.560	2.884	+1.66	-0.3	21.5	41.5
May 7	05 23.82	+19 54.2	3.701	2.941	+1.65	-0.8	21.7	35.7
May 17	05 40.24	+19 43.7	3.832	2.999	+1.63	-1.4	22.0	30.0
May 27	05 56.43	+19 27.7	3.951	3.056	+1.60	-1.9	.	24.3
June 6	06 12.33	+19 06.0	4.059	3.115	+1.57	-2.5	.	18.6
June 16	06 27.88	+18 38.7	4.154	3.173	+1.53	-3.0	.	13.1
June 26	06 43.02	+18 05.9	4.235	3.231	+1.49	-3.6	.	8.1
July 6	06 57.72	+17 28.0	4.301	3.290	+1.44	-4.1	.	5.3
July 16	07 11.90	+16 45.2	4.352	3.349	+1.39	-4.5	.	8.0
July 26	07 25.52	+15 58.0	4.388	3.407	+1.33	-4.9	.	13.2
Aug. 5	07 38.54	+15 06.8	4.408	3.466	+1.27	-5.3	.	19.2
Aug. 15	07 50.89	+14 12.1	4.412	3.525	+1.20	-5.6	.	25.5
Aug. 25	08 02.51	+13 14.5	4.401	3.583	+1.12	-5.9	.	32.0
Sept. 4	08 13.35	+12 14.6	4.373	3.642	+1.04	-6.1	.	38.7
Sept. 14	08 23.31	+11 13.1	4.331	3.700	+0.95	-6.2	.	45.7
Sept. 24	08 32.32	+10 10.7	4.275	3.758	+0.85	-6.3	.	53.0
Oct. 4	08 40.28	+09 08.2	4.206	3.816	+0.73	-6.2	.	60.6
Oct. 14	08 47.08	+08 06.5	4.127	3.873	+0.61	-6.1	.	68.4
Oct. 24	08 52.61	+07 06.7	4.039	3.930	+0.48	-5.8	.	76.7
Nov. 3	08 56.75	+06 09.7	3.945	3.987	+0.33	-5.5	.	85.2
Nov. 13	08 59.38	+05 16.9	3.849	4.044	+0.18	-5.0	.	94.2
Nov. 23	09 00.42	+04 29.5	3.755	4.101	+0.01	-4.4	.	103.6
Dec. 3	08 59.78	+03 48.9	3.666	4.157	-0.16	-3.6	.	113.4
Dec. 13	08 57.50	+03 16.4	3.589	4.212	-0.32	-2.8	.	123.5
Dec. 23	08 53.65	+02 53.2	3.527	4.268	-0.46	-1.8	.	133.8
Jan. 2	08 48.46	+02 40.0	3.487	4.323	-0.58	-0.7	.	144.2
Jan. 12	08 42.26	+02 37.1	3.472	4.378	-0.66	+0.3	.	154.1
Jan. 22	08 35.49	+02 43.9	3.486	4.432	-0.69	+1.2	.	162.0
Feb. 1	08 28.65	+02 59.1	3.530	4.486	-0.67	+1.9	.	164.2
Feb. 11	08 22.25	+03 20.8	3.605	4.540	-0.60	+2.4	.	158.9
Feb. 21	08 16.71	+03 46.6	3.710	4.593	-0.49	+2.7	.	150.0
Mar. 2	08 12.36	+04 14.4	3.841	4.646	-0.36	+2.8	.	140.2
Mar. 12	08 09.42	+04 41.9	3.995	4.698	-0.21	+2.7	.	130.2
Mar. 22	08 07.95	+05 07.3	4.168	4.750	-0.07	+2.4	.	120.4

## Comet 59P/Kearns-Kwee

Epoch = 2019 July 16.0 TT  
 T = 2018 Sept. 16.68678 TT  
 Peri. = 127.67699 e = 0.4750419  
 Node = 312.82679 2000.0 a = 4.4928418 AU  
 Incl. = 9.34059 n = 0.10349572  
 q = 2.3585537 AU P = 9.52 years

$$m_1 = 9.1 + 5 \log(\Delta) + 17.5 \log(r(t-50))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m <sub>1</sub>	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	08 24.42	+23 45.7	1.553	2.509	-0.78	-1.5	16.7	162.8
Jan. 17	08 16.15	+23 29.3	1.555	2.536	-0.86	-1.8	16.8	174.1
Jan. 27	08 07.69	+23 08.8	1.585	2.564	-0.81	-2.3	16.9	172.1
Feb. 6	08 00.19	+22 43.4	1.642	2.594	-0.65	-2.8	17.0	160.8
Feb. 16	07 54.66	+22 13.5	1.725	2.625	-0.42	-3.2	17.2	149.6
Feb. 26	07 51.63	+21 39.9	1.830	2.657	-0.16	-3.5	17.4	139.0
Mar. 8	07 51.27	+21 03.6	1.954	2.691	+0.11	-3.8	17.6	129.0
Mar. 18	07 53.51	+20 24.9	2.094	2.726	+0.36	-4.0	17.9	119.6
Mar. 28	07 58.07	+19 44.1	2.245	2.763	+0.57	-4.2	18.1	110.9
Apr. 7	08 04.62	+19 00.8	2.405	2.800	+0.75	-4.5	18.3	102.7
Apr. 17	08 12.81	+18 14.4	2.570	2.838	+0.90	-4.8	18.6	94.9
Apr. 27	08 22.33	+17 24.8	2.738	2.877	+1.01	-5.2	18.8	87.5
May 7	08 32.90	+16 31.4	2.908	2.917	+1.10	-5.6	19.0	80.5
May 17	08 44.27	+15 34.1	3.076	2.957	+1.17	-6.0	19.3	73.8
May 27	08 56.24	+14 32.8	3.241	2.998	+1.22	-6.4	19.5	67.2
June 6	09 08.66	+13 27.5	3.402	3.039	+1.26	-6.7	19.7	60.8
June 16	09 21.38	+12 18.3	3.557	3.081	+1.28	-7.1	19.9	54.6
June 26	09 34.28	+11 05.5	3.704	3.124	+1.30	-7.5	20.1	48.5
July 6	09 47.29	+09 49.3	3.842	3.166	+1.30	-7.8	20.3	42.4
July 16	10 00.34	+08 30.1	3.971	3.209	+1.30	-8.1	20.4	36.4
July 26	10 13.35	+07 08.3	4.088	3.253	+1.30	-8.3	20.6	30.4
Aug. 5	10 26.29	+05 44.2	4.193	3.296	+1.29	-8.5	20.8	24.4
Aug. 15	10 39.11	+04 18.4	4.285	3.340	+1.27	-8.7	20.9	18.5
Aug. 25	10 51.76	+02 51.2	4.363	3.383	+1.26	-8.8	21.1	12.6
Sept. 4	11 04.23	+01 23.2	4.426	3.427	+1.23	-8.8	21.2	7.1
Sept. 14	11 16.46	+00 05.2	4.473	3.471	+1.21	-8.8	21.3	4.4
Sept. 24	11 28.43	-01 33.4	4.504	3.515	+1.18	-8.8	21.4	8.4
Oct. 4	11 40.08	-03 01.0	4.519	3.558	+1.15	-8.7	21.5	14.4
Oct. 14	11 51.36	-04 27.5	4.517	3.602	+1.11	-8.6	21.6	20.9
Oct. 24	12 02.22	-05 52.4	4.498	3.646	+1.06	-8.4	21.7	27.6
Nov. 3	12 12.58	-07 15.1	4.463	3.689	+1.01	-8.1	21.8	34.6
Nov. 13	12 22.36	-08 35.0	4.412	3.733	+0.94	-7.8	21.9	41.8
Nov. 23	12 31.47	-09 51.7	4.346	3.776	+0.87	-7.5	21.9	49.3
Dec. 3	12 39.79	-11 04.4	4.266	3.819	+0.78	-7.0	22.0	57.0
Dec. 13	12 47.19	-12 12.6	4.175	3.862	+0.68	-6.5	22.0	64.9
Dec. 23	12 53.53	-13 15.6	4.073	3.905	+0.57	-6.0	.	73.2
Jan. 2	12 58.66	-14 12.4	3.965	3.947	+0.44	-5.3	.	81.8
Jan. 12	13 02.42	-15 02.4	3.853	3.990	+0.30	-4.6	.	90.8
Jan. 22	13 04.67	-15 44.5	3.741	4.032	+0.14	-3.7	.	100.1
Feb. 1	13 05.30	-16 17.6	3.634	4.074	-0.03	-2.8	.	109.8
Feb. 11	13 04.25	-16 40.7	3.535	4.115	-0.20	-1.7	.	119.8
Feb. 21	13 01.56	-16 52.8	3.449	4.156	-0.36	-0.6	.	130.2
Mar. 2	12 57.36	-16 53.2	3.383	4.198	-0.49	+0.6	.	140.8
Mar. 12	12 51.92	-16 42.1	3.339	4.238	-0.60	+1.7	.	151.4
Mar. 22	12 45.66	-16 20.3	3.322	4.279	-0.65	+2.7	.	161.5

Comet 371P/LINEAR-Skiff

Epoch = 2019 July 16.0 TT  
 T = 2018 Oct. 4.58022 TT  
 Peri. = 308.47098 e = 0.4760949  
 Node = 67.33443 2000.0 a = 4.1818322 AU  
 Incl. = 17.37932 n = 0.11525351  
 q = 2.1908832 AU P = 8.55 years

$$m_1 = 11.0 + 5 \log(\Delta) + 20.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	01 42.79	+03 54.8	1.947	2.316	+0.89	+14.8	19.7	99.1
Jan. 17	01 52.51	+06 21.3	2.090	2.342	+1.06	+14.4	20.0	92.1
Jan. 27	02 03.78	+08 43.5	2.237	2.370	+1.20	+13.9	20.2	85.4
Feb. 6	02 16.37	+11 00.3	2.386	2.400	+1.32	+13.4	20.5	78.9
Feb. 16	02 30.09	+13 11.1	2.536	2.432	+1.43	+12.7	20.7	72.7
Feb. 26	02 44.76	+15 15.1	2.685	2.466	+1.51	+12.0	21.0	66.6
Mar. 8	03 00.24	+17 11.8	2.832	2.501	+1.59	+11.3	21.2	60.7
Mar. 18	03 16.42	+19 00.7	2.976	2.538	+1.65	+10.4	21.5	54.9
Mar. 28	03 33.18	+20 41.4	3.114	2.576	+1.70	+9.6	21.7	49.2
Apr. 7	03 50.43	+22 13.5	3.246	2.615	+1.75	+8.7	21.9	43.7
Apr. 17	04 08.10	+23 36.8	3.370	2.655	+1.78	+7.8	.	38.1
Apr. 27	04 26.07	+24 51.0	3.487	2.695	+1.81	+6.9	.	32.7
May 7	04 44.27	+25 56.2	3.594	2.737	+1.83	+6.0	.	27.3
May 17	05 02.62	+26 52.4	3.691	2.780	+1.84	+5.1	.	22.0
May 27	05 21.02	+27 39.7	3.778	2.823	+1.84	+4.3	.	16.8
June 6	05 39.39	+28 18.4	3.852	2.866	+1.83	+3.4	.	11.8
June 16	05 57.65	+28 49.0	3.915	2.910	+1.82	+2.6	.	7.4
June 26	06 15.70	+29 11.9	3.964	2.955	+1.79	+1.9	.	5.8
July 6	06 33.47	+29 27.9	4.001	3.000	+1.76	+1.2	.	8.7
July 16	06 50.87	+29 37.7	4.023	3.045	+1.72	+0.7	.	13.6
July 26	07 07.82	+29 42.3	4.032	3.090	+1.67	+0.2	.	19.0
Aug. 5	07 24.26	+29 42.6	4.027	3.135	+1.61	-0.2	.	24.8
Aug. 15	07 40.09	+29 39.8	4.008	3.181	+1.55	-0.4	.	30.8
Aug. 25	07 55.23	+29 35.1	3.975	3.226	+1.47	-0.5	.	37.1
Sept. 4	08 09.62	+29 29.8	3.929	3.272	+1.39	-0.5	.	43.5
Sept. 14	08 23.14	+29 25.4	3.870	3.317	+1.30	-0.3	.	50.2
Sept. 24	08 35.72	+29 23.3	3.799	3.363	+1.20	0.0	.	57.2
Oct. 4	08 47.23	+29 25.1	3.718	3.408	+1.09	+0.5	.	64.5
Oct. 14	08 57.53	+29 32.4	3.628	3.453	+0.96	+1.1	.	72.0
Oct. 24	09 06.49	+29 46.7	3.531	3.498	+0.82	+1.9	.	80.0
Nov. 3	09 13.93	+30 09.4	3.431	3.543	+0.65	+2.8	.	88.3
Nov. 13	09 19.67	+30 41.7	3.330	3.588	+0.47	+3.8	.	97.0
Nov. 23	09 23.51	+31 24.1	3.232	3.632	+0.27	+4.8	.	106.1
Dec. 3	09 25.26	+32 16.5	3.141	3.677	+0.05	+5.7	.	115.7
Dec. 13	09 24.79	+33 17.3	3.062	3.721	-0.17	+6.5	.	125.5
Dec. 23	09 22.05	+34 23.8	3.000	3.764	-0.40	+6.8	.	135.4
Jan. 2	09 17.13	+35 32.0	2.959	3.808	-0.60	+6.7	.	145.2
Jan. 12	09 10.35	+36 36.7	2.944	3.851	-0.76	+6.1	.	153.8
Jan. 22	09 02.23	+37 32.6	2.957	3.893	-0.86	+4.9	.	159.4
Feb. 1	08 53.51	+38 15.2	2.999	3.936	-0.87	+3.4	.	159.1
Feb. 11	08 45.00	+38 42.0	3.072	3.978	-0.81	+1.8	.	153.2
Feb. 21	08 37.46	+38 52.5	3.172	4.019	-0.68	+0.2	.	144.7
Mar. 2	08 31.49	+38 47.9	3.296	4.061	-0.49	-1.2	.	135.3
Mar. 12	08 27.46	+38 30.8	3.441	4.102	-0.29	-2.3	.	125.8
Mar. 22	08 25.50	+38 03.9	3.602	4.142	-0.08	-3.1	.	116.4

Comet P/2018 P3 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2018 Oct. 9.46223 TT  
 Peri. = 305.87866 e = 0.4159812  
 Node = 59.20908 2000.0 a = 3.0072638 AU  
 Incl. = 8.90880 n = 0.18899346  
 q = 1.7562986 AU P = 5.22 years

$$m1 = 8.1 + 5 \log(\Delta) + 35.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	01 05.14	+04 41.6	1.619	1.905	+1.63	+15.9	18.9	90.7
Jan. 17	01 21.90	+07 17.6	1.750	1.936	+1.72	+15.3	19.4	85.3
Jan. 27	01 39.49	+09 47.3	1.884	1.971	+1.80	+14.6	19.8	80.1
Feb. 6	01 57.78	+12 09.6	2.021	2.007	+1.86	+13.8	20.2	75.0
Feb. 16	02 16.68	+14 23.7	2.160	2.045	+1.92	+12.9	20.6	70.0
Feb. 26	02 36.08	+16 28.6	2.300	2.084	+1.96	+12.0	21.1	65.0
Mar. 8	02 55.92	+18 23.7	2.439	2.125	+2.01	+11.0	21.5	60.1
Mar. 18	03 16.12	+20 08.5	2.576	2.167	+2.04	+9.9	21.9	55.2
Mar. 28	03 36.62	+21 42.3	2.710	2.210	+2.06	+8.8	.	50.3
Apr. 7	03 57.35	+23 05.0	2.840	2.254	+2.08	+7.6	.	45.4
Apr. 17	04 18.23	+24 16.3	2.966	2.298	+2.09	+6.5	.	40.6
Apr. 27	04 39.18	+25 16.0	3.085	2.342	+2.10	+5.3	.	35.7
May 7	05 00.13	+26 04.3	3.197	2.387	+2.09	+4.2	.	30.8
May 17	05 20.99	+26 41.3	3.301	2.433	+2.08	+3.1	.	25.9
May 27	05 41.68	+27 07.5	3.397	2.478	+2.06	+2.0	.	21.1
June 6	06 02.12	+27 23.3	3.482	2.523	+2.03	+1.0	.	16.2
June 16	06 22.23	+27 29.4	3.557	2.569	+1.99	+0.1	.	11.4
June 26	06 41.94	+27 26.4	3.620	2.614	+1.95	-0.8	.	7.0
July 6	07 01.19	+27 15.2	3.671	2.659	+1.90	-1.5	.	4.5
July 16	07 19.91	+26 56.8	3.710	2.704	+1.84	-2.2	.	7.0
July 26	07 38.04	+26 32.1	3.735	2.748	+1.78	-2.8	.	11.7
Aug. 5	07 55.55	+26 02.3	3.746	2.792	+1.71	-3.2	.	17.0
Aug. 15	08 12.38	+25 28.4	3.744	2.835	+1.64	-3.6	.	22.6
Aug. 25	08 28.48	+24 51.6	3.727	2.879	+1.57	-3.8	.	28.4
Sept. 4	08 43.81	+24 13.2	3.697	2.921	+1.49	-3.9	.	34.4
Sept. 14	08 58.31	+23 34.5	3.652	2.963	+1.40	-3.8	.	40.7
Sept. 24	09 11.92	+22 56.9	3.595	3.005	+1.31	-3.7	.	47.2
Oct. 4	09 24.55	+22 21.7	3.524	3.046	+1.21	-3.3	.	54.0
Oct. 14	09 36.12	+21 50.6	3.442	3.086	+1.09	-2.8	.	61.1
Oct. 24	09 46.52	+21 25.1	3.350	3.126	+0.97	-2.2	.	68.6
Nov. 3	09 55.60	+21 06.7	3.249	3.165	+0.83	-1.4	.	76.4
Nov. 13	10 03.20	+20 57.2	3.142	3.204	+0.67	-0.4	.	84.6
Nov. 23	10 09.14	+20 57.9	3.032	3.242	+0.50	+0.7	.	93.3
Dec. 3	10 13.23	+21 10.1	2.922	3.279	+0.30	+1.9	.	102.4
Dec. 13	10 15.25	+21 34.5	2.817	3.316	+0.08	+3.1	.	112.1
Dec. 23	10 15.06	+22 10.8	2.722	3.352	-0.15	+4.2	.	122.3
Jan. 2	10 12.56	+22 57.7	2.640	3.387	-0.38	+5.2	.	132.9
Jan. 12	10 07.80	+23 52.2	2.578	3.421	-0.59	+5.7	.	143.8
Jan. 22	10 01.04	+24 50.0	2.540	3.455	-0.77	+5.8	.	154.7
Feb. 1	09 52.76	+25 45.8	2.530	3.489	-0.88	+5.2	.	164.2
Feb. 11	09 43.70	+26 34.1	2.551	3.521	-0.92	+4.2	.	167.6
Feb. 21	09 34.67	+27 10.7	2.602	3.553	-0.87	+2.9	.	161.3
Mar. 2	09 26.48	+27 33.2	2.683	3.584	-0.74	+1.4	.	151.3
Mar. 12	09 19.81	+27 41.2	2.790	3.614	-0.57	+0.1	.	140.7
Mar. 22	09 15.05	+27 36.1	2.919	3.644	-0.36	-1.2	.	130.3



Comet 369P/Hill

Epoch = 2019 July 16.0 TT  
 T = 2018 Oct. 15.10374 TT  
 Peri. = 13.26242 e = 0.5541434  
 Node = 47.31707 2000.0 a = 4.3891552 AU  
 Incl. = 10.30822 n = 0.10718467  
 q = 1.9569338 AU P = 9.20 years

$$m1 = 11.0 + 5 \log(\Delta) + 17.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	05 46.31	+37 35.1	1.160	2.099	-0.51	+1.2	17.0	156.5
Jan. 17	05 42.67	+37 38.4	1.238	2.133	-0.18	-0.6	17.2	147.2
Jan. 27	05 42.51	+37 27.1	1.335	2.169	+0.18	-1.7	17.5	137.9
Feb. 6	05 45.91	+37 06.3	1.449	2.208	+0.53	-2.4	17.8	129.1
Feb. 16	05 52.61	+36 39.8	1.577	2.249	+0.83	-2.9	18.1	120.8
Feb. 26	06 02.09	+36 09.4	1.716	2.292	+1.08	-3.2	18.5	113.0
Mar. 8	06 13.82	+35 35.6	1.865	2.337	+1.28	-3.6	18.8	105.6
Mar. 18	06 27.33	+34 58.4	2.021	2.384	+1.43	-3.9	19.1	98.7
Mar. 28	06 42.15	+34 17.4	2.182	2.432	+1.54	-4.3	19.4	92.1
Apr. 7	06 57.93	+33 32.1	2.347	2.481	+1.62	-4.8	19.8	85.7
Apr. 17	07 14.35	+32 42.2	2.513	2.532	+1.67	-5.3	20.1	79.5
Apr. 27	07 31.15	+31 47.5	2.680	2.583	+1.69	-5.7	20.4	73.6
May 7	07 48.13	+30 48.0	2.846	2.635	+1.70	-6.2	20.6	67.7
May 17	08 05.16	+29 43.7	3.010	2.688	+1.70	-6.7	20.9	62.0
May 27	08 22.08	+28 35.1	3.169	2.741	+1.68	-7.1	21.2	56.4
June 6	08 38.82	+27 22.4	3.324	2.795	+1.66	-7.5	21.4	50.8
June 16	08 55.31	+26 06.1	3.472	2.849	+1.63	-7.8	21.7	45.2
June 26	09 11.48	+24 46.9	3.612	2.903	+1.60	-8.1	21.9	39.7
July 6	09 27.33	+23 25.1	3.743	2.958	+1.57	-8.3	.	34.2
July 16	09 42.81	+22 01.6	3.865	3.013	+1.53	-8.4	.	28.7
July 26	09 57.91	+20 36.7	3.975	3.067	+1.49	-8.5	.	23.2
Aug. 5	10 12.63	+19 11.2	4.072	3.122	+1.45	-8.6	.	17.8
Aug. 15	10 26.95	+17 45.8	4.157	3.176	+1.41	-8.5	.	12.7
Aug. 25	10 40.86	+16 20.9	4.227	3.231	+1.37	-8.4	.	8.6
Sept. 4	10 54.35	+14 57.3	4.282	3.285	+1.33	-8.3	.	7.6
Sept. 14	11 07.41	+13 35.6	4.322	3.339	+1.28	-8.0	.	10.9
Sept. 24	11 20.02	+12 16.5	4.345	3.393	+1.23	-7.7	.	16.1
Oct. 4	11 32.13	+11 00.7	4.352	3.447	+1.18	-7.4	.	22.2
Oct. 14	11 43.72	+09 48.8	4.343	3.500	+1.13	-6.9	.	28.6
Oct. 24	11 54.73	+08 41.7	4.317	3.553	+1.07	-6.4	.	35.4
Nov. 3	12 05.10	+07 39.9	4.275	3.605	+1.00	-5.8	.	42.4
Nov. 13	12 14.73	+06 44.5	4.218	3.658	+0.92	-5.2	.	49.8
Nov. 23	12 23.55	+05 56.0	4.147	3.710	+0.83	-4.4	.	57.4
Dec. 3	12 31.43	+05 15.3	4.064	3.761	+0.73	-3.6	.	65.4
Dec. 13	12 38.24	+04 43.2	3.970	3.812	+0.62	-2.7	.	73.6
Dec. 23	12 43.86	+04 20.3	3.870	3.863	+0.49	-1.8	.	82.3
Jan. 2	12 48.11	+04 07.2	3.765	3.913	+0.35	-0.7	.	91.3
Jan. 12	12 50.88	+04 04.4	3.660	3.963	+0.19	+0.3	.	100.7
Jan. 22	12 52.03	+04 11.7	3.560	4.012	+0.02	+1.3	.	110.5
Feb. 1	12 51.49	+04 28.9	3.468	4.061	-0.15	+2.2	.	120.8
Feb. 11	12 49.26	+04 54.8	3.390	4.110	-0.31	+3.0	.	131.4
Feb. 21	12 45.44	+05 27.6	3.332	4.158	-0.46	+3.6	.	142.2
Mar. 2	12 40.24	+06 04.9	3.297	4.205	-0.58	+3.8	.	153.1
Mar. 12	12 34.03	+06 43.3	3.290	4.253	-0.66	+3.8	.	163.5
Mar. 22	12 27.26	+07 19.5	3.313	4.299	-0.69	+3.4	.	170.4

Comet 300P/Catalina

Epoch = 2019 July 16.0 TT  
 T = 2018 Nov. 2.07128 TT  
 Peri. = 222.86076 e = 0.6915428  
 Node = 95.67013 2000.0 a = 2.6998420 AU  
 Incl. = 5.67655 n = 0.22217570  
 q = 0.8327857 AU P = 4.44 years

$$m_1 = 16.4 + 5 \log(\Delta) + 10.0 \log(r(t-15))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	23 45.83	-06 43.1	1.258	1.275	+4.07	+29.5	17.4	68.0
Jan. 17	00 24.14	-02 01.5	1.386	1.374	+3.56	+26.4	18.0	68.5
Jan. 27	00 57.85	+02 07.0	1.533	1.475	+3.16	+23.0	18.5	67.7
Feb. 6	01 28.05	+05 42.6	1.694	1.574	+2.86	+19.9	19.1	65.9
Feb. 16	01 55.58	+08 48.3	1.866	1.673	+2.63	+17.1	19.6	63.3
Feb. 26	02 21.08	+11 27.6	2.043	1.769	+2.46	+14.6	20.1	60.0
Mar. 8	02 45.01	+13 44.1	2.224	1.864	+2.32	+12.5	20.5	56.2
Mar. 18	03 07.73	+15 41.0	2.404	1.957	+2.21	+10.7	20.9	52.1
Mar. 28	03 29.47	+17 20.4	2.583	2.047	+2.13	+9.1	21.3	47.6
Apr. 7	03 50.40	+18 44.6	2.757	2.136	+2.05	+7.6	21.6	42.9
Apr. 17	04 10.64	+19 54.9	2.925	2.222	+1.99	+6.3	21.9	38.0
Apr. 27	04 30.25	+20 52.8	3.085	2.306	+1.93	+5.1	.	32.9
May 7	04 49.31	+21 39.4	3.234	2.387	+1.88	+4.1	.	27.7
May 17	05 07.82	+22 15.6	3.372	2.467	+1.82	+3.1	.	22.4
May 27	05 25.79	+22 42.4	3.497	2.545	+1.77	+2.2	.	16.9
June 6	05 43.22	+23 00.6	3.607	2.620	+1.71	+1.4	.	11.4
June 16	06 00.10	+23 11.1	3.703	2.694	+1.66	+0.7	.	5.7
June 26	06 16.40	+23 14.6	3.782	2.765	+1.60	+0.0	.	0.2
July 6	06 32.11	+23 12.0	3.844	2.835	+1.54	-0.6	.	6.0
July 16	06 47.17	+23 04.0	3.889	2.903	+1.47	-1.1	.	12.1
July 26	07 01.56	+22 51.6	3.916	2.969	+1.40	-1.5	.	18.3
Aug. 5	07 15.23	+22 35.5	3.925	3.033	+1.32	-1.8	.	24.7
Aug. 15	07 28.10	+22 16.8	3.916	3.096	+1.24	-2.0	.	31.3
Aug. 25	07 40.14	+21 56.3	3.889	3.157	+1.15	-2.1	.	38.2
Sept. 4	07 51.24	+21 35.2	3.846	3.216	+1.06	-2.1	.	45.2
Sept. 14	08 01.31	+21 14.4	3.786	3.273	+0.95	-2.0	.	52.6
Sept. 24	08 10.25	+20 55.3	3.712	3.330	+0.83	-1.8	.	60.2
Oct. 4	08 17.92	+20 39.0	3.625	3.384	+0.69	-1.4	.	68.2
Oct. 14	08 24.16	+20 26.8	3.528	3.437	+0.54	-0.9	.	76.6
Oct. 24	08 28.81	+20 19.9	3.423	3.489	+0.37	-0.3	.	85.5
Nov. 3	08 31.67	+20 19.5	3.315	3.539	+0.18	+0.4	.	94.8
Nov. 13	08 32.56	+20 26.6	3.207	3.587	-0.02	+1.1	.	104.7
Nov. 23	08 31.34	+20 41.7	3.104	3.635	-0.24	+2.0	.	115.1
Dec. 3	08 27.89	+21 04.7	3.013	3.680	-0.47	+2.7	.	126.1
Dec. 13	08 22.26	+21 34.5	2.938	3.725	-0.68	+3.3	.	137.6
Dec. 23	08 14.65	+22 09.3	2.887	3.768	-0.86	+3.6	.	149.6
Jan. 2	08 05.46	+22 46.2	2.863	3.810	-0.98	+3.7	.	161.9
Jan. 12	07 55.34	+23 21.9	2.871	3.851	-1.03	+3.4	.	174.1
Jan. 22	07 45.04	+23 53.7	2.913	3.890	-1.01	+2.9	.	172.3
Feb. 1	07 35.35	+24 19.6	2.987	3.928	-0.91	+2.2	.	160.2
Feb. 11	07 26.98	+24 38.8	3.092	3.965	-0.75	+1.6	.	148.2
Feb. 21	07 20.39	+24 51.6	3.224	4.001	-0.55	+0.9	.	136.6
Mar. 2	07 15.84	+24 58.6	3.378	4.035	-0.34	+0.4	.	125.5
Mar. 12	07 13.40	+25 00.9	3.548	4.068	-0.13	0.0	.	115.0
Mar. 22	07 12.98	+24 59.3	3.729	4.100	+0.06	-0.3	.	104.9

Comet 64P/Swift-Gehrels

Epoch = 2019 July 16.0 TT  
 T = 2018 Nov. 3.88489 TT  
 Peri. = 97.14009 e = 0.6874681  
 Node = 299.99603 2000.0 a = 4.4571466 AU  
 Incl. = 8.94939 n = 0.10474148  
 q = 1.3930005 AU P = 9.41 years

$$m_1 = 8.5 + 5 \log(\Delta) + 17.5 \log(r(t-30))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	03 11.93	+29 09.1	0.791	1.588	+2.39	-7.0	10.8	126.6
Jan. 17	03 35.60	+28 04.6	0.901	1.645	+2.33	-5.8	11.3	121.6
Jan. 27	03 58.65	+27 11.8	1.024	1.708	+2.27	-4.7	11.8	116.4
Feb. 6	04 21.07	+26 28.1	1.161	1.774	+2.21	-4.0	12.3	111.2
Feb. 16	04 42.95	+25 50.8	1.309	1.844	+2.16	-3.5	12.9	105.9
Feb. 26	05 04.30	+25 17.1	1.468	1.915	+2.11	-3.3	13.4	100.6
Mar. 8	05 25.16	+24 44.8	1.636	1.989	+2.06	-3.2	13.9	95.2
Mar. 18	05 45.55	+24 11.9	1.811	2.064	+2.01	-3.4	14.4	89.9
Mar. 28	06 05.48	+23 37.0	1.991	2.140	+1.97	-3.6	14.9	84.5
Apr. 7	06 24.94	+22 59.0	2.176	2.216	+1.92	-4.0	15.4	79.1
Apr. 17	06 43.94	+22 17.3	2.363	2.293	+1.87	-4.4	15.9	73.7
Apr. 27	07 02.46	+21 31.5	2.550	2.371	+1.83	-4.8	16.3	68.3
May 7	07 20.51	+20 41.4	2.737	2.448	+1.78	-5.2	16.7	62.9
May 17	07 38.07	+19 47.0	2.920	2.525	+1.73	-5.7	17.1	57.4
May 27	07 55.14	+18 48.5	3.100	2.601	+1.68	-6.1	17.5	52.0
June 6	08 11.72	+17 46.0	3.273	2.677	+1.63	-6.5	17.9	46.5
June 16	08 27.81	+16 39.9	3.439	2.753	+1.58	-6.8	18.2	40.9
June 26	08 43.42	+15 30.6	3.596	2.828	+1.53	-7.1	18.5	35.3
July 6	08 58.54	+14 18.5	3.742	2.902	+1.49	-7.4	18.8	29.7
July 16	09 13.18	+13 03.9	3.876	2.976	+1.44	-7.6	19.1	24.0
July 26	09 27.34	+11 47.4	3.998	3.049	+1.39	-7.7	19.4	18.2
Aug. 5	09 41.03	+10 29.3	4.105	3.122	+1.34	-7.9	19.7	12.4
Aug. 15	09 54.22	+09 10.1	4.197	3.193	+1.29	-8.0	19.9	6.8
Aug. 25	10 06.92	+07 50.4	4.272	3.264	+1.24	-8.0	20.1	3.5
Sept. 4	10 19.11	+06 30.5	4.331	3.334	+1.19	-8.0	20.3	7.6
Sept. 14	10 30.75	+05 11.0	4.372	3.403	+1.13	-7.9	20.5	13.7
Sept. 24	10 41.83	+03 52.5	4.395	3.472	+1.08	-7.8	20.7	20.3
Oct. 4	10 52.30	+02 35.4	4.401	3.540	+1.01	-7.6	20.9	27.1
Oct. 14	11 02.09	+01 20.4	4.388	3.606	+0.94	-7.4	21.0	34.2
Oct. 24	11 11.15	+00 08.1	4.358	3.673	+0.86	-7.1	21.2	41.5
Nov. 3	11 19.38	-01 00.8	4.311	3.738	+0.77	-6.7	21.3	49.1
Nov. 13	11 26.69	-02 05.6	4.250	3.802	+0.68	-6.2	21.4	57.0
Nov. 23	11 32.97	-03 05.4	4.175	3.866	+0.57	-5.7	21.5	65.2
Dec. 3	11 38.08	-03 59.5	4.089	3.929	+0.44	-5.0	21.6	73.8
Dec. 13	11 41.90	-04 46.6	3.995	3.991	+0.31	-4.3	21.7	82.7
Dec. 23	11 44.30	-05 25.9	3.898	4.053	+0.16	-3.5	21.7	92.0
Jan. 2	11 45.16	-05 56.3	3.800	4.113	0.00	-2.5	21.8	101.7
Jan. 12	11 44.40	-06 16.7	3.707	4.173	-0.17	-1.5	21.9	111.8
Jan. 22	11 42.02	-06 26.2	3.624	4.233	-0.33	-0.3	21.9	122.4
Feb. 1	11 38.07	-06 24.2	3.556	4.291	-0.47	+0.8	22.0	133.2
Feb. 11	11 32.78	-06 11.0	3.509	4.349	-0.59	+1.9	.	144.3
Feb. 21	11 26.44	-05 47.3	3.487	4.406	-0.68	+2.9	.	155.5
Mar. 2	11 19.49	-05 14.9	3.495	4.462	-0.71	+3.6	.	165.8
Mar. 12	11 12.42	-04 36.4	3.534	4.518	-0.69	+4.1	.	171.0
Mar. 22	11 05.71	-03 54.9	3.604	4.573	-0.63	+4.2	.	164.7

## Comet 38P/Stephan-Oterma

Epoch = 2019 July 16.0 TT  
 T = 2018 Nov. 10.95888 TT  
 Peri. = 359.57293 e = 0.8591618  
 Node = 77.99939 2000.0 a = 11.2788533 AU  
 Incl. = 18.35325 n = 0.02601996  
 q = 1.5884934 AU P = 37.88 years

$$m_1 = 5.4 + 5 \log(\Delta) + 22.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	08 35.43	+42 43.2	0.807	1.742	-0.09	+17.7	10.4	153.1
Jan. 17	08 33.36	+45 15.2	0.858	1.796	-0.31	+12.0	10.8	154.3
Jan. 27	08 29.98	+46 49.1	0.928	1.855	-0.34	+6.2	11.3	151.8
Feb. 6	08 27.17	+47 26.9	1.017	1.920	-0.18	+1.0	11.8	146.8
Feb. 16	08 26.46	+47 17.0	1.125	1.989	+0.08	-3.1	12.4	140.6
Feb. 26	08 28.53	+46 31.4	1.248	2.062	+0.36	-6.1	13.0	133.9
Mar. 8	08 33.37	+45 20.5	1.386	2.138	+0.63	-8.1	13.5	127.2
Mar. 18	08 40.68	+43 52.6	1.538	2.216	+0.85	-9.5	14.1	120.5
Mar. 28	08 49.93	+42 13.9	1.702	2.296	+1.01	-10.3	14.7	114.0
Apr. 7	09 00.63	+40 28.3	1.876	2.378	+1.13	-10.8	15.2	107.6
Apr. 17	09 12.38	+38 38.7	2.058	2.461	+1.22	-11.1	15.8	101.3
Apr. 27	09 24.83	+36 46.9	2.248	2.545	+1.27	-11.3	16.3	95.2
May 7	09 37.72	+34 54.0	2.442	2.630	+1.31	-11.3	16.8	89.2
May 17	09 50.87	+33 01.0	2.641	2.715	+1.32	-11.3	17.3	83.3
May 27	10 04.14	+31 08.6	2.841	2.801	+1.33	-11.2	17.7	77.4
June 6	10 17.42	+29 17.2	3.041	2.887	+1.33	-11.1	18.2	71.6
June 16	10 30.64	+27 27.3	3.240	2.973	+1.32	-10.9	18.6	65.8
June 26	10 43.76	+25 39.3	3.436	3.059	+1.30	-10.7	19.0	60.1
July 6	10 56.74	+23 53.3	3.627	3.145	+1.29	-10.5	19.4	54.3
July 16	11 09.56	+22 09.9	3.811	3.230	+1.27	-10.2	19.8	48.6
July 26	11 22.19	+20 29.3	3.987	3.316	+1.25	-9.9	20.1	42.9
Aug. 5	11 34.64	+18 51.8	4.153	3.401	+1.23	-9.6	20.5	37.2
Aug. 15	11 46.88	+17 17.7	4.308	3.486	+1.21	-9.2	20.8	31.6
Aug. 25	11 58.89	+15 47.5	4.450	3.570	+1.19	-8.8	21.1	26.1
Sept. 4	12 10.68	+14 21.3	4.577	3.654	+1.17	-8.4	21.4	21.0
Sept. 14	12 22.21	+12 59.7	4.690	3.738	+1.14	-7.9	21.6	16.8
Sept. 24	12 33.47	+11 42.9	4.785	3.821	+1.11	-7.4	21.9	14.3
Oct. 4	12 44.42	+10 31.5	4.863	3.904	+1.08	-6.8	.	14.7
Oct. 14	12 55.02	+09 25.8	4.923	3.986	+1.04	-6.2	.	17.9
Oct. 24	13 05.23	+08 26.3	4.965	4.068	+1.00	-5.6	.	23.0
Nov. 3	13 14.99	+07 33.5	4.987	4.149	+0.95	-4.9	.	29.1
Nov. 13	13 24.24	+06 47.8	4.991	4.230	+0.89	-4.2	.	35.9
Nov. 23	13 32.89	+06 09.7	4.978	4.310	+0.83	-3.4	.	43.1
Dec. 3	13 40.85	+05 39.7	4.947	4.390	+0.75	-2.5	.	50.7
Dec. 13	13 48.02	+05 18.0	4.902	4.469	+0.67	-1.7	.	58.6
Dec. 23	13 54.30	+05 05.0	4.844	4.548	+0.57	-0.8	.	66.8
Jan. 2	13 59.56	+05 00.9	4.775	4.626	+0.47	+0.1	.	75.4
Jan. 12	14 03.68	+05 05.8	4.699	4.704	+0.35	+1.0	.	84.3
Jan. 22	14 06.57	+05 19.3	4.620	4.781	+0.22	+1.8	.	93.4
Feb. 1	14 08.11	+05 41.0	4.542	4.858	+0.08	+2.6	.	102.9
Feb. 11	14 08.26	+06 09.8	4.471	4.934	-0.06	+3.2	.	112.6
Feb. 21	14 07.00	+06 44.3	4.410	5.010	-0.20	+3.7	.	122.4
Mar. 2	14 04.38	+07 22.7	4.365	5.085	-0.33	+4.0	.	132.3
Mar. 12	14 00.53	+08 02.5	4.340	5.160	-0.44	+4.0	.	142.1
Mar. 22	13 55.68	+08 41.1	4.340	5.234	-0.53	+3.7	.	151.1

Comet P/2019 A2 (ATLAS)

Epoch = 2019 July 16.0 TT  
 T = 2018 Nov. 22.99890 TT  
 Peri. = 324.52595 e = 0.3811044  
 Node = 139.44046 2000.0 a = 5.7274797 AU  
 Incl. = 14.86942 n = 0.07190494  
 q = 3.5447120 AU P = 13.71 years

$$m1 = 10.2 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .			m	'		°
Jan. 7	07 40.98	+11 51.3	2.589	3.554	-0.58	+4.4	17.8	167.1
Jan. 17	07 35.04	+12 37.8	2.584	3.558	-0.59	+5.0	17.8	170.7
Jan. 27	07 29.32	+13 29.1	2.609	3.564	-0.54	+5.3	17.8	163.3
Feb. 6	07 24.44	+14 22.3	2.663	3.570	-0.42	+5.3	17.9	153.0
Feb. 16	07 20.92	+15 14.7	2.744	3.577	-0.26	+5.1	17.9	142.3
Feb. 26	07 19.12	+16 03.9	2.846	3.585	-0.08	+4.7	18.0	132.0
Mar. 8	07 19.20	+16 48.3	2.968	3.594	+0.11	+4.1	18.1	122.0
Mar. 18	07 21.20	+17 26.9	3.103	3.603	+0.30	+3.5	18.2	112.5
Mar. 28	07 25.03	+17 59.0	3.249	3.614	+0.48	+2.8	18.3	103.4
Apr. 7	07 30.52	+18 24.2	3.401	3.625	+0.63	+2.1	18.5	94.8
Apr. 17	07 37.51	+18 42.4	3.556	3.637	+0.77	+1.4	18.6	86.6
Apr. 27	07 45.77	+18 53.5	3.710	3.650	+0.89	+0.7	18.7	78.7
May 7	07 55.11	+18 57.6	3.862	3.663	+0.99	0.0	18.8	71.2
May 17	08 05.36	+18 54.8	4.008	3.677	+1.07	-0.6	18.9	63.9
May 27	08 16.34	+18 45.5	4.147	3.692	+1.13	-1.3	19.0	56.9
June 6	08 27.89	+18 29.8	4.278	3.708	+1.18	-1.9	19.0	50.0
June 16	08 39.89	+18 08.3	4.398	3.724	+1.22	-2.5	19.1	43.3
June 26	08 52.22	+17 41.2	4.507	3.742	+1.25	-3.0	19.2	36.7
July 6	09 04.78	+17 09.1	4.603	3.759	+1.26	-3.5	19.3	30.2
July 16	09 17.47	+16 32.5	4.686	3.778	+1.27	-3.9	19.3	23.7
July 26	09 30.22	+15 52.0	4.754	3.797	+1.28	-4.2	19.4	17.3
Aug. 5	09 42.97	+15 08.2	4.807	3.816	+1.27	-4.5	19.4	11.0
Aug. 15	09 55.64	+14 21.8	4.845	3.836	+1.26	-4.8	19.5	4.7
Aug. 25	10 08.19	+13 33.4	4.866	3.857	+1.25	-4.9	19.5	2.8
Sept. 4	10 20.55	+12 43.9	4.872	3.878	+1.22	-5.0	19.5	8.9
Sept. 14	10 32.67	+11 54.1	4.861	3.900	+1.20	-5.0	19.5	15.4
Sept. 24	10 44.50	+11 04.7	4.833	3.922	+1.16	-4.9	19.6	22.2
Oct. 4	10 55.97	+10 16.7	4.789	3.945	+1.13	-4.7	19.6	29.1
Oct. 14	11 07.03	+09 31.1	4.730	3.968	+1.08	-4.4	19.6	36.1
Oct. 24	11 17.59	+08 48.8	4.656	3.992	+1.03	-4.0	19.6	43.3
Nov. 3	11 27.58	+08 10.9	4.569	4.016	+0.96	-3.5	19.5	50.8
Nov. 13	11 36.90	+07 38.5	4.469	4.040	+0.89	-2.9	19.5	58.5
Nov. 23	11 45.44	+07 12.6	4.358	4.065	+0.81	-2.2	19.5	66.4
Dec. 3	11 53.09	+06 54.3	4.239	4.090	+0.71	-1.4	19.5	74.7
Dec. 13	11 59.72	+06 44.9	4.115	4.116	+0.60	-0.4	19.4	83.2
Dec. 23	12 05.19	+06 45.1	3.988	4.142	+0.48	+0.6	19.4	92.1
Jan. 2	12 09.37	+06 55.8	3.862	4.168	+0.34	+1.7	19.3	101.3
Jan. 12	12 12.14	+07 17.3	3.742	4.194	+0.20	+2.7	19.3	110.9
Jan. 22	12 13.41	+07 49.5	3.632	4.221	+0.04	+3.8	19.3	120.8
Feb. 1	12 13.16	+08 31.6	3.536	4.248	-0.11	+4.7	19.2	131.1
Feb. 11	12 11.43	+09 21.8	3.459	4.275	-0.25	+5.4	19.2	141.5
Feb. 21	12 08.37	+10 17.6	3.405	4.303	-0.37	+5.8	19.2	152.0
Mar. 2	12 04.25	+11 15.6	3.378	4.331	-0.46	+5.8	19.2	161.7
Mar. 12	11 59.44	+12 11.8	3.381	4.359	-0.50	+5.4	19.2	168.4
Mar. 22	11 54.38	+13 02.7	3.413	4.387	-0.50	+4.7	19.3	166.1

Comet 247P/LINEAR

Epoch = 2019 July 16.0 TT  
 T = 2018 Dec. 2.09862 TT  
 Peri. = 47.45160 e = 0.6248936  
 Node = 54.01029 2000.0 a = 3.9699237 AU  
 Incl. = 13.66148 n = 0.12460367  
 q = 1.4891438 AU P = 7.91 years

$$m1 = 16.3 + 5 \log(\Delta) + 12.5 \log(r(t-30))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	11 13.60	+35 21.0	0.743	1.541	+1.22	+7.2	17.8	126.0
Jan. 17	11 22.96	+36 33.1	0.734	1.573	+0.59	+7.0	17.8	132.1
Jan. 27	11 26.01	+37 38.4	0.737	1.612	-0.03	+5.7	17.9	138.4
Feb. 6	11 23.19	+38 23.6	0.752	1.655	-0.56	+2.8	18.0	144.2
Feb. 16	11 15.96	+38 34.1	0.782	1.704	-0.88	-1.3	18.2	148.5
Feb. 26	11 06.60	+38 00.9	0.829	1.758	-0.96	-5.8	18.5	150.1
Mar. 8	10 57.49	+36 43.9	0.894	1.814	-0.82	-9.9	18.8	148.3
Mar. 18	10 50.52	+34 50.4	0.977	1.874	-0.53	-12.9	19.1	143.8
Mar. 28	10 46.63	+32 32.3	1.078	1.937	-0.21	-14.7	19.5	137.8
Apr. 7	10 45.95	+30 00.4	1.195	2.001	+0.10	-15.6	19.9	131.1
Apr. 17	10 48.22	+27 22.8	1.328	2.067	+0.37	-15.8	20.3	124.3
Apr. 27	10 52.92	+24 45.0	1.474	2.134	+0.58	-15.7	20.7	117.5
May 7	10 59.55	+22 09.8	1.631	2.202	+0.75	-15.3	21.1	110.8
May 17	11 07.71	+19 38.6	1.798	2.270	+0.88	-14.9	21.5	104.3
May 27	11 17.02	+17 12.1	1.972	2.339	+0.98	-14.4	21.9	98.0
June 6	11 27.20	+14 50.4	2.153	2.408	+1.06	-13.9	.	91.8
June 16	11 38.05	+12 33.3	2.337	2.477	+1.11	-13.5	.	85.7
June 26	11 49.40	+10 20.7	2.524	2.546	+1.16	-13.0	.	79.7
July 6	12 01.13	+08 12.3	2.711	2.615	+1.19	-12.6	.	73.7
July 16	12 13.16	+06 08.1	2.897	2.683	+1.22	-12.2	.	67.8
July 26	12 25.41	+04 07.9	3.080	2.751	+1.23	-11.8	.	61.9
Aug. 5	12 37.83	+02 11.7	3.258	2.819	+1.25	-11.4	.	56.0
Aug. 15	12 50.39	+00 19.5	3.430	2.886	+1.26	-11.0	.	50.0
Aug. 25	13 03.04	-01 28.7	3.594	2.952	+1.27	-10.6	.	44.0
Sept. 4	13 15.76	-03 12.8	3.749	3.018	+1.28	-10.2	.	38.0
Sept. 14	13 28.53	-04 52.6	3.892	3.083	+1.28	-9.7	.	31.9
Sept. 24	13 41.30	-06 28.1	4.022	3.148	+1.28	-9.3	.	25.7
Oct. 4	13 54.07	-07 59.1	4.138	3.212	+1.27	-8.8	.	19.4
Oct. 14	14 06.77	-09 25.5	4.239	3.275	+1.27	-8.4	.	13.1
Oct. 24	14 19.38	-10 47.0	4.323	3.337	+1.25	-7.9	.	6.8
Nov. 3	14 31.86	-12 03.5	4.390	3.399	+1.24	-7.4	.	2.8
Nov. 13	14 44.12	-13 14.9	4.438	3.460	+1.21	-6.9	.	7.8
Nov. 23	14 56.12	-14 21.2	4.468	3.520	+1.18	-6.3	.	14.5
Dec. 3	15 07.76	-15 22.2	4.478	3.580	+1.14	-5.8	.	21.5
Dec. 13	15 18.97	-16 18.0	4.470	3.638	+1.09	-5.3	.	28.8
Dec. 23	15 29.63	-17 08.6	4.443	3.696	+1.03	-4.8	.	36.3
Jan. 2	15 39.62	-17 54.1	4.399	3.753	+0.96	-4.3	.	44.0
Jan. 12	15 48.82	-18 34.7	4.338	3.810	+0.87	-3.8	.	51.9
Jan. 22	15 57.07	-19 10.6	4.262	3.866	+0.77	-3.3	.	60.0
Feb. 1	16 04.23	-19 42.0	4.175	3.921	+0.65	-2.9	.	68.4
Feb. 11	16 10.13	-20 09.3	4.077	3.975	+0.51	-2.5	.	77.1
Feb. 21	16 14.60	-20 32.6	3.973	4.028	+0.36	-2.1	.	86.1
Mar. 2	16 17.48	-20 52.3	3.866	4.081	+0.19	-1.8	.	95.4
Mar. 12	16 18.64	-21 08.3	3.761	4.133	+0.02	-1.4	.	105.1
Mar. 22	16 17.99	-21 20.6	3.662	4.185	-0.17	-1.0	.	115.2

## Comet C/2018 L2 (ATLAS)

Epoch = 2019 July 16.0 TT  
 T = 2018 Dec. 2.59146 TT  
 Peri. = 56.23639  
 Node = 243.01895 2000.0  
 Incl. = 67.42268  
 q = 1.7118307 AU  
 e = 0.9930810

$$m1 = 4.6 + 5 \log(\Delta) + 20.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .9			m	' .0		°
Jan. 7	19 13.58	+20 50.9	2.355	1.773	+3.14	+21.0	11.4	43.3
Jan. 17	19 45.58	+24 22.0	2.363	1.811	+3.27	+21.1	11.6	45.3
Jan. 27	20 18.83	+27 50.3	2.389	1.857	+3.38	+20.4	11.9	46.7
Feb. 6	20 52.98	+31 08.6	2.436	1.911	+3.45	+19.0	12.2	47.3
Feb. 16	21 27.55	+34 10.9	2.502	1.970	+3.46	+17.2	12.5	47.3
Feb. 26	22 02.04	+36 52.9	2.586	2.035	+3.43	+15.0	12.8	46.5
Mar. 8	22 35.97	+39 12.7	2.684	2.105	+3.34	+12.8	13.2	45.2
Mar. 18	23 08.89	+41 10.6	2.793	2.180	+3.22	+10.6	13.6	43.4
Mar. 28	23 40.47	+42 48.1	2.908	2.257	+3.07	+8.7	14.0	41.3
Apr. 7	00 10.47	+44 07.9	3.026	2.338	+2.91	+7.1	14.4	39.2
Apr. 17	00 38.77	+45 12.6	3.142	2.421	+2.73	+5.7	14.8	37.3
Apr. 27	01 05.29	+46 04.8	3.254	2.506	+2.55	+4.6	15.1	35.7
May 7	01 30.04	+46 47.0	3.357	2.593	+2.38	+3.8	15.5	34.8
May 17	01 53.01	+47 21.2	3.449	2.682	+2.20	+3.0	15.9	34.8
May 27	02 14.23	+47 49.0	3.529	2.771	+2.03	+2.5	16.2	35.8
June 6	02 33.72	+48 11.8	3.595	2.861	+1.85	+2.1	16.5	37.8
June 16	02 51.46	+48 30.8	3.644	2.952	+1.68	+1.7	16.8	40.9
June 26	03 07.43	+48 46.7	3.678	3.044	+1.50	+1.5	17.1	44.9
July 6	03 21.58	+49 00.5	3.695	3.136	+1.31	+1.3	17.4	49.8
July 16	03 33.81	+49 12.4	3.697	3.228	+1.11	+1.1	17.6	55.3
July 26	03 44.03	+49 22.7	3.683	3.321	+0.90	+1.0	17.9	61.5
Aug. 5	03 52.06	+49 31.6	3.655	3.413	+0.68	+0.8	18.1	68.3
Aug. 15	03 57.74	+49 38.3	3.616	3.506	+0.43	+0.5	18.3	75.7
Aug. 25	04 00.90	+49 42.1	3.568	3.598	+0.17	+0.2	18.5	83.6
Sept. 4	04 01.36	+49 41.4	3.515	3.690	-0.11	-0.4	18.7	92.0
Sept. 14	03 59.02	+49 33.7	3.461	3.782	-0.39	-1.3	18.9	100.9
Sept. 24	03 53.90	+49 15.9	3.410	3.874	-0.66	-2.5	19.0	110.3
Oct. 4	03 46.19	+48 44.6	3.370	3.966	-0.90	-4.0	19.2	120.0
Oct. 14	03 36.37	+47 56.2	3.345	4.057	-1.07	-5.9	19.4	129.9
Oct. 24	03 25.15	+46 48.6	3.341	4.149	-1.17	-7.9	19.6	139.5
Nov. 3	03 13.39	+45 21.3	3.364	4.239	-1.17	-9.7	19.8	148.1
Nov. 13	03 02.04	+43 37.0	3.418	4.330	-1.08	-11.2	20.0	154.1
Nov. 23	02 51.88	+41 40.4	3.505	4.420	-0.93	-12.1	20.2	155.0
Dec. 3	02 43.46	+39 38.0	3.625	4.510	-0.73	-12.3	20.5	150.6
Dec. 13	02 37.11	+37 36.3	3.778	4.599	-0.52	-11.9	20.7	142.7
Dec. 23	02 32.86	+35 40.8	3.958	4.689	-0.31	-11.0	21.0	133.4
Jan. 2	02 30.63	+33 55.7	4.163	4.777	-0.12	-9.8	21.3	123.5
Jan. 12	02 30.26	+32 23.1	4.387	4.866	+0.05	-8.5	21.6	113.6
Jan. 22	02 31.50	+31 03.9	4.625	4.954	+0.20	-7.2	21.8	103.8
Feb. 1	02 34.12	+29 57.9	4.872	5.041	+0.33	-5.9	.	94.2
Feb. 11	02 37.92	+29 04.2	5.122	5.129	+0.44	-4.8	.	84.9
Feb. 21	02 42.68	+28 21.3	5.370	5.215	+0.52	-3.7	.	75.8
Mar. 2	02 48.22	+27 47.9	5.613	5.302	+0.59	-2.9	.	66.9
Mar. 12	02 54.39	+27 22.4	5.846	5.388	+0.65	-2.2	.	58.2
Mar. 22	03 01.04	+27 03.4	6.066	5.474	+0.69	-1.6	.	49.7

## Comet C/2018 V1 (Machholz-Fujikawa-Iwamoto)

Epoch = 2019 July 16.0 TT  
 T = 2018 Dec. 3.51828 TT  
 Peri. = 88.80675  
 Node = 128.76009 2000.0  
 Incl. = 144.01072  
 q = 0.3869154 AU  
 e = 1.0003958

$$m1 = 13.8 + 5 \log(\Delta) + 12.5 \log(r(t+20))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	19 44.33	-23 46.1	1.895	0.931	+1.12	-15.8	16.6	8.0
Jan. 17	19 54.66	-26 08.5	2.097	1.121	+0.95	-12.7	17.5	5.3
Jan. 27	20 03.67	-28 07.8	2.250	1.303	+0.85	-11.2	18.3	12.0
Feb. 6	20 11.71	-29 55.9	2.362	1.479	+0.75	-10.5	18.9	20.4
Feb. 16	20 18.76	-31 41.1	2.435	1.647	+0.65	-10.6	19.4	29.4
Feb. 26	20 24.69	-33 29.5	2.476	1.810	+0.52	-11.2	19.9	38.6
Mar. 8	20 29.26	-35 26.2	2.488	1.968	+0.37	-12.3	20.2	48.0
Mar. 18	20 32.09	-37 35.7	2.477	2.122	+0.17	-13.8	20.6	57.8
Mar. 28	20 32.67	-40 01.6	2.448	2.271	-0.09	-15.6	20.8	68.0
Apr. 7	20 30.35	-42 46.1	2.407	2.416	-0.43	-17.5	21.1	78.5
Apr. 17	20 24.19	-45 49.5	2.363	2.558	-0.87	-19.3	21.3	89.4
Apr. 27	20 13.03	-49 07.7	2.323	2.697	-1.44	-20.3	21.5	100.6
May 7	19 55.47	-52 30.8	2.297	2.832	-2.16	-20.0	21.7	111.9
May 17	19 30.22	-55 41.2	2.293	2.966	-2.97	-17.4	22.0	122.9
May 27	18 57.03	-58 15.0	2.319	3.096	-3.71	-12.4	.	132.6
June 6	18 17.88	-59 48.6	2.381	3.225	-4.08	-5.4	.	139.9
June 16	17 37.45	-60 10.6	2.482	3.351	-3.90	+1.6	.	143.1
June 26	17 01.08	-59 28.6	2.621	3.475	-3.26	+7.0	.	141.5
July 6	16 32.05	-58 03.5	2.795	3.597	-2.46	+10.0	.	136.1
July 16	16 10.97	-56 18.4	2.999	3.717	-1.70	+10.9	.	128.5
July 26	15 56.85	-54 30.5	3.226	3.836	-1.08	+10.5	.	120.0
Aug. 5	15 48.29	-52 50.1	3.472	3.953	-0.60	+9.4	.	111.2
Aug. 15	15 44.00	-51 22.4	3.730	4.069	-0.24	+8.0	.	102.3
Aug. 25	15 42.93	-50 09.1	3.995	4.183	+0.04	+6.5	.	93.7
Sept. 4	15 44.32	-49 09.8	4.261	4.296	+0.25	+5.2	.	85.2
Sept. 14	15 47.59	-48 23.8	4.524	4.407	+0.41	+3.9	.	76.9
Sept. 24	15 52.28	-47 49.6	4.781	4.517	+0.54	+2.8	.	68.9
Oct. 4	15 58.09	-47 25.7	5.027	4.626	+0.63	+1.9	.	61.0
Oct. 14	16 04.74	-47 10.9	5.260	4.734	+0.70	+1.0	.	53.5
Oct. 24	16 12.00	-47 03.9	5.476	4.841	+0.75	+0.3	.	46.2
Nov. 3	16 19.72	-47 03.8	5.672	4.946	+0.79	-0.3	.	39.5
Nov. 13	16 27.72	-47 09.6	5.848	5.051	+0.81	-0.9	.	33.4
Nov. 23	16 35.85	-47 20.8	6.000	5.155	+0.82	-1.4	.	28.6
Dec. 3	16 43.98	-47 36.9	6.128	5.257	+0.81	-1.9	.	25.7
Dec. 13	16 51.95	-47 57.5	6.232	5.359	+0.78	-2.3	.	25.4
Dec. 23	16 59.64	-48 22.4	6.310	5.460	+0.75	-2.7	.	27.9
Jan. 2	17 06.90	-48 51.4	6.364	5.560	+0.69	-3.1	.	32.5
Jan. 12	17 13.55	-49 24.6	6.395	5.660	+0.63	-3.5	.	38.6
Jan. 22	17 19.44	-50 01.9	6.403	5.758	+0.54	-3.9	.	45.6
Feb. 1	17 24.39	-50 43.2	6.391	5.856	+0.43	-4.3	.	53.3
Feb. 11	17 28.19	-51 28.3	6.362	5.953	+0.31	-4.7	.	61.4
Feb. 21	17 30.65	-52 17.0	6.320	6.049	+0.16	-5.0	.	69.7
Mar. 2	17 31.54	-53 08.6	6.268	6.144	-0.01	-5.3	.	78.3
Mar. 12	17 30.64	-54 02.0	6.210	6.239	-0.20	-5.4	.	87.1
Mar. 22	17 27.77	-54 55.9	6.152	6.333	-0.40	-5.3	.	95.9



Comet 60P/Tsuchinshan

Epoch = 2019 July 16.0 TT  
 T = 2018 Dec. 11.24796 TT  
 Peri. = 216.56758 e = 0.5376816  
 Node = 267.58190 2000.0 a = 3.5101716 AU  
 Incl. = 3.60656 n = 0.14986891  
 q = 1.6228169 AU P = 6.58 years

$$m1 = 8.7 + 5 \log(\Delta) + 22.5 \log(r(t-10))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	11 27.76	-01 40.1	0.991	1.644	+1.18	-12.1	13.5	112.8
Jan. 17	11 38.01	-03 31.5	0.938	1.663	+0.83	-9.9	13.4	119.8
Jan. 27	11 44.60	-04 58.8	0.893	1.687	+0.45	-7.2	13.4	127.8
Feb. 6	11 47.27	-05 57.4	0.859	1.716	+0.05	-4.1	13.5	136.8
Feb. 16	11 46.12	-06 24.4	0.838	1.749	-0.30	-0.9	13.6	146.7
Feb. 26	11 41.86	-06 20.3	0.833	1.787	-0.56	+2.0	13.8	157.2
Mar. 8	11 35.68	-05 49.5	0.847	1.828	-0.66	+4.2	14.0	167.5
Mar. 18	11 29.18	-05 01.5	0.882	1.873	-0.61	+5.3	14.3	172.1
Mar. 28	11 23.87	-04 08.1	0.939	1.920	-0.42	+5.2	14.7	164.7
Apr. 7	11 20.76	-03 19.6	1.018	1.970	-0.16	+4.3	15.1	154.8
Apr. 17	11 20.39	-02 43.7	1.116	2.022	+0.12	+2.7	15.6	145.0
Apr. 27	11 22.75	-02 24.0	1.231	2.075	+0.38	+1.0	16.0	135.9
May 7	11 27.56	-02 21.0	1.361	2.130	+0.60	-0.6	16.5	127.4
May 17	11 34.49	-02 34.1	1.503	2.186	+0.79	-2.1	17.0	119.5
May 27	11 43.12	-03 01.1	1.656	2.243	+0.94	-3.4	17.4	112.1
June 6	11 53.10	-03 40.1	1.818	2.300	+1.06	-4.5	17.9	105.1
June 16	12 04.16	-04 28.9	1.985	2.358	+1.16	-5.3	18.3	98.4
June 26	12 16.05	-05 25.5	2.158	2.417	+1.23	-6.0	18.8	92.0
July 6	12 28.60	-06 28.2	2.334	2.475	+1.29	-6.5	19.2	85.7
July 16	12 41.68	-07 35.5	2.511	2.534	+1.33	-6.9	19.6	79.6
July 26	12 55.16	-08 45.9	2.689	2.592	+1.37	-7.2	19.9	73.6
Aug. 5	13 08.99	-09 58.3	2.864	2.651	+1.40	-7.3	20.3	67.7
Aug. 15	13 23.09	-11 11.6	3.037	2.709	+1.42	-7.3	20.6	61.8
Aug. 25	13 37.42	-12 24.7	3.204	2.766	+1.44	-7.3	21.0	55.9
Sept. 4	13 51.95	-13 37.0	3.366	2.824	+1.46	-7.2	21.3	49.9
Sept. 14	14 06.63	-14 47.7	3.519	2.881	+1.48	-6.9	21.6	44.0
Sept. 24	14 21.44	-15 55.9	3.663	2.937	+1.49	-6.7	21.9	38.0
Oct. 4	14 36.34	-17 01.2	3.796	2.993	+1.49	-6.3	.	31.9
Oct. 14	14 51.30	-18 02.9	3.916	3.048	+1.50	-6.0	.	25.7
Oct. 24	15 06.27	-19 00.6	4.023	3.103	+1.50	-5.5	.	19.5
Nov. 3	15 21.21	-19 53.9	4.116	3.158	+1.49	-5.1	.	13.2
Nov. 13	15 36.07	-20 42.4	4.192	3.211	+1.48	-4.6	.	6.8
Nov. 23	15 50.78	-21 25.8	4.251	3.264	+1.46	-4.1	.	1.3
Dec. 3	16 05.27	-22 04.1	4.293	3.316	+1.43	-3.5	.	6.8
Dec. 13	16 19.45	-22 37.1	4.317	3.368	+1.40	-3.0	.	13.5
Dec. 23	16 33.25	-23 04.8	4.323	3.419	+1.35	-2.5	.	20.5
Jan. 2	16 46.55	-23 27.5	4.311	3.469	+1.30	-2.0	.	27.6
Jan. 12	16 59.24	-23 45.4	4.281	3.519	+1.23	-1.5	.	34.8
Jan. 22	17 11.21	-23 58.8	4.234	3.568	+1.15	-1.1	.	42.3
Feb. 1	17 22.32	-24 08.2	4.171	3.616	+1.06	-0.7	.	49.9
Feb. 11	17 32.43	-24 14.1	4.094	3.663	+0.95	-0.4	.	57.7
Feb. 21	17 41.41	-24 17.2	4.005	3.710	+0.83	-0.2	.	65.8
Mar. 2	17 49.08	-24 18.1	3.905	3.756	+0.69	0.0	.	74.1
Mar. 12	17 55.28	-24 17.4	3.798	3.802	+0.53	+0.1	.	82.7
Mar. 22	17 59.87	-24 15.7	3.688	3.846	+0.36	+0.2	.	91.6

## Comet 46P/Wirtanen

Epoch = 2019 July 16.0 TT  
 T = 2018 Dec. 12.93447 TT  
 Peri. = 356.35830 e = 0.6586375  
 Node = 82.15250 2000.0 a = 3.0917444 AU  
 Incl. = 11.74504 n = 0.18130037  
 q = 1.0554056 AU P = 5.44 years

$$m1 = 8.6 + 5 \log(\Delta) + 25.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .			m	'		°
Jan. 7	08 01.74	+59 23.8	0.154	1.108	+7.55	+4.9	5.6	141.9
Jan. 17	08 56.07	+58 39.1	0.212	1.156	+3.34	-11.6	6.8	140.6
Jan. 27	09 19.28	+56 18.5	0.278	1.214	+1.37	-16.2	7.9	141.5
Feb. 6	09 28.70	+53 24.6	0.351	1.282	+0.58	-18.6	9.0	142.4
Feb. 16	09 33.30	+50 11.4	0.433	1.356	+0.38	-20.0	10.1	142.1
Feb. 26	09 37.17	+46 49.0	0.527	1.435	+0.42	-20.4	11.1	140.3
Mar. 8	09 41.93	+43 24.8	0.632	1.517	+0.56	-20.3	12.1	137.0
Mar. 18	09 48.23	+40 04.4	0.750	1.601	+0.72	-19.7	13.1	132.6
Mar. 28	09 56.01	+36 51.7	0.882	1.686	+0.85	-18.8	14.0	127.5
Apr. 7	10 05.06	+33 48.0	1.025	1.772	+0.97	-17.9	14.9	122.0
Apr. 17	10 15.17	+30 53.6	1.180	1.857	+1.06	-16.9	15.7	116.3
Apr. 27	10 26.06	+28 08.1	1.345	1.942	+1.12	-16.1	16.5	110.6
May 7	10 37.53	+25 30.7	1.519	2.027	+1.17	-15.3	17.2	104.8
May 17	10 49.44	+23 00.5	1.700	2.110	+1.21	-14.7	17.9	99.0
May 27	11 01.66	+20 36.7	1.887	2.192	+1.23	-14.1	18.5	93.3
June 6	11 14.09	+18 18.6	2.078	2.273	+1.25	-13.5	19.1	87.5
June 16	11 26.68	+16 05.7	2.272	2.352	+1.27	-13.0	19.7	81.8
June 26	11 39.37	+13 57.6	2.466	2.431	+1.27	-12.6	20.2	76.1
July 6	11 52.13	+11 53.9	2.660	2.507	+1.28	-12.1	20.7	70.3
July 16	12 04.93	+09 54.4	2.850	2.583	+1.28	-11.7	21.2	64.6
July 26	12 17.75	+07 59.0	3.036	2.657	+1.28	-11.3	21.6	58.8
Aug. 5	12 30.58	+06 07.6	3.216	2.729	+1.28	-10.9	22.0	53.0
Aug. 15	12 43.41	+04 20.4	3.389	2.800	+1.28	-10.5	.	47.2
Aug. 25	12 56.23	+02 37.3	3.551	2.870	+1.28	-10.1	.	41.3
Sept. 4	13 09.03	+00 58.4	3.703	2.938	+1.28	-9.6	.	35.3
Sept. 14	13 21.79	+00 36.1	3.842	3.005	+1.27	-9.2	.	29.4
Sept. 24	13 34.49	-02 06.0	3.966	3.071	+1.27	-8.7	.	23.3
Oct. 4	13 47.12	-03 31.0	4.076	3.135	+1.26	-8.2	.	17.4
Oct. 14	13 59.64	-04 51.1	4.169	3.198	+1.24	-7.7	.	11.7
Oct. 24	14 12.01	-06 05.8	4.244	3.260	+1.23	-7.2	.	7.4
Nov. 3	14 24.19	-07 15.1	4.300	3.320	+1.21	-6.6	.	7.7
Nov. 13	14 36.12	-08 18.7	4.338	3.379	+1.18	-6.0	.	12.6
Nov. 23	14 47.74	-09 16.3	4.356	3.437	+1.14	-5.4	.	18.9
Dec. 3	14 58.97	-10 07.8	4.355	3.493	+1.10	-4.8	.	25.8
Dec. 13	15 09.71	-10 53.0	4.334	3.548	+1.04	-4.2	.	32.9
Dec. 23	15 19.85	-11 31.9	4.295	3.602	+0.98	-3.5	.	40.4
Jan. 2	15 29.28	-12 04.3	4.238	3.655	+0.90	-2.9	.	48.1
Jan. 12	15 37.86	-12 30.2	4.165	3.707	+0.81	-2.2	.	56.1
Jan. 22	15 45.44	-12 49.8	4.079	3.758	+0.70	-1.6	.	64.3
Feb. 1	15 51.86	-13 03.1	3.981	3.807	+0.57	-1.0	.	72.8
Feb. 11	15 56.94	-13 10.2	3.874	3.856	+0.43	-0.4	.	81.6
Feb. 21	16 00.52	-13 11.5	3.762	3.903	+0.27	+0.2	.	90.8
Mar. 2	16 02.45	-13 07.2	3.650	3.950	+0.10	+0.7	.	100.3
Mar. 12	16 02.59	-12 57.8	3.541	3.995	-0.09	+1.2	.	110.2
Mar. 22	16 00.88	-12 43.6	3.441	4.039	-0.27	+1.7	.	120.5

Comet 137P/Shoemaker-Levy

Epoch = 2019 July 16.0 TT  
 T = 2018 Dec. 13.39097 TT  
 Peri. = 141.01344 e = 0.5729987  
 Node = 233.07979 2000.0 a = 4.5202366 AU  
 Incl. = 4.85373 n = 0.10255630  
 q = 1.9301469 AU P = 9.61 years

H = 14.4 , G = 0.15

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion	V	Elong.
2019/20	h m	° ' "			m		°
Jan. 7	23 45.21	+00 45.0	2.031	1.944	+2.12 +11.0	18.6	70.8
Jan. 17	00 06.61	+02 37.6	2.134	1.957	+2.16 +11.5	18.7	66.3
Jan. 27	00 28.37	+04 33.7	2.238	1.975	+2.19 +11.7	18.8	61.8
Feb. 6	00 50.40	+06 31.0	2.345	1.996	+2.22 +11.7	18.9	57.5
Feb. 16	01 12.62	+08 27.2	2.452	2.022	+2.23 +11.5	19.0	53.2
Feb. 26	01 34.97	+10 20.2	2.560	2.051	+2.24 +11.0	19.0	48.9
Mar. 8	01 57.40	+12 08.1	2.668	2.083	+2.25 +10.4	19.1	44.7
Mar. 18	02 19.86	+13 49.3	2.776	2.119	+2.25 +9.7	19.2	40.4
Mar. 28	02 42.30	+15 22.3	2.881	2.157	+2.24 +8.8	19.2	36.2
Apr. 7	03 04.69	+16 46.0	2.984	2.198	+2.23 +7.8	19.3	31.8
Apr. 17	03 26.95	+17 59.6	3.084	2.242	+2.22 +6.8	19.3	27.5
Apr. 27	03 49.04	+19 02.5	3.179	2.287	+2.20 +5.7	19.4	23.1
May 7	04 10.89	+19 54.3	3.268	2.334	+2.17 +4.6	19.4	18.6
May 17	04 32.44	+20 34.9	3.351	2.383	+2.13 +3.4	19.4	14.1
May 27	04 53.60	+21 04.4	3.427	2.434	+2.09 +2.4	19.4	9.5
June 6	05 14.31	+21 23.2	3.495	2.485	+2.04 +1.3	19.3	4.9
June 16	05 34.51	+21 31.5	3.553	2.538	+1.99 +0.3	19.3	1.8
June 26	05 54.11	+21 30.1	3.601	2.591	+1.93 -0.7	19.5	5.6
July 6	06 13.07	+21 19.6	3.639	2.646	+1.86 -1.5	19.7	10.6
July 16	06 31.30	+21 01.0	3.665	2.701	+1.78 -2.3	19.8	15.8
July 26	06 48.75	+20 35.0	3.679	2.756	+1.70 -3.0	20.0	21.2
Aug. 5	07 05.38	+20 02.7	3.680	2.812	+1.61 -3.5	20.1	26.8
Aug. 15	07 21.10	+19 25.0	3.669	2.868	+1.52 -4.0	20.2	32.6
Aug. 25	07 35.86	+18 43.1	3.644	2.925	+1.42 -4.4	20.3	38.7
Sept. 4	07 49.59	+17 58.1	3.608	2.981	+1.31 -4.6	20.4	45.0
Sept. 14	08 02.21	+17 11.1	3.558	3.038	+1.20 -4.8	20.4	51.6
Sept. 24	08 13.63	+16 23.3	3.498	3.094	+1.07 -4.8	20.4	58.5
Oct. 4	08 23.75	+15 36.1	3.426	3.151	+0.93 -4.6	20.5	65.8
Oct. 14	08 32.43	+14 50.6	3.346	3.207	+0.79 -4.4	20.5	73.4
Oct. 24	08 39.56	+14 08.4	3.259	3.263	+0.62 -4.0	20.5	81.5
Nov. 3	08 44.97	+13 30.7	3.168	3.319	+0.44 -3.5	20.4	90.0
Nov. 13	08 48.52	+12 59.1	3.075	3.375	+0.25 -2.8	20.4	99.0
Nov. 23	08 50.10	+12 34.8	2.986	3.431	+0.04 -2.0	20.3	108.6
Dec. 3	08 49.59	+12 18.9	2.904	3.486	-0.17 -1.1	20.2	118.7
Dec. 13	08 47.02	+12 12.1	2.834	3.541	-0.37 -0.2	20.1	129.3
Dec. 23	08 42.52	+12 14.6	2.782	3.596	-0.55 +0.7	20.0	140.5
Jan. 2	08 36.36	+12 25.6	2.753	3.650	-0.69 +1.5	19.9	151.9
Jan. 12	08 29.05	+12 43.9	2.751	3.704	-0.77 +2.1	19.8	163.4
Jan. 22	08 21.20	+13 07.3	2.779	3.757	-0.79 +2.5	19.7	173.0
Feb. 1	08 13.47	+13 33.4	2.838	3.810	-0.74 +2.7	19.9	169.3
Feb. 11	08 06.53	+13 59.8	2.928	3.863	-0.63 +2.6	20.1	158.5
Feb. 21	08 00.89	+14 24.6	3.046	3.915	-0.48 +2.3	20.3	147.3
Mar. 2	07 56.88	+14 46.4	3.190	3.967	-0.30 +2.0	20.6	136.4
Mar. 12	07 54.67	+15 04.2	3.354	4.018	-0.12 +1.5	20.8	125.9
Mar. 22	07 54.25	+15 17.4	3.534	4.069	+0.05 +1.1	20.9	115.9

Comet 375P/Hill

Epoch = 2019 July 16.0 TT  
 T = 2018 Dec. 21.43395 TT  
 Peri. = 119.42935 e = 0.6591794  
 Node = 359.96308 2000.0 a = 5.5607648 AU  
 Incl. = 17.36571 n = 0.07516268  
 q = 1.8952232 AU P = 13.11 years

$$m1 = 13.5 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	10 50.36	+33 26.4	1.110	1.903	+0.28	-3.3	17.9	130.7
Jan. 17	10 51.04	+32 51.6	1.060	1.914	-0.18	-3.8	17.9	138.9
Jan. 27	10 47.26	+32 08.1	1.027	1.931	-0.60	-5.1	17.8	147.5
Feb. 6	10 39.74	+31 08.0	1.012	1.953	-0.90	-7.2	17.9	155.6
Feb. 16	10 30.01	+29 44.5	1.019	1.979	-1.02	-9.8	18.0	161.1
Feb. 26	10 19.98	+27 56.0	1.049	2.010	-0.95	-12.1	18.2	160.8
Mar. 8	10 11.40	+25 47.0	1.103	2.045	-0.72	-13.8	18.4	154.9
Mar. 18	10 05.52	+23 24.8	1.180	2.084	-0.41	-14.6	18.6	146.6
Mar. 28	10 02.85	+20 57.6	1.278	2.126	-0.09	-14.8	18.9	138.0
Apr. 7	10 03.32	+18 30.9	1.394	2.172	+0.21	-14.5	19.3	129.5
Apr. 17	10 06.61	+16 07.9	1.525	2.220	+0.47	-14.0	19.6	121.4
Apr. 27	10 12.23	+13 49.9	1.669	2.271	+0.67	-13.5	20.0	113.8
May 7	10 19.74	+11 36.8	1.824	2.324	+0.84	-13.1	20.3	106.6
May 17	10 28.73	+09 27.9	1.988	2.379	+0.97	-12.7	20.6	99.8
May 27	10 38.86	+07 22.7	2.157	2.435	+1.06	-12.3	21.0	93.3
June 6	10 49.85	+05 20.5	2.331	2.493	+1.14	-12.1	21.3	87.0
June 16	11 01.52	+03 20.6	2.508	2.553	+1.20	-11.9	21.6	80.9
June 26	11 13.67	+01 22.8	2.685	2.613	+1.24	-11.7	21.9	75.0
July 6	11 26.21	+00 33.2	2.863	2.674	+1.27	-11.5	.	69.1
July 16	11 39.03	-02 27.6	3.038	2.736	+1.29	-11.4	.	63.3
July 26	11 52.06	-04 20.4	3.209	2.799	+1.31	-11.2	.	57.5
Aug. 5	12 05.26	-06 11.6	3.376	2.862	+1.33	-11.0	.	51.8
Aug. 15	12 18.57	-08 01.1	3.536	2.925	+1.34	-10.8	.	46.1
Aug. 25	12 31.95	-09 48.7	3.688	2.989	+1.34	-10.6	.	40.3
Sept. 4	12 45.40	-11 34.2	3.830	3.053	+1.35	-10.4	.	34.5
Sept. 14	12 58.87	-13 17.5	3.961	3.117	+1.35	-10.2	.	28.7
Sept. 24	13 12.33	-14 58.4	4.081	3.181	+1.35	-9.9	.	22.9
Oct. 4	13 25.77	-16 36.7	4.186	3.245	+1.34	-9.7	.	17.3
Oct. 14	13 39.14	-18 12.2	4.278	3.308	+1.33	-9.4	.	12.0
Oct. 24	13 52.40	-19 44.6	4.354	3.372	+1.32	-9.1	.	8.3
Nov. 3	14 05.51	-21 14.0	4.413	3.436	+1.30	-8.8	.	8.7
Nov. 13	14 18.40	-22 40.0	4.455	3.499	+1.27	-8.4	.	13.1
Nov. 23	14 31.00	-24 02.8	4.481	3.562	+1.24	-8.1	.	19.1
Dec. 3	14 43.24	-25 22.2	4.488	3.625	+1.20	-7.8	.	25.6
Dec. 13	14 55.01	-26 38.2	4.479	3.687	+1.15	-7.4	.	32.6
Dec. 23	15 06.20	-27 51.1	4.452	3.749	+1.08	-7.1	.	39.8
Jan. 2	15 16.68	-29 00.8	4.410	3.811	+1.00	-6.8	.	47.2
Jan. 12	15 26.29	-30 07.7	4.353	3.873	+0.91	-6.5	.	54.9
Jan. 22	15 34.89	-31 11.7	4.284	3.934	+0.80	-6.3	.	62.9
Feb. 1	15 42.29	-32 13.2	4.204	3.994	+0.67	-6.0	.	71.1
Feb. 11	15 48.29	-33 12.1	4.116	4.055	+0.52	-5.7	.	79.5
Feb. 21	15 52.72	-34 08.2	4.024	4.115	+0.35	-5.4	.	88.3
Mar. 2	15 55.38	-35 01.1	3.931	4.174	+0.16	-5.1	.	97.3
Mar. 12	15 56.13	-35 50.0	3.841	4.233	-0.03	-4.6	.	106.6
Mar. 22	15 54.88	-36 33.6	3.759	4.292	-0.24	-4.0	.	116.1

## Comet C/2018 X3 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2018 Dec. 30.74848 TT  
 Peri. = 359.81961 e = 0.7825209  
 Node = 78.92479 2000.0 a = 12.4092573 AU  
 Incl. = 43.36919 n = 0.02254682  
 q = 2.6987541 AU P = 43.71 years

$$m_1 = 14.6 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .			m	' .		°
Jan. 7	04 19.66	+23 25.5	1.864	2.700	-0.69	+15.7	20.3	140.9
Jan. 17	04 14.16	+25 56.7	1.966	2.703	-0.38	+14.4	20.4	129.8
Jan. 27	04 11.80	+28 15.4	2.087	2.711	-0.06	+13.2	20.5	119.5
Feb. 6	04 12.61	+30 22.3	2.223	2.721	+0.25	+12.1	20.7	109.9
Feb. 16	04 16.46	+32 18.9	2.368	2.734	+0.54	+11.1	20.8	101.0
Feb. 26	04 23.06	+34 06.4	2.519	2.750	+0.80	+10.3	21.0	92.7
Mar. 8	04 32.16	+35 45.6	2.672	2.769	+1.04	+9.5	21.2	85.1
Mar. 18	04 43.47	+37 17.0	2.824	2.791	+1.24	+8.7	21.3	77.9
Mar. 28	04 56.72	+38 40.7	2.974	2.816	+1.42	+7.9	21.5	71.2
Apr. 7	05 11.70	+39 56.5	3.119	2.843	+1.58	+7.1	21.6	64.9
Apr. 17	05 28.18	+41 04.2	3.258	2.873	+1.72	+6.3	21.7	59.0
Apr. 27	05 45.95	+42 03.4	3.390	2.906	+1.84	+5.4	21.9	53.4
May 7	06 04.84	+42 53.7	3.515	2.940	+1.94	+4.5	22.0	48.2
May 17	06 24.65	+43 35.0	3.630	2.977	+2.02	+3.6	.	43.3
May 27	06 45.18	+44 06.9	3.737	3.016	+2.09	+2.7	.	38.9
June 6	07 06.26	+44 29.6	3.834	3.057	+2.13	+1.8	.	34.8
June 16	07 27.70	+44 43.3	3.922	3.099	+2.16	+0.9	.	31.3
June 26	07 49.34	+44 48.4	3.999	3.144	+2.17	+0.1	.	28.5
July 6	08 11.02	+44 45.6	4.067	3.190	+2.16	-0.7	.	26.6
July 16	08 32.58	+44 35.6	4.124	3.237	+2.14	-1.3	.	25.6
July 26	08 53.90	+44 19.6	4.171	3.286	+2.12	-1.9	.	25.8
Aug. 5	09 14.89	+43 58.7	4.208	3.336	+2.08	-2.3	.	27.0
Aug. 15	09 35.44	+43 34.4	4.234	3.387	+2.03	-2.6	.	29.3
Aug. 25	09 55.49	+43 07.9	4.251	3.439	+1.98	-2.7	.	32.3
Sept. 4	10 14.99	+42 40.9	4.258	3.493	+1.92	-2.7	.	36.0
Sept. 14	10 33.88	+42 15.0	4.255	3.547	+1.85	-2.5	.	40.2
Sept. 24	10 52.12	+41 51.7	4.243	3.602	+1.79	-2.1	.	44.8
Oct. 4	11 09.69	+41 32.7	4.223	3.658	+1.72	-1.6	.	49.8
Oct. 14	11 26.52	+41 19.6	4.195	3.714	+1.64	-0.9	.	55.0
Oct. 24	11 42.56	+41 13.9	4.160	3.771	+1.56	-0.1	.	60.5
Nov. 3	11 57.76	+41 17.2	4.119	3.829	+1.47	+0.9	.	66.3
Nov. 13	12 12.01	+41 30.7	4.074	3.887	+1.37	+1.9	.	72.2
Nov. 23	12 25.23	+41 55.3	4.026	3.946	+1.26	+3.1	.	78.3
Dec. 3	12 37.27	+42 32.0	3.978	4.005	+1.13	+4.3	.	84.5
Dec. 13	12 47.97	+43 20.9	3.930	4.065	+0.99	+5.5	.	90.8
Dec. 23	12 57.15	+44 21.5	3.886	4.125	+0.83	+6.7	.	97.1
Jan. 2	13 04.61	+45 32.9	3.849	4.185	+0.64	+7.7	.	103.2
Jan. 12	13 10.12	+46 52.9	3.820	4.245	+0.44	+8.4	.	109.1
Jan. 22	13 13.46	+48 18.5	3.802	4.306	+0.21	+8.7	.	114.6
Feb. 1	13 14.46	+49 45.5	3.798	4.366	-0.03	+8.6	.	119.3
Feb. 11	13 13.04	+51 09.2	3.810	4.427	-0.28	+8.0	.	123.1
Feb. 21	13 09.23	+52 24.1	3.839	4.488	-0.50	+6.8	.	125.7
Mar. 2	13 03.29	+53 25.0	3.887	4.550	-0.69	+5.1	.	126.7
Mar. 12	12 55.71	+54 07.2	3.953	4.611	-0.82	+3.1	.	126.2
Mar. 22	12 47.17	+54 27.9	4.038	4.672	-0.88	+0.8	.	124.3

Comet P/2018 Y2 (Africano)

Epoch = 2019 July 16.0 TT  
 T = 2019 Jan. 2.61611 TT  
 Peri. = 162.50937 e = 0.4789833  
 Node = 297.25760 2000.0 a = 7.4733766 AU  
 Incl. = 11.68650 n = 0.04824239  
 q = 3.8937540 AU P = 20.43 years

$$m1 = 11.1 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .			m	'		°
Jan. 7	06 40.43	+27 36.5	2.918	3.894	-0.63	-2.0	19.3	171.6
Jan. 17	06 34.47	+27 14.5	2.952	3.895	-0.55	-2.4	19.4	160.9
Jan. 27	06 29.54	+26 49.5	3.013	3.897	-0.42	-2.6	19.4	149.9
Feb. 6	06 26.10	+26 22.6	3.100	3.899	-0.25	-2.7	19.5	139.1
Feb. 16	06 24.44	+25 55.0	3.208	3.903	-0.06	-2.8	19.5	128.7
Feb. 26	06 24.67	+25 27.3	3.334	3.908	+0.13	-2.7	19.6	118.7
Mar. 8	06 26.77	+25 00.1	3.473	3.913	+0.31	-2.7	19.7	109.2
Mar. 18	06 30.63	+24 33.3	3.620	3.919	+0.48	-2.7	19.8	100.1
Mar. 28	06 36.07	+24 06.6	3.772	3.927	+0.62	-2.7	19.9	91.5
Apr. 7	06 42.90	+23 39.4	3.926	3.935	+0.75	-2.8	20.0	83.2
Apr. 17	06 50.94	+23 11.3	4.078	3.944	+0.86	-2.9	20.1	75.2
Apr. 27	06 59.98	+22 41.5	4.226	3.954	+0.95	-3.1	20.2	67.6
May 7	07 09.86	+22 09.5	4.368	3.965	+1.03	-3.3	20.3	60.2
May 17	07 20.41	+21 34.8	4.501	3.977	+1.09	-3.6	20.4	53.1
May 27	07 31.48	+20 57.0	4.624	3.989	+1.13	-4.0	20.4	46.1
June 6	07 42.95	+20 15.9	4.736	4.003	+1.16	-4.3	20.5	39.3
June 16	07 54.70	+19 31.4	4.835	4.017	+1.19	-4.7	20.6	32.6
June 26	08 06.62	+18 43.3	4.921	4.032	+1.20	-5.0	20.6	26.0
July 6	08 18.64	+17 51.7	4.992	4.047	+1.20	-5.4	20.7	19.5
July 16	08 30.66	+16 56.6	5.048	4.064	+1.20	-5.7	20.7	13.0
July 26	08 42.61	+15 58.5	5.088	4.081	+1.19	-6.0	20.7	6.7
Aug. 5	08 54.41	+14 57.3	5.113	4.099	+1.17	-6.3	20.8	2.4
Aug. 15	09 06.01	+13 53.6	5.121	4.118	+1.15	-6.5	20.8	7.3
Aug. 25	09 17.34	+12 47.8	5.112	4.137	+1.12	-6.7	20.8	13.8
Sept. 4	09 28.33	+11 40.2	5.087	4.157	+1.08	-6.8	20.8	20.5
Sept. 14	09 38.92	+10 31.4	5.046	4.178	+1.03	-6.9	20.8	27.3
Sept. 24	09 49.03	+09 21.9	4.990	4.199	+0.98	-7.0	20.8	34.3
Oct. 4	09 58.59	+08 12.4	4.919	4.221	+0.92	-6.9	20.8	41.5
Oct. 14	10 07.52	+07 03.6	4.833	4.244	+0.85	-6.8	20.8	48.9
Oct. 24	10 15.72	+05 56.2	4.736	4.267	+0.78	-6.6	20.8	56.5
Nov. 3	10 23.09	+04 50.9	4.627	4.291	+0.69	-6.4	20.8	64.3
Nov. 13	10 29.52	+03 48.8	4.509	4.315	+0.59	-6.0	20.7	72.5
Nov. 23	10 34.90	+02 50.7	4.386	4.340	+0.47	-5.6	20.7	80.9
Dec. 3	10 39.09	+01 57.6	4.259	4.365	+0.35	-5.0	20.6	89.7
Dec. 13	10 42.00	+01 10.6	4.132	4.391	+0.22	-4.3	20.6	98.8
Dec. 23	10 43.52	+00 30.6	4.009	4.418	+0.07	-3.6	20.6	108.3
Jan. 2	10 43.60	+00 01.2	3.896	4.444	-0.07	-2.7	20.5	118.1
Jan. 12	10 42.24	+00 24.1	3.795	4.472	-0.21	-1.8	20.5	128.3
Jan. 22	10 39.53	+00 37.7	3.712	4.499	-0.34	-0.8	20.5	138.7
Feb. 1	10 35.65	+00 41.8	3.652	4.527	-0.44	+0.1	20.5	149.3
Feb. 11	10 30.90	+00 37.3	3.618	4.556	-0.51	+0.9	20.5	159.7
Feb. 21	10 25.66	+00 25.3	3.612	4.585	-0.54	+1.5	20.5	168.3
Mar. 2	10 20.34	+00 07.7	3.637	4.614	-0.52	+2.0	20.5	169.2
Mar. 12	10 15.40	+00 13.0	3.691	4.643	-0.46	+2.1	20.6	161.3
Mar. 22	10 11.20	+00 34.4	3.774	4.673	-0.37	+2.1	20.7	151.3

Comet 239P/LINEAR

Epoch = 2019 July 16.0 TT  
 T = 2019 Jan. 10.15919 TT  
 Peri. = 220.38107 e = 0.6309337  
 Node = 255.90797 2000.0 a = 4.4694579 AU  
 Incl. = 11.30566 n = 0.10430900  
 q = 1.6495263 AU P = 9.45 years

$$m1 = 14.6 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	08 14.21	+02 51.6	0.706	1.650	-0.22	-15.8	17.1	155.0
Jan. 17	08 11.35	+00 29.4	0.694	1.651	-0.34	-12.1	17.1	159.1
Jan. 27	08 07.93	-01 12.6	0.702	1.659	-0.31	-7.8	17.1	159.0
Feb. 6	08 05.50	-02 11.2	0.728	1.674	-0.13	-3.6	17.3	154.9
Feb. 16	08 05.40	-02 31.3	0.772	1.695	+0.15	-0.3	17.5	148.7
Feb. 26	08 08.35	-02 23.5	0.831	1.722	+0.47	+1.9	17.7	141.9
Mar. 8	08 14.47	-01 59.0	0.906	1.755	+0.78	+2.9	18.0	135.2
Mar. 18	08 23.54	-01 28.7	0.994	1.793	+1.05	+3.0	18.4	128.7
Mar. 28	08 35.08	-01 00.5	1.094	1.836	+1.27	+2.5	18.8	122.6
Apr. 7	08 48.55	+00 39.7	1.206	1.882	+1.44	+1.5	19.1	116.7
Apr. 17	09 03.49	+00 29.5	1.329	1.932	+1.56	+0.4	19.5	111.1
Apr. 27	09 19.43	+00 31.4	1.462	1.986	+1.64	-0.8	19.9	105.6
May 7	09 36.05	+00 45.3	1.603	2.042	+1.69	-2.0	20.3	100.3
May 17	09 53.07	-01 10.9	1.752	2.100	+1.72	-3.2	20.7	95.1
May 27	10 10.27	-01 47.2	1.908	2.160	+1.72	-4.2	21.0	90.0
June 6	10 27.52	-02 32.7	2.069	2.222	+1.72	-5.0	21.4	84.9
June 16	10 44.73	-03 26.4	2.234	2.285	+1.71	-5.8	21.7	79.8
June 26	11 01.81	-04 26.7	2.402	2.349	+1.70	-6.3	.	74.7
July 6	11 18.74	-05 32.4	2.572	2.413	+1.68	-6.8	.	69.6
July 16	11 35.49	-06 42.4	2.742	2.479	+1.66	-7.2	.	64.4
July 26	11 52.05	-07 55.4	2.910	2.544	+1.65	-7.4	.	59.2
Aug. 5	12 08.43	-09 10.4	3.076	2.610	+1.63	-7.6	.	53.9
Aug. 15	12 24.64	-10 26.6	3.237	2.676	+1.61	-7.6	.	48.6
Aug. 25	12 40.67	-11 43.1	3.392	2.743	+1.59	-7.6	.	43.1
Sept. 4	12 56.55	-12 59.1	3.540	2.809	+1.58	-7.6	.	37.6
Sept. 14	13 12.26	-14 14.0	3.678	2.875	+1.56	-7.4	.	32.0
Sept. 24	13 27.81	-15 27.0	3.807	2.940	+1.55	-7.2	.	26.2
Oct. 4	13 43.20	-16 37.6	3.923	3.006	+1.53	-6.9	.	20.4
Oct. 14	13 58.40	-17 45.3	4.026	3.071	+1.51	-6.6	.	14.6
Oct. 24	14 13.39	-18 49.6	4.114	3.135	+1.49	-6.2	.	9.0
Nov. 3	14 28.15	-19 50.1	4.187	3.200	+1.46	-5.8	.	5.1
Nov. 13	14 42.61	-20 46.4	4.243	3.263	+1.43	-5.4	.	7.2
Nov. 23	14 56.73	-21 38.3	4.282	3.327	+1.39	-4.9	.	12.9
Dec. 3	15 10.43	-22 25.5	4.303	3.390	+1.34	-4.5	.	19.4
Dec. 13	15 23.62	-23 07.9	4.307	3.452	+1.29	-4.0	.	26.3
Dec. 23	15 36.22	-23 45.4	4.293	3.514	+1.22	-3.5	.	33.4
Jan. 2	15 48.10	-24 18.1	4.261	3.575	+1.14	-3.0	.	40.8
Jan. 12	15 59.14	-24 46.0	4.214	3.635	+1.05	-2.5	.	48.4
Jan. 22	16 09.20	-25 09.3	4.151	3.695	+0.95	-2.1	.	56.2
Feb. 1	16 18.12	-25 28.1	4.076	3.755	+0.82	-1.6	.	64.3
Feb. 11	16 25.75	-25 42.8	3.990	3.814	+0.69	-1.2	.	72.6
Feb. 21	16 31.93	-25 53.4	3.896	3.872	+0.53	-0.8	.	81.3
Mar. 2	16 36.48	-26 00.0	3.797	3.929	+0.36	-0.4	.	90.3
Mar. 12	16 39.25	-26 02.7	3.697	3.986	+0.18	-0.1	.	99.7
Mar. 22	16 40.16	-26 01.3	3.601	4.043	-0.02	+0.4	.	109.4

Comet 374P/Larson

Epoch = 2019 July 16.0 TT  
 T = 2019 Jan. 10.82018 TT  
 Peri. = 51.58441 e = 0.4622844  
 Node = 7.92882 2000.0 a = 4.9775733 AU  
 Incl. = 10.75761 n = 0.08875188  
 q = 2.6765188 AU P = 11.11 years

$$m_1 = 0.3 + 5 \log(\Delta) + 40.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	02 07.18	+23 49.1	2.158	2.677	+0.61	+2.0	19.1	111.3
Jan. 17	02 14.33	+24 13.3	2.279	2.677	+0.84	+2.9	19.2	103.0
Jan. 27	02 23.63	+24 45.4	2.405	2.679	+1.04	+3.6	19.3	95.1
Feb. 6	02 34.80	+25 23.8	2.535	2.683	+1.21	+4.1	19.5	87.7
Feb. 16	02 47.62	+26 07.0	2.665	2.689	+1.36	+4.5	19.6	80.7
Feb. 26	03 01.85	+26 53.0	2.795	2.697	+1.49	+4.7	19.8	74.0
Mar. 8	03 17.32	+27 39.9	2.923	2.706	+1.61	+4.7	19.9	67.7
Mar. 18	03 33.84	+28 26.1	3.047	2.718	+1.70	+4.5	20.1	61.5
Mar. 28	03 51.27	+29 09.8	3.167	2.731	+1.79	+4.2	20.3	55.6
Apr. 7	04 09.45	+29 49.5	3.282	2.746	+1.86	+3.7	20.4	49.9
Apr. 17	04 28.26	+30 24.1	3.390	2.762	+1.91	+3.1	20.6	44.3
Apr. 27	04 47.54	+30 52.4	3.491	2.781	+1.95	+2.5	20.8	38.9
May 7	05 07.19	+31 13.6	3.584	2.800	+1.98	+1.7	21.0	33.6
May 17	05 27.07	+31 27.2	3.669	2.822	+1.99	+0.9	21.1	28.5
May 27	05 47.04	+31 32.8	3.745	2.844	+2.00	+0.1	21.3	23.4
June 6	06 07.00	+31 30.1	3.812	2.868	+1.99	-0.7	21.5	18.5
June 16	06 26.83	+31 19.5	3.869	2.894	+1.97	-1.5	21.7	13.9
June 26	06 46.41	+31 01.0	3.916	2.920	+1.94	-2.3	21.9	10.1
July 6	07 05.66	+30 35.1	3.952	2.948	+1.90	-3.0	.	8.0
July 16	07 24.48	+30 02.6	3.976	2.977	+1.85	-3.6	.	9.2
July 26	07 42.79	+29 24.2	3.989	3.007	+1.80	-4.1	.	12.8
Aug. 5	08 00.53	+28 40.7	3.990	3.038	+1.74	-4.6	.	17.5
Aug. 15	08 17.63	+27 53.1	3.979	3.070	+1.67	-4.9	.	22.7
Aug. 25	08 34.02	+27 02.6	3.956	3.102	+1.60	-5.2	.	28.3
Sept. 4	08 49.67	+26 10.1	3.920	3.136	+1.52	-5.3	.	34.1
Sept. 14	09 04.50	+25 17.0	3.872	3.170	+1.44	-5.3	.	40.2
Sept. 24	09 18.45	+24 24.5	3.813	3.205	+1.34	-5.2	.	46.5
Oct. 4	09 31.45	+23 33.8	3.742	3.241	+1.24	-4.9	.	53.1
Oct. 14	09 43.41	+22 46.3	3.661	3.277	+1.14	-4.5	.	59.9
Oct. 24	09 54.24	+22 03.3	3.571	3.314	+1.02	-4.0	.	67.2
Nov. 3	10 03.81	+21 26.2	3.473	3.351	+0.88	-3.3	.	74.7
Nov. 13	10 11.98	+20 56.4	3.370	3.389	+0.73	-2.5	.	82.7
Nov. 23	10 18.60	+20 35.0	3.263	3.427	+0.57	-1.6	.	91.1
Dec. 3	10 23.51	+20 23.0	3.157	3.465	+0.39	-0.7	.	99.9
Dec. 13	10 26.55	+20 21.1	3.054	3.504	+0.20	+0.4	.	109.2
Dec. 23	10 27.59	+20 29.1	2.960	3.543	-0.01	+1.3	.	119.0
Jan. 2	10 26.56	+20 46.3	2.878	3.582	-0.22	+2.2	.	129.3
Jan. 12	10 23.50	+21 10.7	2.814	3.622	-0.41	+2.7	.	139.9
Jan. 22	10 18.62	+21 39.5	2.771	3.661	-0.58	+3.0	.	150.7
Feb. 1	10 12.28	+22 08.9	2.755	3.701	-0.69	+2.8	.	161.2
Feb. 11	10 05.05	+22 35.0	2.767	3.741	-0.75	+2.3	.	169.2
Feb. 21	09 57.59	+22 54.3	2.810	3.781	-0.73	+1.4	.	167.4
Mar. 2	09 50.58	+23 04.3	2.883	3.821	-0.65	+0.4	.	158.3
Mar. 12	09 44.63	+23 03.8	2.983	3.861	-0.52	-0.6	.	147.9
Mar. 22	09 40.14	+22 53.2	3.108	3.902	-0.36	-1.6	.	137.5



Comet C/2018 A3 (ATLAS)

Epoch = 2019 July 16.0 TT  
 T = 2019 Jan. 12.84266 TT  
 Peri. = 86.42529  
 Node = 194.28529 2000.0  
 Incl. = 139.56078  
 q = 3.2766729 AU  
 e = 0.9936249

$$m1 = 8.0 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	09 38.45	+73 12.9	2.609	3.277	-7.38	+25.7	15.2	125.4
Jan. 17	08 05.86	+76 19.5	2.617	3.277	-11.13	+8.2	15.2	124.5
Jan. 27	06 15.94	+76 03.4	2.676	3.279	-9.70	-12.4	15.3	119.8
Feb. 6	04 58.12	+73 04.1	2.779	3.285	-5.55	-22.5	15.4	112.4
Feb. 16	04 16.22	+69 07.5	2.918	3.293	-2.83	-24.0	15.5	103.6
Feb. 26	03 55.12	+65 14.2	3.081	3.303	-1.39	-22.1	15.6	94.1
Mar. 8	03 45.15	+61 46.4	3.259	3.316	-0.60	-19.1	15.8	84.6
Mar. 18	03 41.41	+58 49.9	3.443	3.332	-0.14	-15.9	15.9	75.3
Mar. 28	03 41.35	+56 23.8	3.624	3.351	+0.14	-13.1	16.0	66.4
Apr. 7	03 43.56	+54 24.6	3.796	3.372	+0.31	-10.6	16.2	57.9
Apr. 17	03 47.20	+52 48.9	3.954	3.395	+0.42	-8.4	16.3	49.9
Apr. 27	03 51.71	+51 32.9	4.093	3.421	+0.48	-6.6	16.4	42.6
May 7	03 56.70	+50 33.6	4.211	3.449	+0.51	-5.1	16.5	36.2
May 17	04 01.88	+49 48.4	4.304	3.479	+0.52	-3.8	16.6	31.2
May 27	04 07.00	+49 15.1	4.373	3.512	+0.50	-2.7	16.7	28.1
June 6	04 11.85	+48 52.2	4.414	3.546	+0.46	-1.8	16.7	27.6
June 16	04 16.21	+48 38.3	4.429	3.583	+0.40	-0.9	16.8	29.8
June 26	04 19.85	+48 32.3	4.417	3.621	+0.32	-0.2	16.8	34.1
July 6	04 22.55	+48 33.3	4.380	3.661	+0.21	+0.5	16.8	40.1
July 16	04 24.00	+48 40.4	4.319	3.703	+0.07	+1.0	16.9	47.2
July 26	04 23.91	+48 52.7	4.236	3.747	-0.11	+1.5	16.9	55.0
Aug. 5	04 21.90	+49 08.9	4.135	3.792	-0.32	+1.8	16.9	63.5
Aug. 15	04 17.54	+49 27.2	4.020	3.838	-0.58	+1.8	16.9	72.5
Aug. 25	04 10.42	+49 44.7	3.895	3.886	-0.88	+1.6	16.8	82.0
Sept. 4	04 00.10	+49 57.4	3.767	3.936	-1.22	+0.8	16.8	92.1
Sept. 14	03 46.30	+49 59.4	3.643	3.986	-1.57	-0.7	16.8	102.7
Sept. 24	03 29.03	+49 43.4	3.530	4.038	-1.90	-2.9	16.8	113.6
Oct. 4	03 08.76	+49 01.1	3.437	4.091	-2.16	-6.0	16.8	124.8
Oct. 14	02 46.57	+47 45.4	3.374	4.145	-2.27	-9.5	16.8	135.5
Oct. 24	02 23.98	+45 53.7	3.347	4.200	-2.22	-13.1	16.9	144.9
Nov. 3	02 02.60	+43 28.9	3.363	4.256	-2.02	-16.0	16.9	150.7
Nov. 13	01 43.74	+40 40.1	3.424	4.313	-1.71	-17.7	17.0	150.5
Nov. 23	01 28.14	+37 39.9	3.530	4.370	-1.37	-18.1	17.1	144.3
Dec. 3	01 15.98	+34 40.9	3.677	4.429	-1.03	-17.4	17.3	135.0
Dec. 13	01 07.10	+31 53.0	3.858	4.488	-0.72	-15.9	17.5	124.4
Dec. 23	01 01.12	+29 22.4	4.066	4.548	-0.46	-14.0	17.6	113.4
Jan. 2	00 57.60	+27 12.1	4.293	4.608	-0.23	-11.9	17.8	102.5
Jan. 12	00 56.11	+25 22.6	4.531	4.669	-0.05	-9.8	18.0	91.9
Jan. 22	00 56.25	+23 52.7	4.773	4.730	+0.09	-8.0	18.1	81.6
Feb. 1	00 57.72	+22 40.4	5.012	4.792	+0.21	-6.3	18.3	71.6
Feb. 11	01 00.21	+21 43.5	5.242	4.855	+0.30	-4.9	18.5	61.9
Feb. 21	01 03.49	+20 59.6	5.458	4.918	+0.36	-3.8	18.6	52.4
Mar. 2	01 07.36	+20 26.7	5.657	4.981	+0.41	-2.8	18.7	43.2
Mar. 12	01 11.65	+20 02.7	5.834	5.045	+0.45	-2.0	18.9	34.3
Mar. 22	01 16.20	+19 45.7	5.988	5.109	+0.47	-1.4	19.0	25.8

Comet 171P/Spahr

Epoch = 2019 July 16.0 TT  
 T = 2019 Jan. 13.67601 TT  
 Peri. = 347.13016 e = 0.5018401  
 Node = 101.69639 2000.0 a = 3.5577047 AU  
 Incl. = 21.93365 n = 0.14687546  
 q = 1.7723058 AU P = 6.71 years

$$m1 = 11.4 + 5 \log(\Delta) + 20.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion	m1	Elong.
2019/20	h m	° ' "			m		°
Jan. 7	04 20.85	+09 39.1	0.919	1.773	-0.12 +25.7	16.2	137.6
Jan. 17	04 21.60	+13 52.6	0.978	1.773	+0.31 +24.7	16.3	129.2
Jan. 27	04 26.58	+17 50.7	1.054	1.776	+0.72 +22.7	16.5	121.2
Feb. 6	04 35.57	+21 26.4	1.143	1.785	+1.11 +20.2	16.7	113.8
Feb. 16	04 48.22	+24 36.3	1.242	1.798	+1.45 +17.5	17.0	107.0
Feb. 26	05 04.02	+27 19.2	1.350	1.816	+1.73 +14.8	17.2	100.7
Mar. 8	05 22.49	+29 34.8	1.464	1.837	+1.98 +12.1	17.5	94.9
Mar. 18	05 43.16	+31 23.4	1.583	1.863	+2.17 +9.4	17.8	89.5
Mar. 28	06 05.52	+32 45.5	1.707	1.892	+2.31 +6.8	18.1	84.5
Apr. 7	06 29.13	+33 41.9	1.833	1.925	+2.41 +4.3	18.4	79.7
Apr. 17	06 53.56	+34 13.9	1.962	1.961	+2.47 +1.9	18.7	75.1
Apr. 27	07 18.39	+34 22.9	2.092	1.999	+2.49 -0.3	19.0	70.7
May 7	07 43.29	+34 10.8	2.223	2.040	+2.48 -2.3	19.3	66.4
May 17	08 07.97	+33 39.6	2.353	2.083	+2.45 -4.1	19.6	62.2
May 27	08 32.20	+32 51.7	2.483	2.128	+2.39 -5.6	19.9	58.0
June 6	08 55.82	+31 49.2	2.612	2.175	+2.33 -6.9	20.2	53.9
June 16	09 18.74	+30 34.7	2.738	2.223	+2.25 -8.0	20.5	49.8
June 26	09 40.90	+29 10.4	2.861	2.272	+2.17 -8.9	20.8	45.8
July 6	10 02.29	+27 38.3	2.981	2.322	+2.10 -9.6	21.1	41.7
July 16	10 22.94	+26 00.4	3.096	2.373	+2.02 -10.0	21.4	37.6
July 26	10 42.86	+24 18.6	3.205	2.425	+1.95 -10.3	21.6	33.6
Aug. 5	11 02.11	+22 34.4	3.308	2.477	+1.89 -10.5	21.9	29.6
Aug. 15	11 20.73	+20 49.3	3.403	2.529	+1.83 -10.5	.	25.8
Aug. 25	11 38.77	+19 04.7	3.490	2.582	+1.77 -10.4	.	22.2
Sept. 4	11 56.28	+17 21.8	3.568	2.635	+1.72 -10.2	.	19.0
Sept. 14	12 13.28	+15 41.7	3.636	2.688	+1.67 -9.8	.	16.8
Sept. 24	12 29.82	+14 05.4	3.692	2.741	+1.63 -9.4	.	15.9
Oct. 4	12 45.91	+12 34.0	3.737	2.794	+1.58 -8.8	.	16.7
Oct. 14	13 01.55	+11 08.3	3.769	2.846	+1.54 -8.2	.	19.2
Oct. 24	13 16.73	+09 49.3	3.788	2.898	+1.49 -7.5	.	23.0
Nov. 3	13 31.45	+08 37.6	3.794	2.951	+1.44 -6.7	.	27.6
Nov. 13	13 45.64	+07 34.2	3.785	3.002	+1.39 -5.9	.	32.8
Nov. 23	13 59.27	+06 39.7	3.764	3.054	+1.33 -4.9	.	38.5
Dec. 3	14 12.27	+05 54.9	3.728	3.105	+1.26 -3.9	.	44.6
Dec. 13	14 24.53	+05 20.3	3.680	3.155	+1.18 -2.9	.	51.0
Dec. 23	14 35.96	+04 56.5	3.620	3.205	+1.09 -1.8	.	57.8
Jan. 2	14 46.42	+04 44.0	3.549	3.255	+0.99 -0.6	.	64.8
Jan. 12	14 55.75	+04 42.9	3.469	3.304	+0.87 +0.5	.	72.2
Jan. 22	15 03.80	+04 53.3	3.382	3.352	+0.73 +1.7	.	79.9
Feb. 1	15 10.39	+05 15.1	3.290	3.400	+0.57 +2.8	.	87.9
Feb. 11	15 15.32	+05 47.6	3.198	3.448	+0.40 +3.8	.	96.2
Feb. 21	15 18.45	+06 29.6	3.108	3.494	+0.21 +4.7	.	104.9
Mar. 2	15 19.61	+07 19.6	3.024	3.541	0.00 +5.3	.	113.7
Mar. 12	15 18.73	+08 14.6	2.950	3.586	-0.20 +5.7	.	122.7
Mar. 22	15 15.84	+09 11.5	2.892	3.632	-0.40 +5.6	.	131.7

## Comet C/2017 M4 (ATLAS)

Epoch = 2019 July 16.0 TT  
 T = 2019 Jan. 17.94660 TT  
 Peri. = 167.56690  
 Node = 65.86503 2000.0  
 Incl. = 105.64691  
 q = 3.2512742 AU  
 e = 1.0016995

$$m_1 = 6.1 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m <sub>1</sub>	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	17 13.49	-11 26.7	4.069	3.253	+0.59	-10.2	14.3	29.9
Jan. 17	17 19.19	-13 08.4	3.976	3.251	+0.54	-10.2	14.2	37.5
Jan. 27	17 24.23	-14 50.4	3.861	3.252	+0.46	-10.3	14.2	45.8
Feb. 6	17 28.36	-16 34.9	3.728	3.256	+0.35	-10.7	14.1	54.5
Feb. 16	17 31.29	-18 24.1	3.578	3.263	+0.21	-11.3	14.0	63.7
Feb. 26	17 32.67	-20 20.8	3.417	3.273	+0.04	-12.2	13.9	73.3
Mar. 8	17 32.11	-22 27.4	3.249	3.285	-0.18	-13.3	13.8	83.3
Mar. 18	17 29.09	-24 46.1	3.080	3.300	-0.46	-14.6	13.7	93.9
Mar. 28	17 23.04	-27 18.3	2.917	3.317	-0.80	-15.9	13.6	104.9
Apr. 7	17 13.32	-30 02.9	2.767	3.337	-1.20	-17.0	13.5	116.6
Apr. 17	16 59.32	-32 55.7	2.641	3.360	-1.65	-17.4	13.5	128.6
Apr. 27	16 40.68	-35 47.9	2.547	3.385	-2.12	-16.7	13.4	140.6
May 7	16 17.58	-38 25.9	2.492	3.413	-2.52	-14.4	13.4	151.5
May 17	15 51.08	-40 35.0	2.483	3.442	-2.77	-10.9	13.4	158.2
May 27	15 23.18	-42 04.8	2.521	3.474	-2.77	-6.7	13.5	156.6
June 6	14 56.28	-42 53.8	2.605	3.509	-2.55	-2.9	13.6	148.3
June 16	14 32.48	-43 09.4	2.728	3.545	-2.16	-0.2	13.8	137.6
June 26	14 12.91	-43 03.9	2.883	3.583	-1.71	+1.2	13.9	126.6
July 6	13 57.87	-42 49.2	3.061	3.623	-1.26	+1.6	14.1	115.9
July 16	13 47.05	-42 34.8	3.256	3.665	-0.87	+1.2	14.3	105.8
July 26	13 39.86	-42 26.3	3.459	3.708	-0.54	+0.4	14.5	96.2
Aug. 5	13 35.70	-42 27.0	3.664	3.754	-0.27	-0.7	14.7	87.2
Aug. 15	13 33.98	-42 38.6	3.865	3.800	-0.06	-1.8	14.8	78.8
Aug. 25	13 34.24	-43 01.3	4.060	3.849	+0.12	-2.9	15.0	70.8
Sept. 4	13 36.08	-43 34.9	4.244	3.898	+0.26	-4.0	15.1	63.4
Sept. 14	13 39.17	-44 19.1	4.413	3.949	+0.37	-5.0	15.3	56.6
Sept. 24	13 43.24	-45 13.3	4.566	4.001	+0.45	-6.0	15.4	50.4
Oct. 4	13 48.07	-46 17.1	4.701	4.054	+0.52	-6.9	15.5	44.9
Oct. 14	13 53.47	-47 30.0	4.816	4.109	+0.56	-7.8	15.7	40.5
Oct. 24	13 59.24	-48 51.5	4.910	4.164	+0.59	-8.6	15.8	37.4
Nov. 3	14 05.22	-50 21.6	4.984	4.220	+0.60	-9.5	15.8	35.9
Nov. 13	14 11.22	-51 59.9	5.036	4.278	+0.59	-10.3	15.9	36.2
Nov. 23	14 17.03	-53 46.3	5.069	4.336	+0.56	-11.1	16.0	38.2
Dec. 3	14 22.42	-55 40.8	5.083	4.395	+0.50	-11.9	16.1	41.6
Dec. 13	14 27.08	-57 42.9	5.079	4.454	+0.41	-12.6	16.1	46.2
Dec. 23	14 30.65	-59 52.5	5.060	4.515	+0.28	-13.4	16.2	51.6
Jan. 2	14 32.61	-62 09.0	5.028	4.575	+0.08	-14.0	16.2	57.5
Jan. 12	14 32.27	-64 31.1	4.986	4.637	-0.19	-14.5	16.3	63.8
Jan. 22	14 28.66	-66 56.9	4.939	4.699	-0.59	-14.7	16.3	70.3
Feb. 1	14 20.37	-69 23.1	4.890	4.762	-1.15	-14.5	16.3	76.8
Feb. 11	14 05.52	-71 44.1	4.842	4.825	-1.94	-13.5	16.4	83.1
Feb. 21	13 41.72	-73 51.3	4.801	4.888	-2.96	-11.5	16.4	89.2
Mar. 2	13 06.89	-75 31.4	4.769	4.952	-4.11	-7.9	16.4	94.9
Mar. 12	12 21.51	-76 28.7	4.750	5.017	-4.95	-2.8	16.5	99.8
Mar. 22	11 31.20	-76 30.6	4.748	5.081	-4.95	+3.0	16.5	104.0

## Comet 131P/Mueller

Epoch = 2019 July 16.0 TT  
 T = 2019 Jan. 24.20584 TT  
 Peri. = 179.07027 e = 0.3434213  
 Node = 214.19032 2000.0 a = 3.6818878 AU  
 Incl. = 7.35337 n = 0.13950772  
 q = 2.4174491 AU P = 7.06 years

$$m_1 = 9.7 + 5 \log(\Delta) + 17.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .5			m	'		°
Jan. 7	00 15.69	+02 33.5	2.416	2.420	+1.38	+6.2	18.3	78.5
Jan. 17	00 29.98	+03 39.2	2.533	2.418	+1.48	+7.0	18.4	72.0
Jan. 27	00 45.22	+04 52.1	2.648	2.418	+1.57	+7.6	18.5	65.8
Feb. 6	01 01.25	+06 10.4	2.759	2.419	+1.64	+8.0	18.6	59.8
Feb. 16	01 17.98	+07 32.1	2.865	2.422	+1.71	+8.3	18.7	54.1
Feb. 26	01 35.29	+08 55.5	2.967	2.427	+1.76	+8.4	18.8	48.5
Mar. 8	01 53.11	+10 18.7	3.062	2.433	+1.81	+8.3	18.9	43.1
Mar. 18	02 11.39	+11 40.3	3.150	2.441	+1.85	+8.0	19.0	37.8
Mar. 28	02 30.05	+12 58.8	3.232	2.451	+1.89	+7.6	19.1	32.6
Apr. 7	02 49.05	+14 12.9	3.306	2.463	+1.92	+7.1	19.1	27.6
Apr. 17	03 08.32	+15 21.3	3.372	2.476	+1.94	+6.5	19.2	22.6
Apr. 27	03 27.81	+16 22.9	3.430	2.490	+1.96	+5.8	19.3	17.7
May 7	03 47.45	+17 16.9	3.480	2.506	+1.97	+5.0	19.4	12.9
May 17	04 07.18	+18 02.6	3.520	2.523	+1.97	+4.1	19.5	8.2
May 27	04 26.91	+18 39.3	3.551	2.542	+1.97	+3.2	19.5	4.1
June 6	04 46.59	+19 06.7	3.573	2.562	+1.96	+2.2	19.6	3.9
June 16	05 06.10	+19 24.6	3.586	2.583	+1.94	+1.3	19.7	7.8
June 26	05 25.38	+19 32.8	3.588	2.605	+1.91	+0.3	19.8	12.6
July 6	05 44.32	+19 31.6	3.580	2.629	+1.87	-0.6	19.8	17.5
July 16	06 02.84	+19 21.2	3.562	2.653	+1.82	-1.5	19.9	22.6
July 26	06 20.84	+19 02.2	3.534	2.678	+1.77	-2.4	19.9	27.9
Aug. 5	06 38.24	+18 35.1	3.495	2.704	+1.70	-3.1	20.0	33.2
Aug. 15	06 54.92	+18 00.6	3.446	2.731	+1.63	-3.8	20.0	38.8
Aug. 25	07 10.81	+17 19.7	3.387	2.759	+1.54	-4.4	20.1	44.5
Sept. 4	07 25.78	+16 33.3	3.318	2.788	+1.44	-4.9	20.1	50.5
Sept. 14	07 39.74	+15 42.6	3.240	2.817	+1.34	-5.3	20.1	56.7
Sept. 24	07 52.56	+14 48.6	3.153	2.846	+1.22	-5.5	20.1	63.3
Oct. 4	08 04.12	+13 52.9	3.059	2.876	+1.08	-5.6	20.2	70.1
Oct. 14	08 14.24	+12 56.7	2.958	2.907	+0.93	-5.6	20.2	77.3
Oct. 24	08 22.79	+12 01.8	2.854	2.938	+0.76	-5.4	20.2	84.9
Nov. 3	08 29.55	+11 09.7	2.747	2.969	+0.57	-5.0	20.2	93.0
Nov. 13	08 34.36	+10 22.4	2.641	3.001	+0.37	-4.4	20.2	101.6
Nov. 23	08 37.04	+09 41.8	2.539	3.033	+0.14	-3.6	20.2	110.8
Dec. 3	08 37.45	+09 09.8	2.445	3.065	-0.09	-2.7	20.2	120.5
Dec. 13	08 35.56	+08 48.1	2.364	3.098	-0.31	-1.6	20.2	130.7
Dec. 23	08 31.49	+08 37.9	2.301	3.130	-0.52	-0.4	20.2	141.4
Jan. 2	08 25.54	+08 39.7	2.259	3.163	-0.68	+0.8	20.2	152.3
Jan. 12	08 18.26	+08 53.0	2.243	3.196	-0.77	+1.9	20.3	162.7
Jan. 22	08 10.38	+09 16.0	2.256	3.228	-0.79	+2.7	20.4	169.3
Feb. 1	08 02.69	+09 45.9	2.299	3.261	-0.73	+3.3	20.5	165.2
Feb. 11	07 55.99	+10 19.8	2.371	3.294	-0.59	+3.5	20.6	155.4
Feb. 21	07 50.86	+10 54.4	2.469	3.327	-0.41	+3.4	20.8	144.8
Mar. 2	07 47.67	+11 27.3	2.591	3.359	-0.20	+3.1	21.0	134.4
Mar. 12	07 46.58	+11 56.4	2.731	3.392	+0.01	+2.7	21.2	124.3
Mar. 22	07 47.54	+12 20.5	2.886	3.424	+0.20	+2.1	21.4	114.7

## Comet 223P/Skiff

Epoch = 2019 July 16.0 TT  
 T = 2019 Jan. 27.26615 TT  
 Peri. = 37.82589 e = 0.4154971  
 Node = 346.78809 2000.0 a = 4.1588235 AU  
 Incl. = 27.01307 n = 0.11621129  
 q = 2.4308444 AU P = 8.48 years

$$m_1 = 13.1 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion	m1	Elong.
2019/20	h m	° '			m		°
Jan. 7	23 14.12	+08 52.1	2.636	2.435	+1.31 +12.2	19.1	67.5
Jan. 17	23 27.69	+10 56.6	2.742	2.432	+1.41 +12.7	19.1	61.5
Jan. 27	23 42.24	+13 05.4	2.842	2.431	+1.50 +13.1	19.2	55.9
Feb. 6	23 57.65	+15 17.8	2.936	2.432	+1.59 +13.4	19.3	50.6
Feb. 16	00 13.86	+17 33.0	3.023	2.435	+1.66 +13.6	19.4	45.5
Feb. 26	00 30.80	+19 49.8	3.104	2.440	+1.73 +13.7	19.4	40.7
Mar. 8	00 48.45	+22 07.4	3.177	2.447	+1.80 +13.7	19.5	36.2
Mar. 18	01 06.79	+24 24.4	3.244	2.456	+1.87 +13.6	19.6	31.9
Mar. 28	01 25.80	+26 39.7	3.303	2.467	+1.94 +13.4	19.6	28.1
Apr. 7	01 45.48	+28 51.9	3.355	2.480	+2.01 +13.0	19.7	24.6
Apr. 17	02 05.84	+30 59.8	3.400	2.495	+2.07 +12.5	19.7	21.8
Apr. 27	02 26.85	+33 01.9	3.437	2.512	+2.14 +11.9	19.8	19.6
May 7	02 48.50	+34 57.3	3.468	2.531	+2.20 +11.1	19.8	18.4
May 17	03 10.76	+36 44.6	3.491	2.551	+2.26 +10.2	19.9	18.3
May 27	03 33.56	+38 22.8	3.507	2.572	+2.31 +9.3	19.9	19.2
June 6	03 56.83	+39 51.0	3.516	2.596	+2.35 +8.3	20.0	21.1
June 16	04 20.44	+41 08.7	3.518	2.620	+2.38 +7.2	20.0	23.7
June 26	04 44.27	+42 15.4	3.512	2.646	+2.39 +6.1	20.1	26.9
July 6	05 08.14	+43 11.2	3.498	2.673	+2.38 +5.0	20.1	30.6
July 16	05 31.87	+43 56.3	3.477	2.702	+2.36 +3.9	20.1	34.6
July 26	05 55.25	+44 31.5	3.447	2.731	+2.31 +3.0	20.2	38.8
Aug. 5	06 18.10	+44 57.8	3.410	2.762	+2.25 +2.2	20.2	43.4
Aug. 15	06 40.18	+45 16.6	3.364	2.793	+2.16 +1.5	20.2	48.2
Aug. 25	07 01.31	+45 29.5	3.311	2.826	+2.05 +1.0	20.2	53.3
Sept. 4	07 21.30	+45 38.6	3.250	2.859	+1.93 +0.8	20.2	58.7
Sept. 14	07 39.95	+45 45.9	3.181	2.893	+1.78 +0.7	20.2	64.4
Sept. 24	07 57.09	+45 53.6	3.106	2.928	+1.62 +0.9	20.2	70.5
Oct. 4	08 12.51	+46 04.0	3.026	2.963	+1.44 +1.3	20.2	76.8
Oct. 14	08 25.99	+46 19.0	2.942	2.999	+1.23 +1.8	20.2	83.6
Oct. 24	08 37.29	+46 40.5	2.856	3.035	+1.00 +2.6	20.2	90.7
Nov. 3	08 46.11	+47 09.8	2.769	3.072	+0.73 +3.4	20.2	98.2
Nov. 13	08 52.14	+47 47.2	2.686	3.109	+0.44 +4.2	20.2	106.1
Nov. 23	08 55.04	+48 31.9	2.609	3.146	+0.11 +4.8	20.2	114.2
Dec. 3	08 54.51	+49 21.2	2.542	3.184	-0.25 +5.0	20.2	122.6
Dec. 13	08 50.37	+50 10.4	2.489	3.222	-0.61 +4.7	20.2	130.9
Dec. 23	08 42.73	+50 52.9	2.455	3.260	-0.94 +3.6	20.2	138.7
Jan. 2	08 32.11	+51 21.2	2.443	3.298	-1.19 +1.8	20.2	145.1
Jan. 12	08 19.54	+51 28.5	2.456	3.336	-1.31 -0.6	20.3	148.8
Jan. 22	08 06.42	+51 10.9	2.495	3.375	-1.29 -3.2	20.4	148.7
Feb. 1	07 54.22	+50 28.2	2.561	3.413	-1.12 -5.5	20.5	144.7
Feb. 11	07 44.16	+49 24.1	2.653	3.452	-0.86 -7.4	20.6	138.2
Feb. 21	07 36.94	+48 04.6	2.767	3.490	-0.55 -8.6	20.7	130.4
Mar. 2	07 32.81	+46 35.4	2.901	3.529	-0.25 -9.2	20.9	122.1
Mar. 12	07 31.63	+45 01.7	3.051	3.567	+0.03 -9.5	21.0	113.6
Mar. 22	07 33.09	+43 27.2	3.213	3.606	+0.28 -9.4	21.2	105.2

Comet C/2017 B3 (LINEAR)

Epoch = 2019 July 16.0 TT  
 T = 2019 Feb. 2.56597 TT  
 Peri. = 284.76118  
 Node = 2.17754 2000.0  
 Incl. = 54.17849  
 q = 3.9212480 AU  
 e = 1.0020853

$$m1 = 6.1 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	20 07.59	-64 35.4	4.587	3.928	+3.16	+8.7	15.3	43.2
Jan. 17	20 38.03	-63 03.9	4.588	3.924	+2.90	+9.6	15.3	42.9
Jan. 27	21 05.91	-61 24.5	4.583	3.922	+2.65	+10.2	15.3	43.1
Feb. 6	21 31.37	-59 40.4	4.572	3.921	+2.42	+10.6	15.3	43.9
Feb. 16	21 54.62	-57 54.3	4.554	3.923	+2.21	+10.6	15.3	45.3
Feb. 26	22 15.86	-56 08.7	4.530	3.927	+2.02	+10.4	15.3	47.3
Mar. 8	22 35.29	-54 25.8	4.499	3.932	+1.85	+10.1	15.3	49.8
Mar. 18	22 53.08	-52 47.5	4.460	3.939	+1.69	+9.5	15.3	52.8
Mar. 28	23 09.33	-51 15.4	4.414	3.949	+1.55	+8.8	15.3	56.3
Apr. 7	23 24.17	-49 51.1	4.361	3.960	+1.41	+8.0	15.3	60.2
Apr. 17	23 37.62	-48 35.8	4.300	3.973	+1.27	+7.0	15.3	64.5
Apr. 27	23 49.70	-47 30.5	4.232	3.988	+1.13	+5.9	15.2	69.2
May 7	00 00.41	-46 36.1	4.158	4.004	+0.99	+4.8	15.2	74.3
May 17	00 09.66	-45 53.3	4.080	4.023	+0.84	+3.6	15.2	79.6
May 27	00 17.38	-45 22.3	3.997	4.043	+0.68	+2.4	15.2	85.3
June 6	00 23.43	-45 03.3	3.912	4.065	+0.51	+1.3	15.2	91.3
June 16	00 27.66	-44 55.7	3.828	4.088	+0.32	+0.2	15.1	97.6
June 26	00 29.90	-44 58.4	3.746	4.113	+0.11	-0.8	15.1	104.1
July 6	00 29.96	-45 09.5	3.669	4.140	-0.12	-1.5	15.1	110.8
July 16	00 27.68	-45 26.2	3.601	4.168	-0.36	-1.8	15.1	117.5
July 26	00 23.00	-45 44.4	3.545	4.198	-0.60	-1.7	15.1	124.0
Aug. 5	00 15.94	-45 59.4	3.504	4.229	-0.83	-1.1	15.1	130.1
Aug. 15	00 06.76	-46 05.7	3.483	4.262	-1.02	+0.1	15.1	135.2
Aug. 25	23 55.94	-45 58.1	3.483	4.296	-1.15	+1.7	15.1	138.8
Sept. 4	23 44.17	-45 32.3	3.508	4.331	-1.20	+3.7	15.2	140.1
Sept. 14	23 32.29	-44 45.9	3.559	4.368	-1.16	+5.8	15.3	138.9
Sept. 24	23 21.12	-43 39.1	3.636	4.406	-1.05	+7.7	15.3	135.3
Oct. 4	23 11.34	-42 13.8	3.738	4.445	-0.88	+9.4	15.4	129.8
Oct. 14	23 03.42	-40 33.4	3.863	4.485	-0.68	+10.7	15.6	123.0
Oct. 24	22 57.55	-38 42.2	4.009	4.526	-0.47	+11.6	15.7	115.5
Nov. 3	22 53.77	-36 43.8	4.171	4.569	-0.27	+12.1	15.8	107.5
Nov. 13	22 51.95	-34 41.6	4.347	4.612	-0.08	+12.3	15.9	99.3
Nov. 23	22 51.89	-32 38.2	4.532	4.657	+0.08	+12.3	16.1	91.1
Dec. 3	22 53.38	-30 35.3	4.722	4.702	+0.22	+12.2	16.2	82.8
Dec. 13	22 56.17	-28 34.2	4.913	4.748	+0.34	+12.0	16.3	74.6
Dec. 23	23 00.04	-26 35.7	5.102	4.795	+0.44	+11.7	16.4	66.5
Jan. 2	23 04.80	-24 40.2	5.284	4.843	+0.52	+11.4	16.6	58.5
Jan. 12	23 10.26	-22 48.0	5.458	4.892	+0.58	+11.0	16.7	50.5
Jan. 22	23 16.26	-20 59.2	5.619	4.941	+0.62	+10.7	16.8	42.7
Feb. 1	23 22.67	-19 13.9	5.766	4.991	+0.66	+10.3	16.9	35.0
Feb. 11	23 29.35	-17 32.2	5.896	5.042	+0.68	+10.0	17.0	27.6
Feb. 21	23 36.19	-15 54.0	6.008	5.094	+0.69	+9.6	17.1	20.5
Mar. 2	23 43.11	-14 19.5	6.100	5.146	+0.69	+9.2	17.1	14.4
Mar. 12	23 49.99	-12 48.8	6.171	5.198	+0.68	+8.9	17.2	10.8
Mar. 22	23 56.77	-11 21.8	6.221	5.251	+0.67	+8.5	17.3	12.2

Comet 123P/West-Hartley

Epoch = 2019 July 16.0 TT  
 T = 2019 Feb. 5.14290 TT  
 Peri. = 103.02112 e = 0.4486024  
 Node = 46.49936 2000.0 a = 3.8573844 AU  
 Incl. = 15.35952 n = 0.13009622  
 q = 2.1269525 AU P = 7.58 years

$$m1 = 8.4 + 5 \log(\Delta) + 17.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	11 30.87	+28 12.6	1.455	2.139	+0.79	+3.9	15.0	121.4
Jan. 17	11 37.36	+28 57.2	1.371	2.132	+0.47	+5.0	14.8	129.0
Jan. 27	11 40.42	+29 50.5	1.302	2.128	+0.11	+5.6	14.7	136.7
Feb. 6	11 39.82	+30 45.3	1.248	2.127	-0.26	+5.2	14.6	144.1
Feb. 16	11 35.75	+31 31.1	1.214	2.129	-0.57	+3.6	14.6	150.3
Feb. 26	11 28.95	+31 56.2	1.200	2.133	-0.79	+1.0	14.6	153.8
Mar. 8	11 20.66	+31 51.0	1.207	2.141	-0.85	-2.4	14.6	153.3
Mar. 18	11 12.46	+31 10.2	1.237	2.151	-0.76	-6.0	14.7	148.9
Mar. 28	11 05.79	+29 55.1	1.287	2.164	-0.54	-9.2	14.8	142.3
Apr. 7	11 01.59	+28 11.2	1.356	2.180	-0.26	-11.7	15.0	134.8
Apr. 17	11 00.33	+26 06.0	1.441	2.198	+0.04	-13.4	15.2	127.2
Apr. 27	11 01.95	+23 46.6	1.541	2.219	+0.31	-14.5	15.4	119.7
May 7	11 06.16	+21 18.7	1.653	2.242	+0.55	-15.1	15.6	112.6
May 17	11 12.59	+18 46.2	1.774	2.268	+0.75	-15.4	15.9	105.7
May 27	11 20.83	+16 12.0	1.903	2.295	+0.91	-15.4	16.1	99.2
June 6	11 30.53	+13 37.7	2.039	2.325	+1.04	-15.4	16.4	93.0
June 16	11 41.40	+11 04.5	2.179	2.356	+1.14	-15.2	16.6	87.0
June 26	11 53.18	+08 33.1	2.322	2.388	+1.22	-15.0	16.8	81.2
July 6	12 05.70	+06 04.3	2.467	2.423	+1.29	-14.7	17.1	75.6
July 16	12 18.82	+03 38.2	2.613	2.458	+1.34	-14.4	17.3	70.0
July 26	12 32.43	+01 15.4	2.757	2.495	+1.38	-14.1	17.6	64.5
Aug. 5	12 46.44	-01 03.9	2.900	2.533	+1.42	-13.7	17.8	59.1
Aug. 15	13 00.81	-03 19.2	3.039	2.572	+1.45	-13.3	18.0	53.7
Aug. 25	13 15.46	-05 30.4	3.174	2.612	+1.48	-12.9	18.2	48.3
Sept. 4	13 30.39	-07 37.0	3.302	2.653	+1.51	-12.4	18.4	42.8
Sept. 14	13 45.55	-09 38.8	3.424	2.694	+1.53	-11.9	18.6	37.3
Sept. 24	14 00.92	-11 35.5	3.537	2.736	+1.55	-11.4	18.8	31.8
Oct. 4	14 16.46	-13 26.8	3.641	2.778	+1.56	-10.8	19.0	26.2
Oct. 14	14 32.16	-15 12.3	3.734	2.821	+1.58	-10.2	19.1	20.5
Oct. 24	14 47.97	-16 51.9	3.816	2.864	+1.59	-9.6	19.3	14.7
Nov. 3	15 03.85	-18 25.3	3.884	2.908	+1.59	-9.0	19.5	8.8
Nov. 13	15 19.76	-19 52.4	3.939	2.952	+1.59	-8.4	19.6	3.1
Nov. 23	15 35.62	-21 13.1	3.980	2.995	+1.58	-7.7	19.7	3.9
Dec. 3	15 51.39	-22 27.5	4.005	3.039	+1.57	-7.1	19.9	10.0
Dec. 13	16 06.96	-23 35.6	4.015	3.083	+1.54	-6.5	20.0	16.3
Dec. 23	16 22.26	-24 37.6	4.010	3.127	+1.51	-5.9	20.1	22.9
Jan. 2	16 37.17	-25 34.1	3.989	3.171	+1.47	-5.4	20.2	29.6
Jan. 12	16 51.58	-26 25.4	3.953	3.215	+1.41	-4.9	20.3	36.4
Jan. 22	17 05.35	-27 12.2	3.902	3.259	+1.34	-4.5	20.3	43.5
Feb. 1	17 18.36	-27 55.3	3.837	3.302	+1.25	-4.1	20.4	50.7
Feb. 11	17 30.43	-28 35.5	3.760	3.346	+1.15	-3.9	20.5	58.1
Feb. 21	17 41.41	-29 14.1	3.673	3.389	+1.03	-3.8	20.5	65.7
Mar. 2	17 51.11	-29 51.8	3.576	3.432	+0.89	-3.8	20.5	73.6
Mar. 12	17 59.35	-30 29.9	3.474	3.474	+0.74	-3.9	20.6	81.8
Mar. 22	18 05.91	-31 09.1	3.368	3.517	+0.56	-4.0	20.6	90.3

Comet C/2018 Y1 (Iwamoto)

Epoch = 2019 July 16.0 TT  
 T = 2019 Feb. 7.01677 TT  
 Peri. = 358.04830  
 Node = 147.48130 2000.0  
 Incl. = 160.39892  
 q = 1.2867562 AU  
 e = 0.9885358

$$m1 = 9.5 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	14 11.74	-23 25.1	1.393	1.368	-0.77	+7.2	11.6	67.8
Jan. 17	14 00.17	-21 43.7	1.057	1.325	-1.78	+15.1	10.8	80.9
Jan. 27	13 32.67	-17 46.0	0.713	1.297	-4.47	+40.2	9.9	98.4
Feb. 6	12 15.09	-05 02.7	0.403	1.287	-14.11	149.6	8.6	131.1
Feb. 16	08 36.24	+27 37.4	0.327	1.294	-25.04	128.8	8.2	156.1
Feb. 26	05 49.10	+35 12.2	0.591	1.318	-8.33	-1.1	9.6	110.4
Mar. 8	04 55.85	+34 27.1	0.933	1.358	-2.91	-5.1	10.7	89.7
Mar. 18	04 35.78	+33 45.9	1.278	1.413	-1.20	-2.9	11.5	75.7
Mar. 28	04 27.42	+33 25.4	1.608	1.479	-0.48	-1.2	12.2	64.2
Apr. 7	04 24.43	+33 19.4	1.916	1.555	-0.11	0.0	12.8	54.0
Apr. 17	04 24.32	+33 23.4	2.195	1.639	+0.09	+0.8	13.4	44.6
Apr. 27	04 25.88	+33 34.6	2.444	1.730	+0.22	+1.5	13.8	35.7
May 7	04 28.45	+33 51.5	2.661	1.825	+0.29	+2.0	14.2	27.4
May 17	04 31.57	+34 13.1	2.843	1.924	+0.33	+2.4	14.6	19.9
May 27	04 34.93	+34 38.9	2.991	2.025	+0.34	+2.8	14.9	14.3
June 6	04 38.24	+35 08.7	3.104	2.128	+0.32	+3.2	15.2	13.0
June 16	04 41.24	+35 42.3	3.184	2.233	+0.27	+3.6	15.5	17.0
June 26	04 43.68	+36 19.9	3.231	2.338	+0.20	+4.0	15.7	23.9
July 6	04 45.28	+37 01.6	3.247	2.444	+0.10	+4.4	15.9	31.9
July 16	04 45.69	+37 47.6	3.235	2.551	-0.04	+4.8	16.1	40.6
July 26	04 44.56	+38 37.9	3.197	2.657	-0.22	+5.3	16.3	49.8
Aug. 5	04 41.42	+39 32.2	3.138	2.763	-0.44	+5.6	16.4	59.4
Aug. 15	04 35.74	+40 29.3	3.062	2.869	-0.73	+5.8	16.5	69.5
Aug. 25	04 26.94	+41 26.9	2.975	2.974	-1.08	+5.6	16.6	80.2
Sept. 4	04 14.39	+42 20.8	2.885	3.079	-1.48	+4.9	16.7	91.4
Sept. 14	03 57.62	+43 03.8	2.799	3.184	-1.92	+3.4	16.8	103.2
Sept. 24	03 36.55	+43 26.6	2.728	3.288	-2.33	+0.7	16.8	115.5
Oct. 4	03 11.75	+43 17.8	2.682	3.391	-2.64	-3.0	16.9	128.0
Oct. 14	02 44.70	+42 28.7	2.670	3.494	-2.75	-7.3	17.1	140.0
Oct. 24	02 17.58	+40 56.9	2.700	3.596	-2.63	-11.3	17.2	150.0
Nov. 3	01 52.54	+38 49.2	2.776	3.697	-2.32	-14.2	17.4	154.6
Nov. 13	01 31.17	+36 20.0	2.900	3.798	-1.90	-15.5	17.6	151.3
Nov. 23	01 14.11	+33 45.1	3.067	3.898	-1.47	-15.3	17.8	142.6
Dec. 3	01 01.31	+31 17.7	3.271	3.997	-1.06	-13.9	18.1	131.9
Dec. 13	00 52.32	+29 06.5	3.504	4.096	-0.71	-12.0	18.3	120.8
Dec. 23	00 46.53	+27 15.4	3.758	4.194	-0.43	-10.0	18.6	109.8
Jan. 2	00 43.36	+25 45.2	4.025	4.291	-0.19	-7.9	18.8	99.1
Jan. 12	00 42.28	+24 34.8	4.298	4.388	-0.01	-6.0	19.1	88.7
Jan. 22	00 42.84	+23 42.3	4.570	4.484	+0.13	-4.4	19.3	78.8
Feb. 1	00 44.69	+23 05.4	4.836	4.579	+0.24	-2.9	19.5	69.2
Feb. 11	00 47.51	+22 41.9	5.091	4.674	+0.33	-1.7	19.7	59.9
Feb. 21	00 51.07	+22 29.5	5.329	4.768	+0.39	-0.7	19.9	50.9
Mar. 2	00 55.16	+22 26.5	5.549	4.862	+0.43	+0.1	20.1	42.3
Mar. 12	00 59.60	+22 31.2	5.747	4.955	+0.46	+0.8	20.2	34.0
Mar. 22	01 04.25	+22 42.1	5.922	5.047	+0.47	+1.4	20.4	26.3



## Comet P/1996 R2 (Lagerkvist)

Epoch = 2019 July 16.0 TT  
 T = 2019 Feb. 11.46027 TT  
 Peri. = 333.29009 e = 0.3136415  
 Node = 40.04754 2000.0 a = 3.7739324 AU  
 Incl. = 2.60085 n = 0.13443517  
 q = 2.5902706 AU P = 7.33 years

$$m_1 = 2.7 + 5 \log(\Delta) + 30.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	23 06.44	-07 11.6	2.969	2.599	-0.81 -5.5	17.5	23.8/65	58.8
Jan. 17	23 21.21	-05 29.9	3.071	2.595	-0.78 -5.5	17.6	24.8/65	52.6
Jan. 27	23 36.50	-03 43.8	3.167	2.592	-0.77 -5.4	17.6	25.7/65	46.7
Feb. 6	23 52.25	-01 54.3	3.255	2.590	-0.75 -5.4	17.7	26.4/65	40.8
Feb. 16	00 08.36	+00 02.4	3.335	2.590	-0.74 -5.3	17.7	26.9/65	35.2
Feb. 26	00 24.78	+01 50.7	3.406	2.592	-0.73 -5.3	17.8	27.3/65	29.6
Mar. 8	00 41.48	+03 44.2	3.468	2.594	-0.73 -5.2	17.8	27.6/66	24.1
Mar. 18	00 58.40	+05 37.0	3.521	2.598	-0.72 -5.0	17.9	27.8/66	18.8
Mar. 28	01 15.52	+07 28.0	3.564	2.604	-0.72 -4.9	17.9	27.9/67	13.5
Apr. 7	01 32.82	+09 16.3	3.597	2.611	-0.72 -4.7	18.0	27.8/67	8.3
Apr. 17	01 50.26	+11 01.1	3.620	2.619	-0.72 -4.5	18.0	27.7/68	3.1
Apr. 27	02 07.82	+12 41.4	3.634	2.628	-0.72 -4.3	18.1	27.6/69	2.1
May 7	02 25.48	+14 16.5	3.637	2.639	-0.72 -4.1	18.1	27.3/70	7.2
May 17	02 43.18	+15 45.8	3.630	2.651	-0.73 -3.9	18.2	27.0/71	12.3
May 27	03 00.88	+17 08.6	3.612	2.664	-0.73 -3.6	18.3	26.5/73	17.5
June 6	03 18.54	+18 24.4	3.585	2.678	-0.74 -3.3	18.3	26.0/74	22.7
June 16	03 36.07	+19 32.9	3.548	2.693	-0.75 -3.1	18.4	25.5/75	28.0
June 26	03 53.39	+20 33.9	3.501	2.710	-0.75 -2.8	18.4	24.8/77	33.3
July 6	04 10.42	+21 27.4	3.444	2.727	-0.76 -2.5	18.5	24.0/78	38.8
July 16	04 27.04	+22 13.3	3.378	2.745	-0.77 -2.2	18.5	23.1/79	44.4
July 26	04 43.14	+22 51.9	3.303	2.765	-0.78 -1.9	18.5	22.0/81	50.1
Aug. 5	04 58.56	+23 23.8	3.220	2.785	-0.79 -1.6	18.6	20.8/82	56.1
Aug. 15	05 13.15	+23 49.5	3.129	2.806	-0.80 -1.4	18.6	19.4/83	62.3
Aug. 25	05 26.73	+24 09.9	3.031	2.828	-0.81 -1.1	18.7	17.8/84	68.8
Sept. 4	05 39.11	+24 25.8	2.927	2.851	-0.83 -0.9	18.7	15.9/85	75.7
Sept. 14	05 50.06	+24 38.3	2.819	2.874	-0.85 -0.7	18.7	13.8/85	82.9
Sept. 24	05 59.35	+24 48.7	2.709	2.898	-0.88 -0.5	18.7	11.3/85	90.5
Oct. 4	06 06.71	+24 58.1	2.599	2.923	-0.91 -0.3	18.7	8.5/84	98.7
Oct. 14	06 11.89	+25 07.5	2.492	2.948	-0.95 -0.2	18.8	5.4/80	107.4
Oct. 24	06 14.67	+25 17.6	2.391	2.974	-1.00 -0.1	18.8	2.1/60	116.7
Nov. 3	06 14.84	+25 28.9	2.300	3.000	-1.05 0.0	18.8	2.1/304	126.6
Nov. 13	06 12.39	+25 40.9	2.225	3.026	-1.10 -0.1	18.9	5.4/283	137.2
Nov. 23	06 07.45	+25 52.5	2.168	3.054	-1.15 -0.2	18.9	8.4/277	148.3
Dec. 3	06 00.46	+26 02.3	2.136	3.081	-1.19 -0.4	19.0	10.6/274	160.0
Dec. 13	05 52.15	+26 08.7	2.131	3.109	-1.21 -0.7	19.1	11.7/272	171.7
Dec. 23	05 43.42	+26 10.9	2.156	3.137	-1.21 -0.9	19.3	11.5/270	174.9
Jan. 2	05 35.26	+26 09.0	2.210	3.165	-1.18 -1.2	19.4	10.1/268	163.4
Jan. 12	05 28.53	+26 04.3	2.293	3.193	-1.14 -1.3	19.6	7.7/266	151.8
Jan. 22	05 23.82	+25 58.4	2.400	3.222	-1.08 -1.4	19.8	4.7/263	140.6
Feb. 1	05 21.45	+25 52.8	2.529	3.251	-1.02 -1.4	20.1	1.5/250	130.0
Feb. 11	05 21.49	+25 48.5	2.675	3.280	-0.96 -1.3	20.3	1.8/101	119.9
Feb. 21	05 23.81	+25 45.8	2.834	3.309	-0.90 -1.2	20.6	4.7/92	110.3
Mar. 2	05 28.22	+25 44.5	3.001	3.338	-0.84 -1.0	20.8	7.4/90	101.2
Mar. 12	05 34.45	+25 44.1	3.172	3.367	-0.79 -0.8	21.0	9.6/90	92.6
Mar. 22	05 42.25	+25 43.8	3.345	3.397	-0.74 -0.6	21.3	11.6/90	84.4

Comet 149P/Mueller

Epoch = 2019 July 16.0 TT  
 T = 2019 Feb. 17.06905 TT  
 Peri. = 43.82062 e = 0.3900033  
 Node = 145.22924 2000.0 a = 4.3174238 AU  
 Incl. = 29.77009 n = 0.10986694  
 q = 2.6336143 AU P = 8.97 years

$$m1 = -9.0 + 5 \log(\Delta) + 60.0 \log(r(t-120))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	13 28.31	+08 44.1	2.473	2.648	+1.31	+5.7	20.1	89.1
Jan. 17	13 40.93	+09 50.4	2.345	2.642	+1.19	+7.8	19.8	96.3
Jan. 27	13 52.24	+11 17.7	2.225	2.637	+1.05	+9.9	19.5	103.7
Feb. 6	14 01.96	+13 06.2	2.113	2.635	+0.87	+12.0	19.2	111.1
Feb. 16	14 09.75	+15 14.6	2.014	2.634	+0.66	+13.8	18.9	118.6
Feb. 26	14 15.37	+17 39.0	1.931	2.634	+0.43	+15.1	18.6	125.7
Mar. 8	14 18.57	+20 13.6	1.865	2.637	+0.18	+15.7	18.4	132.2
Mar. 18	14 19.26	+22 49.3	1.820	2.641	-0.07	+15.2	18.2	137.5
Mar. 28	14 17.58	+25 15.5	1.796	2.646	-0.29	+13.7	18.0	140.9
Apr. 7	14 13.90	+27 21.3	1.793	2.653	-0.46	+11.1	17.9	141.8
Apr. 17	14 08.88	+28 57.0	1.813	2.662	-0.54	+7.6	17.8	140.2
Apr. 27	14 03.39	+29 56.6	1.852	2.673	-0.54	+3.9	17.8	136.4
May 7	13 58.29	+30 18.3	1.910	2.685	-0.46	+0.1	17.8	131.2
May 17	13 54.37	+30 03.8	1.984	2.698	-0.30	-3.3	17.8	125.4
May 27	13 52.16	+29 17.8	2.070	2.713	-0.12	-6.1	17.8	119.2
June 6	13 51.93	+28 06.0	2.168	2.729	+0.09	-8.4	17.9	113.0
June 16	13 53.75	+26 34.0	2.275	2.747	+0.29	-10.1	18.0	106.8
June 26	13 57.51	+24 47.4	2.388	2.766	+0.48	-11.3	18.1	100.8
July 6	14 03.07	+22 50.5	2.507	2.786	+0.65	-12.1	18.3	95.0
July 16	14 10.22	+20 47.2	2.629	2.807	+0.79	-12.6	18.4	89.3
July 26	14 18.75	+18 40.5	2.754	2.830	+0.92	-12.8	18.6	83.8
Aug. 5	14 28.49	+16 32.9	2.880	2.853	+1.03	-12.7	18.7	78.3
Aug. 15	14 39.26	+14 26.3	3.005	2.878	+1.13	-12.5	18.9	73.0
Aug. 25	14 50.92	+12 22.6	3.130	2.903	+1.21	-12.2	19.1	67.8
Sept. 4	15 03.35	+10 23.1	3.253	2.930	+1.28	-11.7	19.3	62.6
Sept. 14	15 16.44	+08 29.0	3.373	2.957	+1.34	-11.1	19.5	57.5
Sept. 24	15 30.09	+06 41.3	3.489	2.986	+1.39	-10.4	19.7	52.5
Oct. 4	15 44.23	+05 01.0	3.599	3.015	+1.44	-9.6	19.9	47.5
Oct. 14	15 58.75	+03 28.8	3.703	3.044	+1.47	-8.7	20.2	42.6
Oct. 24	16 13.59	+02 05.4	3.800	3.074	+1.50	-7.8	20.4	37.8
Nov. 3	16 28.67	+00 51.2	3.888	3.105	+1.52	-6.9	20.6	33.2
Nov. 13	16 43.90	+00 13.4	3.966	3.137	+1.53	-5.9	20.9	28.9
Nov. 23	16 59.21	-01 08.0	4.034	3.169	+1.53	-4.9	21.1	25.2
Dec. 3	17 14.51	-01 52.7	4.091	3.201	+1.53	-3.9	21.4	22.3
Dec. 13	17 29.71	-02 27.3	4.135	3.234	+1.51	-2.9	21.6	20.8
Dec. 23	17 44.72	-02 52.0	4.166	3.267	+1.49	-1.9	21.9	21.0
Jan. 2	17 59.45	-03 07.2	4.184	3.301	+1.45	-1.0	.	22.9
Jan. 12	18 13.80	-03 13.2	4.187	3.334	+1.41	-0.1	.	26.3
Jan. 22	18 27.68	-03 10.7	4.176	3.368	+1.36	+0.7	.	30.7
Feb. 1	18 40.99	-03 00.2	4.152	3.403	+1.30	+1.5	.	35.9
Feb. 11	18 53.62	-02 42.6	4.113	3.437	+1.22	+2.1	.	41.5
Feb. 21	19 05.48	-02 18.9	4.061	3.472	+1.14	+2.7	.	47.6
Mar. 2	19 16.45	-01 49.9	3.997	3.507	+1.04	+3.1	.	54.0
Mar. 12	19 26.43	-01 17.0	3.921	3.541	+0.94	+3.5	.	60.7
Mar. 22	19 35.31	+00 41.3	3.835	3.576	+0.82	+3.7	.	67.6

## Comet C/2018 P5 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2019 Feb. 26.22106 TT  
 Peri. = 131.62829 e = 0.6411537  
 Node = 216.24568 2000.0 a = 12.7523140 AU  
 Incl. = 7.25643 n = 0.02164316  
 q = 4.5761207 AU P = 45.54 years

$$m_1 = 10.9 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	22 10.83	-05 39.6	5.205	4.588	+0.94	+4.1	21.1	46.7
Jan. 17	22 20.46	-04 56.2	5.305	4.583	+0.99	+4.6	21.1	39.1
Jan. 27	22 30.47	-04 08.2	5.390	4.580	+1.02	+5.0	21.2	31.6
Feb. 6	22 40.75	-03 16.1	5.459	4.578	+1.04	+5.4	21.2	24.3
Feb. 16	22 51.22	-02 20.6	5.511	4.577	+1.05	+5.7	21.2	17.1
Feb. 26	23 01.79	-01 22.4	5.547	4.576	+1.06	+5.9	21.2	10.3
Mar. 8	23 12.41	+00 22.1	5.565	4.577	+1.06	+6.1	21.2	4.8
Mar. 18	23 22.99	+00 39.6	5.565	4.578	+1.05	+6.2	21.2	6.6
Mar. 28	23 33.47	+01 42.0	5.548	4.580	+1.04	+6.3	21.2	12.9
Apr. 7	23 43.79	+02 44.4	5.513	4.583	+1.02	+6.2	21.2	19.7
Apr. 17	23 53.89	+03 46.3	5.462	4.587	+0.99	+6.1	21.2	26.6
Apr. 27	00 03.69	+04 46.8	5.396	4.592	+0.96	+6.0	21.2	33.7
May 7	00 13.14	+05 45.5	5.315	4.598	+0.92	+5.7	21.2	40.8
May 17	00 22.15	+06 41.5	5.220	4.605	+0.87	+5.4	21.1	48.0
May 27	00 30.65	+07 34.3	5.114	4.612	+0.82	+5.1	21.1	55.3
June 6	00 38.55	+08 23.3	4.998	4.621	+0.75	+4.7	21.0	62.7
June 16	00 45.75	+09 07.7	4.873	4.630	+0.68	+4.2	21.0	70.3
June 26	00 52.15	+09 46.9	4.742	4.640	+0.59	+3.6	20.9	78.1
July 6	00 57.65	+10 20.2	4.608	4.651	+0.50	+3.0	20.9	86.2
July 16	01 02.14	+10 46.9	4.472	4.663	+0.39	+2.3	20.8	94.5
July 26	01 05.52	+11 06.4	4.340	4.676	+0.27	+1.5	20.8	103.1
Aug. 5	01 07.71	+11 18.1	4.213	4.690	+0.15	+0.7	20.7	112.1
Aug. 15	01 08.66	+11 21.4	4.096	4.704	+0.03	-0.1	20.7	121.4
Aug. 25	01 08.37	+11 16.2	3.993	4.719	-0.10	-1.0	20.6	131.1
Sept. 4	01 06.90	+11 02.5	3.907	4.735	-0.21	-1.8	20.6	141.1
Sept. 14	01 04.41	+10 40.9	3.843	4.752	-0.30	-2.6	20.6	151.5
Sept. 24	01 01.12	+10 12.6	3.804	4.769	-0.36	-3.1	20.6	162.1
Oct. 4	00 57.33	+09 39.3	3.794	4.787	-0.39	-3.5	20.6	172.5
Oct. 14	00 53.42	+09 03.4	3.812	4.806	-0.38	-3.6	20.6	174.7
Oct. 24	00 49.75	+08 27.5	3.860	4.826	-0.34	-3.5	20.7	164.5
Nov. 3	00 46.65	+07 54.0	3.937	4.846	-0.27	-3.1	20.7	153.7
Nov. 13	00 44.42	+07 25.4	4.040	4.867	-0.17	-2.5	20.8	143.0
Nov. 23	00 43.26	+07 03.3	4.167	4.889	-0.05	-1.8	20.9	132.5
Dec. 3	00 43.27	+06 48.9	4.313	4.912	+0.07	-1.0	21.0	122.4
Dec. 13	00 44.51	+06 42.8	4.474	4.935	+0.19	-0.2	21.1	112.5
Dec. 23	00 46.93	+06 44.9	4.646	4.958	+0.31	+0.6	21.2	102.9
Jan. 2	00 50.49	+06 54.9	4.824	4.983	+0.41	+1.4	21.3	93.5
Jan. 12	00 55.08	+07 12.0	5.005	5.008	+0.51	+2.1	21.4	84.5
Jan. 22	01 00.60	+07 35.5	5.184	5.033	+0.60	+2.7	21.5	75.7
Feb. 1	01 06.93	+08 04.5	5.359	5.059	+0.67	+3.2	21.6	67.2
Feb. 11	01 13.97	+08 37.9	5.525	5.086	+0.74	+3.6	21.7	58.9
Feb. 21	01 21.60	+09 15.0	5.681	5.113	+0.79	+3.9	21.8	50.8
Mar. 2	01 29.72	+09 54.8	5.823	5.141	+0.84	+4.1	21.8	42.8
Mar. 12	01 38.24	+10 36.4	5.951	5.169	+0.87	+4.2	21.9	35.0
Mar. 22	01 47.08	+11 19.0	6.063	5.198	+0.90	+4.3	22.0	27.3

Comet C/2010 U3 (Boattini)

Epoch = 2019 July 16.0 TT  
 T = 2019 Feb. 26.54651 TT  
 Peri. = 88.08544  
 Node = 43.06201 2000.0  
 Incl. = 55.51190  
 q = 8.4455422 AU  
 e = 0.9979052

$$m1 = 7.3 + 5 \log(\Delta) + 5.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	11 59.05	+71 56.6	7.962	8.451	+0.05	+4.3	16.4	116.8
Jan. 17	11 58.47	+72 38.7	7.938	8.449	-0.20	+4.0	16.4	118.3
Jan. 27	11 55.34	+73 16.7	7.929	8.447	-0.45	+3.5	16.4	118.8
Feb. 6	11 49.71	+73 47.8	7.935	8.446	-0.69	+2.6	16.4	118.2
Feb. 16	11 41.88	+74 09.5	7.957	8.446	-0.88	+1.6	16.4	116.6
Feb. 26	11 32.46	+74 19.6	7.992	8.446	-1.00	+0.3	16.4	114.1
Mar. 8	11 22.27	+74 16.8	8.041	8.446	-1.02	-1.0	16.5	110.9
Mar. 18	11 12.28	+74 00.3	8.101	8.446	-0.95	-2.4	16.5	107.0
Mar. 28	11 03.37	+73 30.8	8.171	8.447	-0.81	-3.6	16.5	102.8
Apr. 7	10 56.15	+72 49.3	8.248	8.449	-0.61	-4.7	16.5	98.2
Apr. 17	10 51.02	+71 57.7	8.332	8.451	-0.39	-5.6	16.5	93.4
Apr. 27	10 48.07	+70 57.9	8.419	8.453	-0.18	-6.4	16.6	88.5
May 7	10 47.21	+69 51.6	8.508	8.456	+0.02	-6.9	16.6	83.6
May 17	10 48.25	+68 40.6	8.597	8.459	+0.20	-7.3	16.6	78.8
May 27	10 50.94	+67 26.3	8.684	8.462	+0.35	-7.6	16.6	74.1
June 6	10 55.01	+66 10.0	8.767	8.466	+0.48	-7.7	16.7	69.6
June 16	11 00.25	+64 52.8	8.844	8.470	+0.58	-7.7	16.7	65.3
June 26	11 06.42	+63 35.7	8.915	8.475	+0.66	-7.7	16.7	61.4
July 6	11 13.35	+62 19.2	8.977	8.480	+0.73	-7.6	16.7	57.9
July 16	11 20.88	+61 04.4	9.030	8.486	+0.78	-7.4	16.7	54.8
July 26	11 28.87	+59 51.8	9.073	8.492	+0.82	-7.1	16.7	52.4
Aug. 5	11 37.21	+58 41.9	9.105	8.498	+0.85	-6.8	16.7	50.7
Aug. 15	11 45.80	+57 35.5	9.125	8.505	+0.87	-6.4	16.7	49.7
Aug. 25	11 54.55	+56 33.2	9.133	8.512	+0.88	-6.0	16.8	49.6
Sept. 4	12 03.39	+55 35.4	9.128	8.519	+0.89	-5.5	16.8	50.3
Sept. 14	12 12.24	+54 42.8	9.112	8.527	+0.88	-5.0	16.8	51.9
Sept. 24	12 21.02	+53 55.9	9.083	8.536	+0.87	-4.4	16.7	54.2
Oct. 4	12 29.67	+53 15.2	9.043	8.544	+0.86	-3.7	16.7	57.3
Oct. 14	12 38.12	+52 41.4	8.992	8.554	+0.83	-3.0	16.7	61.0
Oct. 24	12 46.28	+52 14.7	8.932	8.563	+0.80	-2.3	16.7	65.3
Nov. 3	12 54.07	+51 55.6	8.863	8.573	+0.76	-1.5	16.7	69.9
Nov. 13	13 01.41	+51 44.3	8.787	8.583	+0.70	-0.7	16.7	75.0
Nov. 23	13 08.19	+51 41.0	8.706	8.594	+0.64	+0.1	16.7	80.2
Dec. 3	13 14.30	+51 45.5	8.622	8.605	+0.57	+0.9	16.7	85.7
Dec. 13	13 19.63	+51 57.7	8.538	8.617	+0.49	+1.6	16.6	91.3
Dec. 23	13 24.07	+52 16.7	8.456	8.628	+0.39	+2.3	16.6	96.8
Jan. 2	13 27.48	+52 41.9	8.378	8.641	+0.28	+2.8	16.6	102.3
Jan. 12	13 29.75	+53 11.9	8.308	8.653	+0.16	+3.2	16.6	107.4
Jan. 22	13 30.79	+53 45.0	8.247	8.666	+0.03	+3.4	16.6	112.2
Feb. 1	13 30.52	+54 19.4	8.198	8.680	-0.10	+3.4	16.6	116.3
Feb. 11	13 28.93	+54 52.7	8.163	8.693	-0.23	+3.2	16.6	119.7
Feb. 21	13 26.04	+55 22.6	8.143	8.707	-0.36	+2.7	16.6	122.0
Mar. 2	13 21.98	+55 46.7	8.141	8.722	-0.46	+2.0	16.6	123.1
Mar. 12	13 16.94	+56 02.7	8.155	8.737	-0.55	+1.1	16.6	123.0
Mar. 22	13 11.21	+56 09.0	8.187	8.752	-0.60	0.0	16.6	121.7

Comet C/2018 V4 (Africano)

Epoch = 2019 July 16.0 TT  
 T = 2019 Mar. 1.56377 TT  
 Peri. = 359.97375  
 Node = 78.38390 2000.0  
 Incl. = 69.00037  
 q = 3.1991839 AU  
 e = 0.9846045

$$m1 = 12.0 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	04 08.20	+04 55.0	2.491	3.240	-0.93	+18.9	19.1	132.8
Jan. 17	04 00.06	+08 02.8	2.590	3.226	-0.67	+18.6	19.2	122.4
Jan. 27	03 54.49	+11 05.4	2.713	3.215	-0.41	+17.8	19.2	112.1
Feb. 6	03 51.51	+14 00.0	2.853	3.207	-0.16	+17.0	19.3	102.0
Feb. 16	03 50.99	+16 45.3	3.004	3.202	+0.08	+16.0	19.4	92.5
Feb. 26	03 52.71	+19 21.5	3.159	3.199	+0.29	+15.1	19.5	83.3
Mar. 8	03 56.43	+21 49.0	3.316	3.200	+0.47	+14.3	19.7	74.7
Mar. 18	04 01.92	+24 08.7	3.468	3.203	+0.64	+13.6	19.8	66.4
Mar. 28	04 08.96	+26 21.6	3.614	3.209	+0.78	+12.9	19.9	58.6
Apr. 7	04 17.39	+28 28.4	3.750	3.218	+0.91	+12.4	19.9	51.2
Apr. 17	04 27.03	+30 29.9	3.874	3.230	+1.03	+11.9	20.0	44.1
Apr. 27	04 37.77	+32 26.7	3.984	3.244	+1.13	+11.4	20.1	37.5
May 7	04 49.50	+34 19.3	4.080	3.261	+1.22	+11.1	20.2	31.4
May 17	05 02.12	+36 08.2	4.160	3.281	+1.31	+10.7	20.3	25.9
May 27	05 15.57	+37 53.9	4.225	3.303	+1.39	+10.4	20.3	21.5
June 6	05 29.80	+39 36.8	4.273	3.328	+1.46	+10.2	20.4	18.7
June 16	05 44.74	+41 17.4	4.306	3.355	+1.53	+9.9	20.4	18.1
June 26	06 00.35	+42 56.0	4.323	3.385	+1.60	+9.8	20.5	19.9
July 6	06 16.61	+44 33.4	4.326	3.417	+1.66	+9.7	20.5	23.4
July 16	06 33.47	+46 10.0	4.314	3.451	+1.72	+9.6	20.6	28.1
July 26	06 50.92	+47 46.4	4.290	3.487	+1.78	+9.7	20.6	33.4
Aug. 5	07 08.93	+49 23.3	4.255	3.525	+1.83	+9.8	20.6	39.0
Aug. 15	07 27.48	+51 01.6	4.209	3.565	+1.88	+9.9	20.6	44.9
Aug. 25	07 46.55	+52 42.0	4.156	3.607	+1.94	+10.2	20.7	51.0
Sept. 4	08 06.15	+54 25.3	4.097	3.650	+1.99	+10.5	20.7	57.2
Sept. 14	08 26.26	+56 12.4	4.034	3.695	+2.04	+10.9	20.7	63.4
Sept. 24	08 46.90	+58 03.7	3.970	3.742	+2.09	+11.4	20.7	69.7
Oct. 4	09 08.06	+59 59.9	3.908	3.790	+2.15	+11.9	20.7	75.9
Oct. 14	09 29.76	+62 01.2	3.849	3.840	+2.20	+12.4	20.8	82.0
Oct. 24	09 52.04	+64 07.2	3.797	3.891	+2.26	+12.9	20.8	88.0
Nov. 3	10 14.91	+66 17.5	3.754	3.943	+2.32	+13.2	20.8	93.6
Nov. 13	10 38.38	+68 30.7	3.724	3.996	+2.38	+13.4	20.9	98.8
Nov. 23	11 02.47	+70 45.1	3.707	4.051	+2.44	+13.4	20.9	103.4
Dec. 3	11 27.12	+72 58.8	3.705	4.106	+2.49	+13.2	21.0	107.2
Dec. 13	11 52.20	+75 09.3	3.720	4.163	+2.52	+12.8	21.0	110.1
Dec. 23	12 17.48	+77 14.4	3.752	4.220	+2.52	+12.1	21.1	112.0
Jan. 2	12 42.39	+79 12.1	3.800	4.278	+2.44	+11.3	21.2	112.8
Jan. 12	13 06.01	+81 00.6	3.865	4.337	+2.24	+10.3	21.3	112.5
Jan. 22	13 26.72	+82 39.1	3.944	4.397	+1.81	+9.3	21.4	111.2
Feb. 1	13 41.50	+84 07.0	4.036	4.457	+0.98	+8.2	21.5	109.2
Feb. 11	13 45.13	+85 23.1	4.138	4.518	-0.55	+6.9	21.6	106.4
Feb. 21	13 28.64	+86 24.4	4.250	4.579	-3.22	+5.1	21.8	103.3
Mar. 2	12 41.33	+87 03.1	4.368	4.642	-6.46	+2.1	21.9	99.8
Mar. 12	11 31.03	+87 07.4	4.492	4.704	-6.91	-1.7	22.0	96.2
Mar. 22	10 33.54	+86 35.5	4.618	4.767	-4.10	-4.8	.	92.5

## Comet P/2012 01 (McNaught)

Epoch = 2019 July 16.0 TT  
 T = 2019 Mar. 2.48258 TT  
 Peri. = 238.18525 e = 0.5943747  
 Node = 91.98817 2000.0 a = 3.5384689 AU  
 Incl. = 7.43221 n = 0.14807475  
 q = 1.4352925 AU P = 6.66 years

$$m_1 = 13.7 + 5 \log(\Delta) + 30.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	19 28.09	-23 31.8	2.533	1.554	-1.63 -0.6	21.5	46.1/85	4.3
Jan. 17	20 01.75	-22 35.5	2.498	1.516	-1.69 -2.1	21.1	47.5/82	2.6
Jan. 27	20 35.79	-21 11.6	2.468	1.485	-1.73 -3.6	20.8	48.8/78	2.5
Feb. 6	21 09.87	-19 21.4	2.443	1.461	-1.74 -5.1	20.6	49.7/76	3.8
Feb. 16	21 43.64	-17 07.2	2.425	1.444	-1.73 -6.4	20.4	50.2/73	5.4
Feb. 26	22 16.85	-14 33.0	2.414	1.436	-1.70 -7.5	20.3	50.4/71	7.0
Mar. 8	22 49.30	-11 43.4	2.410	1.437	-1.65 -8.4	20.3	50.2/70	8.6
Mar. 18	23 20.88	-08 43.8	2.414	1.445	-1.60 -8.9	20.4	49.6/68	10.1
Mar. 28	23 51.52	-05 39.5	2.425	1.463	-1.53 -9.2	20.6	48.6/68	11.8
Apr. 7	00 21.23	-02 35.6	2.442	1.488	-1.46 -9.2	20.8	47.4/67	13.5
Apr. 17	00 50.00	+00 23.5	2.463	1.520	-1.40 -8.9	21.1	45.8/68	15.5
Apr. 27	01 17.85	+03 14.0	2.488	1.558	-1.33 -8.5	21.5	44.2/68	17.6
May 7	01 44.83	+05 53.1	2.513	1.603	-1.26 -7.9	21.8	42.3/69	20.0
May 17	02 10.92	+08 18.8	2.539	1.652	-1.19 -7.3	.	40.4/70	22.6
May 27	02 36.15	+10 29.7	2.562	1.705	-1.13 -6.6	.	38.5/71	25.6
June 6	03 00.49	+12 25.2	2.582	1.762	-1.07 -6.0	.	36.5/73	28.8
June 16	03 23.90	+14 05.2	2.597	1.822	-1.01 -5.4	.	34.5/75	32.4
June 26	03 46.33	+15 30.2	2.605	1.884	-0.96 -4.8	.	32.5/76	36.2
July 6	04 07.73	+16 40.8	2.606	1.948	-0.91 -4.2	.	30.5/78	40.5
July 16	04 27.99	+17 38.0	2.599	2.013	-0.86 -3.8	.	28.5/80	45.0
July 26	04 47.02	+18 23.2	2.583	2.079	-0.82 -3.4	.	26.4/81	49.9
Aug. 5	05 04.72	+18 57.7	2.557	2.146	-0.79 -3.0	.	24.2/83	55.2
Aug. 15	05 20.94	+19 23.1	2.521	2.214	-0.76 -2.7	.	21.8/84	60.9
Aug. 25	05 35.53	+19 41.0	2.476	2.281	-0.74 -2.5	.	19.3/86	67.1
Sept. 4	05 48.33	+19 53.3	2.423	2.349	-0.72 -2.3	.	16.6/87	73.7
Sept. 14	05 59.11	+20 01.8	2.362	2.416	-0.72 -2.2	.	13.6/87	80.9
Sept. 24	06 07.68	+20 08.2	2.296	2.483	-0.73 -2.1	.	10.2/87	88.6
Oct. 4	06 13.76	+20 14.3	2.227	2.550	-0.74 -2.0	.	6.5/84	97.0
Oct. 14	06 17.13	+20 21.6	2.159	2.617	-0.77 -2.0	.	2.7/72	106.0
Oct. 24	06 17.59	+20 31.2	2.095	2.682	-0.81 -2.0	.	2.0/303	115.9
Nov. 3	06 15.02	+20 43.7	2.040	2.747	-0.86 -2.0	.	6.1/283	126.4
Nov. 13	06 09.50	+20 58.7	1.999	2.812	-0.91 -2.1	.	10.0/279	137.8
Nov. 23	06 01.39	+21 15.2	1.980	2.876	-0.96 -2.2	.	13.1/277	149.7
Dec. 3	05 51.37	+21 31.7	1.985	2.939	-1.01 -2.3	.	15.0/276	162.1
Dec. 13	05 40.44	+21 46.9	2.020	3.001	-1.03 -2.5	.	15.4/275	174.7
Dec. 23	05 29.68	+21 59.8	2.085	3.063	-1.02 -2.6	.	14.3/275	172.3
Jan. 2	05 20.12	+22 10.9	2.182	3.124	-1.00 -2.7	.	11.9/275	160.0
Jan. 12	05 12.55	+22 21.1	2.306	3.184	-0.95 -2.7	.	8.8/277	148.1
Jan. 22	05 07.38	+22 31.4	2.455	3.243	-0.90 -2.6	.	5.4/282	136.7
Feb. 1	05 04.73	+22 42.6	2.625	3.301	-0.84 -2.5	.	2.1/304	126.0
Feb. 11	05 04.53	+22 55.3	2.809	3.358	-0.78 -2.3	.	2.0/48	115.8
Feb. 21	05 06.54	+23 09.1	3.005	3.415	-0.72 -2.1	.	4.6/72	106.2
Mar. 2	05 10.51	+23 23.7	3.207	3.471	-0.67 -1.9	.	7.0/78	97.1
Mar. 12	05 16.14	+23 38.6	3.411	3.526	-0.62 -1.6	.	9.0/81	88.4
Mar. 22	05 23.18	+23 52.9	3.615	3.580	-0.58 -1.4	.	10.7/83	80.0

## Comet 29P/Schwassmann-Wachmann

Epoch = 2019 July 16.0 TT  
 T = 2019 Mar. 8.40845 TT  
 Peri. = 47.82631 e = 0.0433144  
 Node = 312.38941 2000.0 a = 6.0279285 AU  
 Incl. = 9.36767 n = 0.06659658  
 q = 5.7668324 AU P = 14.80 years

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	23 02.23	+00 19.5	6.182	5.768	+0.55	+3.1	.	60.9
Jan. 17	23 07.99	+00 52.7	6.316	5.767	+0.61	+3.6	.	52.3
Jan. 27	23 14.28	+01 30.5	6.436	5.767	+0.65	+4.0	.	43.9
Feb. 6	23 21.00	+02 12.2	6.539	5.767	+0.69	+4.4	.	35.7
Feb. 16	23 28.06	+02 57.5	6.623	5.767	+0.72	+4.7	.	27.7
Feb. 26	23 35.37	+03 45.7	6.688	5.767	+0.74	+5.0	.	19.9
Mar. 8	23 42.84	+04 36.2	6.732	5.767	+0.75	+5.2	.	12.5
Mar. 18	23 50.40	+05 28.5	6.754	5.767	+0.76	+5.3	.	6.7
Mar. 28	23 57.96	+06 22.0	6.754	5.767	+0.75	+5.4	.	7.6
Apr. 7	00 05.45	+07 16.3	6.734	5.767	+0.74	+5.4	.	13.9
Apr. 17	00 12.80	+08 10.7	6.692	5.767	+0.72	+5.4	.	21.2
Apr. 27	00 19.93	+09 04.8	6.630	5.767	+0.70	+5.4	.	28.7
May 7	00 26.77	+09 58.2	6.549	5.768	+0.66	+5.3	.	36.3
May 17	00 33.23	+10 50.2	6.451	5.768	+0.62	+5.1	.	44.1
May 27	00 39.25	+11 40.4	6.338	5.768	+0.57	+4.9	.	51.9
June 6	00 44.73	+12 28.3	6.211	5.768	+0.51	+4.6	.	59.9
June 16	00 49.57	+13 13.3	6.072	5.769	+0.45	+4.3	.	68.0
June 26	00 53.69	+13 55.0	5.926	5.769	+0.37	+4.0	.	76.2
July 6	00 56.99	+14 32.7	5.774	5.770	+0.28	+3.5	.	84.7
July 16	00 59.39	+15 05.7	5.620	5.770	+0.19	+3.0	.	93.4
July 26	01 00.79	+15 33.5	5.467	5.771	+0.08	+2.5	.	102.4
Aug. 5	01 01.15	+15 55.4	5.321	5.771	-0.02	+1.8	.	111.6
Aug. 15	01 00.44	+16 10.6	5.184	5.772	-0.13	+1.1	.	121.0
Aug. 25	00 58.67	+16 18.7	5.061	5.772	-0.23	+0.4	.	130.8
Sept. 4	00 55.92	+16 19.2	4.957	5.773	-0.32	-0.4	.	140.7
Sept. 14	00 52.33	+16 12.2	4.875	5.774	-0.40	-1.1	.	150.7
Sept. 24	00 48.12	+15 58.2	4.819	5.774	-0.45	-1.8	.	160.4
Oct. 4	00 43.55	+15 37.9	4.792	5.775	-0.46	-2.3	.	168.3
Oct. 14	00 38.95	+15 13.0	4.795	5.776	-0.45	-2.7	.	168.7
Oct. 24	00 34.61	+14 45.3	4.827	5.777	-0.41	-2.8	.	161.0
Nov. 3	00 30.84	+14 17.0	4.889	5.778	-0.34	-2.8	.	151.1
Nov. 13	00 27.88	+13 50.2	4.978	5.779	-0.24	-2.5	.	140.8
Nov. 23	00 25.91	+13 26.9	5.090	5.780	-0.14	-2.1	.	130.5
Dec. 3	00 25.03	+13 08.5	5.221	5.781	-0.03	-1.5	.	120.3
Dec. 13	00 25.28	+12 56.3	5.366	5.782	+0.09	-0.9	.	110.3
Dec. 23	00 26.66	+12 50.8	5.522	5.783	+0.20	-0.2	.	100.5
Jan. 2	00 29.11	+12 52.3	5.682	5.784	+0.30	+0.5	.	91.0
Jan. 12	00 32.54	+13 00.6	5.843	5.785	+0.39	+1.2	.	81.8
Jan. 22	00 36.87	+13 15.5	6.001	5.786	+0.48	+1.8	.	72.8
Feb. 1	00 41.99	+13 36.5	6.151	5.787	+0.55	+2.4	.	64.0
Feb. 11	00 47.80	+14 02.9	6.291	5.789	+0.61	+2.9	.	55.5
Feb. 21	00 54.19	+14 34.0	6.417	5.790	+0.67	+3.4	.	47.1
Mar. 2	01 01.08	+15 09.3	6.528	5.791	+0.71	+3.7	.	39.0
Mar. 12	01 08.35	+15 47.9	6.621	5.793	+0.75	+4.0	.	31.1
Mar. 22	01 15.94	+16 29.2	6.694	5.794	+0.77	+4.3	.	23.5

Comet C/2019 B1 (Africano)

T = 2019 Mar. 19.39372 TT  
 Peri. = 174.31573  
 Node = 290.25232 2000.0  
 Incl. = 123.50383  
 q = 1.6032220 AU  
 e = 1.0

$$m_1 = 15.5 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m			°
Jan. 7	14 08.40	+45 24.1	1.484	1.867	-1.12	+39.3	19.1	96.2
Jan. 17	13 49.96	+53 12.0	1.250	1.803	-3.09	+56.5	18.5	107.1
Jan. 27	12 56.84	+63 45.1	1.058	1.747	-9.55	+67.7	18.0	117.5
Feb. 6	10 08.55	+72 12.3	0.945	1.698	-25.51	+4.8	17.7	123.1
Feb. 16	06 41.61	+64 30.9	0.944	1.659	-11.61	-86.0	17.6	118.3
Feb. 26	05 29.79	+49 48.4	1.052	1.629	-3.66	-82.8	17.7	105.8
Mar. 8	05 05.66	+37 36.9	1.235	1.611	-1.34	-61.3	18.0	92.0
Mar. 18	04 56.95	+28 47.6	1.454	1.603	-0.44	-43.8	18.4	79.4
Mar. 28	04 54.72	+22 25.5	1.685	1.607	-0.01	-32.3	18.7	68.2
Apr. 7	04 55.78	+17 39.0	1.910	1.623	+0.23	-24.9	19.0	58.2
Apr. 17	04 58.72	+13 53.3	2.122	1.649	+0.36	-20.2	19.3	49.1
Apr. 27	05 02.80	+10 45.9	2.312	1.686	+0.45	-17.2	19.6	40.9
May 7	05 07.62	+08 02.3	2.478	1.732	+0.51	-15.5	19.9	33.7
May 17	05 12.90	+05 32.2	2.617	1.787	+0.55	-14.6	20.1	27.9
May 27	05 18.45	+03 08.3	2.727	1.848	+0.56	-14.3	20.3	24.0
June 6	05 24.12	+00 45.1	2.809	1.917	+0.57	-14.5	20.6	23.0
June 16	05 29.74	-01 42.3	2.863	1.990	+0.55	-15.1	20.8	25.1
June 26	05 35.17	-04 17.9	2.892	2.068	+0.53	-16.2	21.0	29.5
July 6	05 40.25	-07 05.4	2.896	2.150	+0.48	-17.6	21.1	35.4
July 16	05 44.78	-10 08.5	2.880	2.236	+0.41	-19.3	21.3	42.3
July 26	05 48.52	-13 30.2	2.848	2.323	+0.32	-21.3	21.4	49.7
Aug. 5	05 51.20	-17 13.6	2.803	2.413	+0.20	-23.6	21.6	57.4
Aug. 15	05 52.44	-21 20.6	2.751	2.505	+0.03	-26.0	21.7	65.4
Aug. 25	05 51.77	-25 51.7	2.698	2.597	-0.19	-28.4	21.8	73.4
Sept. 4	05 48.58	-30 45.5	2.651	2.691	-0.49	-30.4	21.9	81.3
Sept. 14	05 42.07	-35 56.1	2.618	2.786	-0.87	-31.6	22.0	88.8
Sept. 24	05 31.27	-41 13.2	2.605	2.881	-1.36	-31.5	.	95.6
Oct. 4	05 15.06	-46 21.2	2.619	2.977	-1.96	-29.5	.	101.0
Oct. 14	04 52.47	-50 59.1	2.663	3.073	-2.63	-25.3	.	104.8
Oct. 24	04 23.27	-54 44.4	2.739	3.169	-3.25	-18.9	.	106.5
Nov. 3	03 48.81	-57 18.5	2.848	3.265	-3.62	-11.0	.	106.1
Nov. 13	03 12.42	-58 33.1	2.986	3.361	-3.58	-3.2	.	103.7
Nov. 23	02 38.30	-58 34.7	3.149	3.457	-3.15	+3.3	.	99.8
Dec. 3	02 09.63	-57 39.8	3.331	3.552	-2.50	+7.8	.	94.8
Dec. 13	01 47.61	-56 08.7	3.527	3.648	-1.84	+10.4	.	89.2
Dec. 23	01 31.89	-54 18.5	3.731	3.743	-1.26	+11.6	.	83.1
Jan. 2	01 21.48	-52 21.2	3.937	3.838	-0.79	+11.8	.	77.0
Jan. 12	01 15.27	-50 24.7	4.141	3.933	-0.43	+11.4	.	71.0
Jan. 22	01 12.28	-48 33.9	4.339	4.027	-0.15	+10.7	.	65.2
Feb. 1	01 11.76	-46 51.4	4.526	4.121	+0.06	+9.7	.	59.9
Feb. 11	01 13.09	-45 18.9	4.700	4.214	+0.22	+8.7	.	55.1
Feb. 21	01 15.81	-43 57.4	4.859	4.307	+0.33	+7.5	.	51.1
Mar. 2	01 19.57	-42 47.5	4.999	4.400	+0.42	+6.3	.	48.1
Mar. 12	01 24.07	-41 49.5	5.121	4.492	+0.48	+5.1	.	46.3
Mar. 22	01 29.09	-41 03.7	5.223	4.584	+0.52	+3.9	.	45.8



Comet 78P/Gehrels

Epoch = 2019 July 16.0 TT  
 T = 2019 Apr. 2.68339 TT  
 Peri. = 192.67901 e = 0.4616405  
 Node = 210.54679 2000.0 a = 3.7406298 AU  
 Incl. = 6.24853 n = 0.13623446  
 q = 2.0138036 AU P = 7.23 years

$$m1 = 5.1 + 5 \log(\Delta) + 20.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	23 03.63	-03 51.3	2.456	2.131	+1.84	+8.9	13.6	59.4
Jan. 17	23 22.39	-02 18.5	2.526	2.107	+1.92	+9.8	13.6	54.2
Jan. 27	23 41.93	+00 37.5	2.591	2.084	+1.99	+10.5	13.5	49.1
Feb. 6	00 02.14	+01 10.0	2.652	2.065	+2.06	+11.0	13.5	44.3
Feb. 16	00 22.98	+03 02.2	2.708	2.048	+2.11	+11.4	13.5	39.7
Feb. 26	00 44.36	+04 57.0	2.761	2.035	+2.17	+11.6	13.5	35.3
Mar. 8	01 06.27	+06 52.6	2.810	2.025	+2.22	+11.5	13.5	31.0
Mar. 18	01 28.66	+08 46.9	2.854	2.018	+2.26	+11.3	13.5	26.9
Mar. 28	01 51.50	+10 37.8	2.896	2.014	+2.31	+10.8	13.5	22.9
Apr. 7	02 14.75	+12 23.3	2.934	2.014	+2.35	+10.2	13.5	19.0
Apr. 17	02 38.39	+14 01.5	2.968	2.017	+2.38	+9.3	13.6	15.2
Apr. 27	03 02.33	+15 30.6	3.000	2.024	+2.41	+8.4	13.6	11.5
May 7	03 26.52	+16 49.1	3.028	2.033	+2.43	+7.2	13.7	7.8
May 17	03 50.87	+17 55.7	3.053	2.046	+2.44	+6.0	13.7	4.4
May 27	04 15.28	+18 49.4	3.074	2.062	+2.44	+4.6	13.8	2.4
June 6	04 39.63	+19 29.5	3.091	2.081	+2.43	+3.2	13.9	4.5
June 16	05 03.79	+19 55.6	3.104	2.103	+2.40	+1.8	14.0	8.1
June 26	05 27.63	+20 07.7	3.112	2.128	+2.36	+0.5	14.1	11.9
July 6	05 51.03	+20 06.3	3.115	2.155	+2.31	-0.9	14.2	15.9
July 16	06 13.85	+19 51.8	3.112	2.184	+2.25	-2.1	14.4	20.0
July 26	06 35.98	+19 25.3	3.102	2.216	+2.17	-3.3	14.5	24.3
Aug. 5	06 57.33	+18 47.8	3.085	2.249	+2.09	-4.3	14.6	28.7
Aug. 15	07 17.79	+18 00.7	3.061	2.284	+1.99	-5.2	14.7	33.4
Aug. 25	07 37.28	+17 05.3	3.030	2.321	+1.89	-5.9	14.8	38.2
Sept. 4	07 55.72	+16 03.1	2.990	2.360	+1.78	-6.5	14.9	43.3
Sept. 14	08 13.03	+14 55.8	2.942	2.399	+1.67	-7.0	15.0	48.7
Sept. 24	08 29.14	+13 44.8	2.885	2.440	+1.54	-7.2	15.1	54.3
Oct. 4	08 43.95	+12 32.0	2.820	2.482	+1.41	-7.3	15.2	60.3
Oct. 14	08 57.35	+11 19.0	2.748	2.525	+1.26	-7.2	15.3	66.7
Oct. 24	09 09.24	+10 07.5	2.669	2.569	+1.10	-7.0	15.4	73.4
Nov. 3	09 19.45	+08 59.6	2.584	2.613	+0.92	-6.5	15.5	80.6
Nov. 13	09 27.81	+07 57.1	2.496	2.658	+0.73	-5.9	15.6	88.3
Nov. 23	09 34.15	+07 02.3	2.406	2.703	+0.52	-5.0	15.6	96.5
Dec. 3	09 38.27	+06 17.2	2.318	2.748	+0.28	-3.9	15.7	105.3
Dec. 13	09 40.01	+05 44.1	2.235	2.794	+0.04	-2.6	15.8	114.8
Dec. 23	09 39.29	+05 24.8	2.161	2.840	-0.21	-1.1	15.8	124.9
Jan. 2	09 36.13	+05 20.8	2.101	2.887	-0.44	+0.5	15.9	135.6
Jan. 12	09 30.79	+05 32.4	2.061	2.933	-0.64	+2.0	16.0	146.7
Jan. 22	09 23.75	+05 58.5	2.044	2.979	-0.77	+3.3	16.1	158.0
Feb. 1	09 15.73	+06 36.4	2.055	3.025	-0.82	+4.3	16.3	168.1
Feb. 11	09 07.62	+07 21.9	2.094	3.072	-0.78	+4.8	16.5	170.3
Feb. 21	09 00.25	+08 10.3	2.164	3.118	-0.67	+4.8	16.7	161.6
Mar. 2	08 54.32	+08 57.3	2.261	3.163	-0.49	+4.5	16.9	150.8
Mar. 12	08 50.31	+09 39.2	2.383	3.209	-0.29	+3.8	17.1	140.1
Mar. 22	08 48.41	+10 13.8	2.526	3.254	-0.07	+3.0	17.4	129.8

## Comet 232P/Hill

Epoch = 2019 July 16.0 TT  
 T = 2019 Apr. 6.53223 TT  
 Peri. = 53.53885 e = 0.3346208  
 Node = 56.02843 2000.0 a = 4.4854247 AU  
 Incl. = 14.63034 n = 0.10375254  
 q = 2.9845083 AU P = 9.50 years

$$m_1 = -7.8 + 5 \log(\Delta) + 50.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	05 17.79	+34 44.2	2.121	3.028	-0.67	+1.4	17.9	152.6
Jan. 17	05 12.11	+34 54.5	2.182	3.019	-0.43	+0.6	17.9	142.0
Jan. 27	05 08.98	+34 58.4	2.265	3.011	-0.16	+0.1	17.9	131.7
Feb. 6	05 08.66	+34 58.7	2.365	3.004	+0.13	-0.1	18.0	121.8
Feb. 16	05 11.18	+34 57.3	2.478	2.998	+0.40	-0.2	18.0	112.5
Feb. 26	05 16.36	+34 55.5	2.599	2.993	+0.66	-0.2	18.1	103.7
Mar. 8	05 23.95	+34 53.6	2.727	2.989	+0.88	-0.2	18.2	95.5
Mar. 18	05 33.67	+34 51.0	2.856	2.987	+1.08	-0.3	18.2	87.7
Mar. 28	05 45.21	+34 47.2	2.986	2.985	+1.24	-0.5	18.3	80.3
Apr. 7	05 58.29	+34 41.0	3.113	2.985	+1.38	-0.8	18.4	73.3
Apr. 17	06 12.66	+34 31.5	3.237	2.985	+1.50	-1.2	18.5	66.7
Apr. 27	06 28.06	+34 17.8	3.354	2.987	+1.59	-1.6	18.6	60.3
May 7	06 44.30	+33 59.1	3.466	2.990	+1.66	-2.2	18.7	54.2
May 17	07 01.18	+33 34.8	3.570	2.994	+1.72	-2.8	18.8	48.3
May 27	07 18.51	+33 04.4	3.665	2.999	+1.75	-3.4	18.9	42.6
June 6	07 36.16	+32 27.9	3.751	3.005	+1.78	-4.0	19.0	37.1
June 16	07 53.97	+31 45.0	3.828	3.012	+1.79	-4.6	19.1	31.7
June 26	08 11.83	+30 56.1	3.895	3.020	+1.78	-5.2	19.2	26.6
July 6	08 29.65	+30 01.4	3.951	3.029	+1.78	-5.8	19.3	21.7
July 16	08 47.32	+29 01.4	3.996	3.040	+1.76	-6.3	19.3	17.1
July 26	09 04.79	+27 56.7	4.030	3.051	+1.73	-6.7	19.4	13.4
Aug. 5	09 21.99	+26 48.0	4.052	3.063	+1.70	-7.1	19.5	11.1
Aug. 15	09 38.87	+25 36.1	4.063	3.076	+1.67	-7.3	19.6	11.3
Aug. 25	09 55.39	+24 21.9	4.062	3.090	+1.63	-7.5	19.7	14.0
Sept. 4	10 11.53	+23 06.3	4.048	3.105	+1.59	-7.6	19.8	18.1
Sept. 14	10 27.22	+21 50.2	4.022	3.121	+1.54	-7.6	19.9	23.0
Sept. 24	10 42.46	+20 34.8	3.985	3.138	+1.50	-7.5	20.0	28.3
Oct. 4	10 57.19	+19 21.1	3.935	3.155	+1.44	-7.2	20.1	34.0
Oct. 14	11 11.36	+18 10.2	3.873	3.174	+1.38	-6.9	20.2	39.9
Oct. 24	11 24.93	+17 03.2	3.801	3.193	+1.32	-6.4	20.3	46.1
Nov. 3	11 37.82	+16 01.4	3.717	3.212	+1.25	-5.8	20.4	52.6
Nov. 13	11 49.94	+15 06.0	3.624	3.233	+1.17	-5.1	20.5	59.3
Nov. 23	12 01.19	+14 18.2	3.522	3.254	+1.07	-4.3	20.6	66.3
Dec. 3	12 11.45	+13 39.1	3.414	3.276	+0.96	-3.4	20.6	73.6
Dec. 13	12 20.55	+13 09.8	3.300	3.298	+0.84	-2.3	20.7	81.3
Dec. 23	12 28.35	+12 51.4	3.184	3.321	+0.70	-1.2	20.8	89.3
Jan. 2	12 34.64	+12 44.5	3.068	3.344	+0.54	0.0	20.8	97.7
Jan. 12	12 39.25	+12 49.5	2.955	3.368	+0.36	+1.1	20.9	106.5
Jan. 22	12 42.00	+13 06.0	2.849	3.393	+0.17	+2.2	21.0	115.7
Feb. 1	12 42.74	+13 32.9	2.754	3.418	-0.04	+3.2	21.1	125.2
Feb. 11	12 41.44	+14 07.9	2.674	3.443	-0.24	+3.8	21.2	135.0
Feb. 21	12 38.19	+14 47.7	2.614	3.469	-0.43	+4.1	21.3	144.7
Mar. 2	12 33.21	+15 28.0	2.577	3.495	-0.58	+3.9	21.4	153.9
Mar. 12	12 26.95	+16 03.8	2.567	3.521	-0.67	+3.2	21.6	160.9
Mar. 22	12 20.01	+16 30.6	2.585	3.548	-0.71	+2.0	21.8	162.5

Comet 373P/Rinner

Epoch = 2019 July 16.0 TT  
 T = 2019 Apr. 9.15675 TT  
 Peri. = 221.21615 e = 0.3924479  
 Node = 231.95748 2000.0 a = 3.8078596 AU  
 Incl. = 13.75771 n = 0.13264249  
 q = 2.3134731 AU P = 7.43 years

$$m1 = 1.3 + 5 \log(\Delta) + 40.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	02 40.46	+11 49.2	1.812	2.402	+0.52	-2.1	17.8	115.2
Jan. 17	02 46.79	+11 35.7	1.911	2.385	+0.77	-0.5	17.8	106.5
Jan. 27	02 55.47	+11 37.5	2.016	2.369	+0.99	+0.9	17.8	98.4
Feb. 6	03 06.22	+11 51.6	2.124	2.355	+1.18	+1.9	17.8	90.8
Feb. 16	03 18.80	+12 14.5	2.233	2.343	+1.35	+2.7	17.8	83.8
Feb. 26	03 32.95	+12 43.1	2.341	2.333	+1.49	+3.1	17.9	77.3
Mar. 8	03 48.46	+13 14.4	2.448	2.325	+1.62	+3.2	17.9	71.1
Mar. 18	04 05.15	+13 45.8	2.551	2.319	+1.73	+3.1	17.9	65.3
Mar. 28	04 22.83	+14 14.9	2.650	2.315	+1.82	+2.7	18.0	59.8
Apr. 7	04 41.35	+14 39.7	2.746	2.314	+1.89	+2.2	18.1	54.5
Apr. 17	05 00.57	+14 58.6	2.836	2.314	+1.95	+1.5	18.1	49.5
Apr. 27	05 20.33	+15 09.9	2.921	2.317	+2.00	+0.7	18.2	44.7
May 7	05 40.52	+15 12.6	3.002	2.322	+2.04	-0.2	18.3	40.0
May 17	06 01.00	+15 06.0	3.076	2.329	+2.06	-1.2	18.4	35.5
May 27	06 21.64	+14 49.3	3.145	2.338	+2.07	-2.2	18.5	31.2
June 6	06 42.34	+14 22.4	3.208	2.349	+2.07	-3.3	18.7	26.9
June 16	07 02.99	+13 45.2	3.265	2.362	+2.06	-4.3	18.8	22.8
June 26	07 23.48	+12 58.0	3.316	2.378	+2.04	-5.3	18.9	18.9
July 6	07 43.74	+12 01.1	3.360	2.394	+2.01	-6.2	19.1	15.3
July 16	08 03.70	+10 55.3	3.398	2.413	+1.98	-7.1	19.3	12.1
July 26	08 23.29	+09 41.1	3.428	2.434	+1.94	-7.8	19.4	10.0
Aug. 5	08 42.46	+08 19.4	3.450	2.456	+1.89	-8.5	19.6	9.6
Aug. 15	09 01.18	+06 51.2	3.464	2.479	+1.85	-9.1	19.8	11.3
Aug. 25	09 19.41	+05 17.4	3.470	2.504	+1.80	-9.7	19.9	14.5
Sept. 4	09 37.12	+03 39.0	3.468	2.531	+1.74	-10.1	20.1	18.4
Sept. 14	09 54.28	+01 57.0	3.455	2.558	+1.68	-10.4	20.3	22.9
Sept. 24	10 10.87	+00 12.5	3.434	2.587	+1.63	-10.6	20.5	27.6
Oct. 4	10 26.85	-01 33.6	3.402	2.617	+1.56	-10.7	20.7	32.7
Oct. 14	10 42.18	-03 20.2	3.361	2.648	+1.49	-10.6	20.8	38.1
Oct. 24	10 56.80	-05 06.2	3.310	2.680	+1.42	-10.5	21.0	43.7
Nov. 3	11 10.65	-06 50.7	3.249	2.712	+1.34	-10.3	21.2	49.6
Nov. 13	11 23.62	-08 32.5	3.178	2.746	+1.25	-10.0	21.4	55.8
Nov. 23	11 35.64	-10 10.5	3.099	2.780	+1.14	-9.6	21.5	62.3
Dec. 3	11 46.54	-11 43.7	3.012	2.815	+1.02	-9.0	21.7	69.1
Dec. 13	11 56.17	-13 10.6	2.918	2.850	+0.89	-8.3	21.8	76.3
Dec. 23	12 04.36	-14 29.8	2.820	2.886	+0.73	-7.4	22.0	83.9
Jan. 2	12 10.89	-15 39.8	2.719	2.922	+0.55	-6.4	.	91.9
Jan. 12	12 15.55	-16 38.5	2.619	2.958	+0.36	-5.2	.	100.4
Jan. 22	12 18.16	-17 24.0	2.522	2.995	+0.14	-3.7	.	109.3
Feb. 1	12 18.60	-17 53.6	2.432	3.032	-0.08	-2.0	.	118.8
Feb. 11	12 16.84	-18 05.2	2.355	3.069	-0.29	-0.1	.	128.6
Feb. 21	12 13.04	-17 57.0	2.293	3.107	-0.48	+2.0	.	138.8
Mar. 2	12 07.56	-17 28.2	2.252	3.144	-0.62	+4.0	.	149.1
Mar. 12	12 00.99	-16 40.0	2.236	3.182	-0.69	+5.8	.	158.5
Mar. 22	11 54.04	-15 35.8	2.247	3.219	-0.69	+7.1	.	164.7

## Comet P/2014 C1 (TOTAS)

Epoch = 2019 July 16.0 TT  
 T = 2019 Apr. 13.75695 TT  
 Peri. = 24.15868 e = 0.4466087  
 Node = 167.84820 2000.0 a = 3.0440408 AU  
 Incl. = 2.68081 n = 0.18557880  
 q = 1.6845457 AU P = 5.31 years

$$m_1 = 15.5 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation		m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day				°
Jan. 7	11 27.52	+01 41.4	1.250	1.881	-2.47	+13.5	18.7	19.5/111	114.2
Jan. 17	11 38.88	+00 39.3	1.131	1.846	-2.77	+15.3	18.4	16.4/109	121.4
Jan. 27	11 48.27	+00 06.3	1.023	1.813	-3.11	+17.3	18.1	12.7/106	129.1
Feb. 6	11 55.26	+00 31.5	0.927	1.783	-3.49	+19.6	17.8	8.3/99	137.5
Feb. 16	11 59.48	+00 33.1	0.846	1.757	-3.89	+22.0	17.6	4.2/73	146.6
Feb. 26	12 00.87	+00 10.4	0.781	1.734	-4.27	+24.3	17.4	3.6/357	156.6
Mar. 8	11 59.65	+00 34.2	0.734	1.716	-4.60	+26.2	17.2	6.5/327	167.2
Mar. 18	11 56.68	+01 33.0	0.706	1.701	-4.79	+27.2	17.1	8.1/320	177.9
Mar. 28	11 53.29	+02 34.0	0.699	1.691	-4.82	+27.1	17.0	7.3/321	170.5
Apr. 7	11 50.93	+03 24.5	0.711	1.686	-4.69	+26.0	17.0	4.4/335	159.8
Apr. 17	11 50.88	+03 53.6	0.740	1.685	-4.43	+24.2	17.1	2.8/58	149.8
Apr. 27	11 53.84	+03 56.0	0.785	1.689	-4.10	+22.2	17.2	7.1/100	140.7
May 7	11 59.95	+03 31.1	0.843	1.697	-3.75	+20.1	17.4	12.3/109	132.6
May 17	12 09.00	+02 41.1	0.913	1.710	-3.42	+18.3	17.6	16.9/112	125.4
May 27	12 20.56	+01 30.1	0.993	1.727	-3.11	+16.6	17.9	20.7/113	118.9
June 6	12 34.15	+00 02.8	1.081	1.748	-2.83	+15.1	18.1	23.8/113	113.0
June 16	12 49.38	-01 36.8	1.178	1.773	-2.59	+13.8	18.3	26.1/114	107.6
June 26	13 05.84	-03 24.3	1.283	1.802	-2.38	+12.5	18.6	27.8/113	102.6
July 6	13 23.29	-05 16.4	1.395	1.834	-2.19	+11.3	18.9	29.0/113	97.8
July 16	13 41.51	-07 10.0	1.513	1.869	-2.03	+10.1	19.1	29.9/112	93.2
July 26	14 00.32	-09 02.4	1.636	1.906	-1.88	+9.0	19.4	30.4/111	88.7
Aug. 5	14 19.63	-10 51.6	1.765	1.945	-1.76	+8.0	19.6	30.7/110	84.2
Aug. 15	14 39.34	-12 35.6	1.899	1.987	-1.64	+6.9	19.9	30.8/109	79.8
Aug. 25	14 59.37	-14 13.0	2.036	2.030	-1.54	+6.0	20.1	30.8/108	75.3
Sept. 4	15 19.68	-15 42.5	2.176	2.075	-1.44	+5.1	20.4	30.7/106	70.7
Sept. 14	15 40.22	-17 03.2	2.317	2.121	-1.36	+4.2	20.6	30.5/104	66.2
Sept. 24	16 00.91	-18 14.2	2.459	2.167	-1.28	+3.4	20.8	30.3/103	61.5
Oct. 4	16 21.73	-19 14.9	2.601	2.215	-1.20	+2.7	21.0	30.0/101	56.7
Oct. 14	16 42.60	-20 05.0	2.740	2.263	-1.13	+2.1	21.2	29.7/99	51.8
Oct. 24	17 03.45	-20 44.1	2.876	2.312	-1.07	+1.4	21.4	29.4/97	46.8
Nov. 3	17 24.22	-21 12.2	3.008	2.361	-1.00	+0.9	21.6	29.0/94	41.7
Nov. 13	17 44.85	-21 29.4	3.133	2.410	-0.94	+0.4	21.8	28.6/92	36.5
Nov. 23	18 05.24	-21 36.0	3.251	2.459	-0.89	0.0	22.0	28.2/90	31.2
Dec. 3	18 25.34	-21 32.4	3.360	2.509	-0.84	-0.4	.	27.8/88	25.7
Dec. 13	18 45.06	-21 19.0	3.459	2.558	-0.79	-0.7	.	27.3/86	20.2
Dec. 23	19 04.34	-20 56.6	3.547	2.606	-0.74	-1.0	.	26.8/84	14.5
Jan. 2	19 23.13	-20 26.0	3.622	2.655	-0.70	-1.2	.	26.2/82	8.8
Jan. 12	19 41.36	-19 48.0	3.684	2.703	-0.66	-1.4	.	25.6/81	3.2
Jan. 22	19 58.98	-19 03.6	3.732	2.751	-0.62	-1.5	.	24.9/79	3.5
Feb. 1	20 15.94	-18 13.8	3.766	2.798	-0.59	-1.7	.	24.2/78	9.3
Feb. 11	20 32.21	-17 19.6	3.784	2.845	-0.56	-1.7	.	23.4/76	15.4
Feb. 21	20 47.74	-16 22.1	3.787	2.891	-0.53	-1.8	.	22.5/75	21.7
Mar. 2	21 02.49	-15 22.4	3.775	2.937	-0.51	-1.9	.	21.6/74	28.0
Mar. 12	21 16.42	-14 21.5	3.747	2.982	-0.49	-1.9	.	20.5/73	34.5
Mar. 22	21 29.49	-13 20.7	3.705	3.027	-0.47	-2.0	.	19.3/72	41.1

## Comet P/2017 U3 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2019 Apr. 20.60706 TT  
 Peri. = 297.32374 e = 0.0991102  
 Node = 165.11986 2000.0 a = 4.9337038 AU  
 Incl. = 15.90926 n = 0.08993826  
 q = 4.4447234 AU P = 10.96 years

$$m_1 = 10.3 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	05 50.24	+04 07.2	3.552	4.453	-0.52	+2.1	19.5	153.4
Jan. 17	05 45.42	+04 32.1	3.610	4.451	-0.43	+2.9	19.6	144.9
Jan. 27	05 41.72	+05 04.2	3.694	4.450	-0.30	+3.5	19.6	135.5
Feb. 6	05 39.38	+05 41.7	3.798	4.449	-0.15	+4.0	19.7	125.9
Feb. 16	05 38.55	+06 22.6	3.920	4.448	0.00	+4.2	19.7	116.4
Feb. 26	05 39.26	+07 05.3	4.054	4.447	+0.16	+4.3	19.8	107.1
Mar. 8	05 41.49	+07 48.1	4.197	4.446	+0.30	+4.2	19.9	98.1
Mar. 18	05 45.14	+08 29.7	4.344	4.446	+0.44	+4.0	20.0	89.4
Mar. 28	05 50.08	+09 08.9	4.491	4.445	+0.56	+3.8	20.0	81.0
Apr. 7	05 56.19	+09 44.9	4.635	4.445	+0.67	+3.4	20.1	72.9
Apr. 17	06 03.31	+10 16.9	4.773	4.445	+0.76	+3.0	20.2	65.1
Apr. 27	06 11.30	+10 44.3	4.903	4.445	+0.84	+2.5	20.2	57.6
May 7	06 20.03	+11 07.0	5.022	4.445	+0.91	+2.0	20.3	50.2
May 17	06 29.38	+11 24.4	5.129	4.445	+0.96	+1.5	20.3	43.1
May 27	06 39.23	+11 36.5	5.222	4.446	+1.01	+0.9	20.4	36.2
June 6	06 49.47	+11 43.2	5.300	4.446	+1.04	+0.4	20.4	29.6
June 16	06 59.99	+11 44.5	5.362	4.447	+1.06	-0.2	20.4	23.2
June 26	07 10.71	+11 40.4	5.408	4.448	+1.08	-0.7	20.4	17.3
July 6	07 21.54	+11 31.3	5.436	4.449	+1.09	-1.2	20.5	12.5
July 16	07 32.39	+11 17.1	5.446	4.450	+1.08	-1.7	20.5	10.3
July 26	07 43.18	+10 58.4	5.439	4.452	+1.07	-2.1	20.5	12.2
Aug. 5	07 53.84	+10 35.4	5.414	4.453	+1.05	-2.5	20.5	16.9
Aug. 15	08 04.27	+10 08.6	5.371	4.455	+1.03	-2.9	20.4	22.8
Aug. 25	08 14.40	+09 38.5	5.311	4.457	+0.99	-3.2	20.4	29.2
Sept. 4	08 24.15	+09 05.7	5.235	4.458	+0.95	-3.4	20.4	36.0
Sept. 14	08 33.42	+08 30.8	5.143	4.461	+0.90	-3.6	20.3	43.0
Sept. 24	08 42.13	+07 54.6	5.036	4.463	+0.84	-3.7	20.3	50.3
Oct. 4	08 50.17	+07 17.9	4.916	4.465	+0.76	-3.7	20.3	57.8
Oct. 14	08 57.43	+06 41.8	4.786	4.468	+0.68	-3.5	20.2	65.6
Oct. 24	09 03.80	+06 07.2	4.646	4.470	+0.58	-3.3	20.1	73.7
Nov. 3	09 09.15	+05 35.4	4.500	4.473	+0.47	-3.0	20.1	82.1
Nov. 13	09 13.36	+05 07.6	4.350	4.476	+0.35	-2.5	20.0	90.8
Nov. 23	09 16.32	+04 45.1	4.202	4.479	+0.22	-1.9	19.9	99.9
Dec. 3	09 17.91	+04 29.4	4.057	4.482	+0.08	-1.1	19.9	109.4
Dec. 13	09 18.07	+04 21.8	3.921	4.485	-0.06	-0.3	19.8	119.3
Dec. 23	09 16.79	+04 23.4	3.799	4.489	-0.21	+0.7	19.7	129.5
Jan. 2	09 14.13	+04 34.9	3.695	4.492	-0.34	+1.7	19.7	140.0
Jan. 12	09 10.28	+04 56.4	3.614	4.496	-0.44	+2.7	19.6	150.6
Jan. 22	09 05.51	+05 27.3	3.559	4.500	-0.51	+3.6	19.6	160.8
Feb. 1	09 00.21	+06 06.1	3.534	4.504	-0.54	+4.2	19.6	168.6
Feb. 11	08 54.82	+06 50.7	3.539	4.508	-0.53	+4.7	19.6	167.5
Feb. 21	08 49.81	+07 38.3	3.575	4.512	-0.46	+4.8	19.6	158.9
Mar. 2	08 45.58	+08 26.4	3.640	4.516	-0.36	+4.7	19.7	148.7
Mar. 12	08 42.49	+09 12.2	3.731	4.521	-0.24	+4.4	19.7	138.2
Mar. 22	08 40.73	+09 54.0	3.844	4.525	-0.10	+3.9	19.8	127.9

Comet C/2016 X1 (Lemmon)

Epoch = 2019 July 16.0 TT  
 T = 2019 Apr. 29.63270 TT  
 Peri. = 224.55096  
 Node = 256.42617 2000.0  
 Incl. = 26.45567  
 q = 7.5642527 AU  
 e = 0.9953832

$$m1 = 0.5 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	07 20.52	+04 08.8	6.658	7.597	-0.33	-1.2	17.8	161.5
Jan. 17	07 17.19	+03 59.1	6.655	7.591	-0.33	-0.7	17.8	161.0
Jan. 27	07 14.03	+03 53.9	6.681	7.586	-0.30	-0.3	17.8	155.2
Feb. 6	07 11.25	+03 52.8	6.736	7.582	-0.25	+0.1	17.8	147.0
Feb. 16	07 09.03	+03 55.0	6.816	7.578	-0.18	+0.4	17.9	137.9
Feb. 26	07 07.52	+03 59.6	6.919	7.574	-0.11	+0.6	17.9	128.4
Mar. 8	07 06.81	+04 05.7	7.040	7.571	-0.02	+0.7	17.9	119.0
Mar. 18	07 06.97	+04 12.4	7.176	7.569	+0.06	+0.7	18.0	109.7
Mar. 28	07 08.00	+04 18.8	7.321	7.567	+0.15	+0.6	18.0	100.5
Apr. 7	07 09.89	+04 24.1	7.471	7.566	+0.23	+0.4	18.0	91.6
Apr. 17	07 12.58	+04 27.7	7.622	7.565	+0.31	+0.2	18.1	82.9
Apr. 27	07 16.01	+04 28.8	7.771	7.564	+0.38	0.0	18.1	74.5
May 7	07 20.11	+04 27.2	7.913	7.564	+0.44	-0.3	18.2	66.3
May 17	07 24.80	+04 22.4	8.046	7.565	+0.50	-0.7	18.2	58.4
May 27	07 29.98	+04 14.1	8.168	7.566	+0.54	-1.0	18.2	50.7
June 6	07 35.59	+04 02.1	8.275	7.568	+0.58	-1.4	18.3	43.3
June 16	07 41.53	+03 46.3	8.366	7.570	+0.61	-1.8	18.3	36.2
June 26	07 47.72	+03 26.7	8.439	7.573	+0.63	-2.2	18.3	29.7
July 6	07 54.09	+03 03.3	8.494	7.576	+0.64	-2.6	18.3	23.9
July 16	08 00.56	+02 36.0	8.530	7.580	+0.65	-2.9	18.3	19.6
July 26	08 07.05	+02 05.1	8.545	7.584	+0.65	-3.3	18.4	17.8
Aug. 5	08 13.49	+01 30.7	8.540	7.589	+0.64	-3.6	18.4	19.1
Aug. 15	08 19.80	+00 52.9	8.515	7.594	+0.62	-3.9	18.4	23.1
Aug. 25	08 25.92	+00 12.1	8.470	7.600	+0.60	-4.2	18.4	28.8
Sept. 4	08 31.78	+00 31.4	8.407	7.606	+0.57	-4.5	18.3	35.3
Sept. 14	08 37.28	-01 17.3	8.326	7.613	+0.53	-4.7	18.3	42.3
Sept. 24	08 42.37	-02 05.2	8.229	7.620	+0.48	-4.9	18.3	49.8
Oct. 4	08 46.96	-02 54.5	8.118	7.628	+0.43	-5.0	18.3	57.5
Oct. 14	08 50.98	-03 44.6	7.995	7.636	+0.37	-5.0	18.3	65.5
Oct. 24	08 54.35	-04 34.9	7.863	7.645	+0.30	-5.0	18.2	73.8
Nov. 3	08 57.02	-05 24.6	7.725	7.654	+0.22	-4.9	18.2	82.2
Nov. 13	08 58.92	-06 12.7	7.585	7.664	+0.15	-4.7	18.2	90.8
Nov. 23	09 00.00	-06 58.3	7.447	7.674	+0.06	-4.4	18.1	99.6
Dec. 3	09 00.26	-07 40.4	7.315	7.685	-0.02	-4.0	18.1	108.5
Dec. 13	08 59.70	-08 17.8	7.193	7.696	-0.10	-3.5	18.1	117.4
Dec. 23	08 58.37	-08 49.7	7.085	7.707	-0.17	-2.8	18.1	126.3
Jan. 2	08 56.34	-09 15.0	6.995	7.720	-0.24	-2.1	18.0	134.8
Jan. 12	08 53.77	-09 33.1	6.928	7.732	-0.28	-1.4	18.0	142.6
Jan. 22	08 50.82	-09 43.7	6.885	7.745	-0.31	-0.6	18.0	149.0
Feb. 1	08 47.67	-09 46.7	6.870	7.759	-0.32	+0.1	18.0	152.8
Feb. 11	08 44.56	-09 42.7	6.882	7.773	-0.30	+0.8	18.0	152.8
Feb. 21	08 41.69	-09 32.6	6.922	7.787	-0.27	+1.3	18.1	149.2
Mar. 2	08 39.25	-09 17.6	6.988	7.802	-0.21	+1.7	18.1	143.0
Mar. 12	08 37.41	-08 59.1	7.078	7.818	-0.15	+2.0	18.1	135.5
Mar. 22	08 36.27	-08 38.7	7.190	7.834	-0.07	+2.1	18.2	127.3

Comet 186P/Garradd

Epoch = 2019 July 16.0 TT  
 T = 2019 May 5.14327 TT  
 Peri. = 283.85753 e = 0.1239714  
 Node = 327.02594 2000.0 a = 5.0106493 AU  
 Incl. = 28.41610 n = 0.08787454  
 q = 4.3894721 AU P = 11.22 years

$$m_1 = 8.4 + 5 \log(\Delta) + 10.0 \log(r(t-360))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	15 56.91	-45 33.6	5.039	4.403	+1.34	-6.0	18.5	45.3
Jan. 17	16 10.13	-46 33.7	4.942	4.401	+1.29	-6.0	18.5	51.7
Jan. 27	16 22.78	-47 33.7	4.835	4.399	+1.23	-6.0	18.4	58.4
Feb. 6	16 34.69	-48 33.7	4.717	4.397	+1.14	-6.0	18.4	65.3
Feb. 16	16 45.63	-49 33.8	4.592	4.395	+1.03	-6.0	18.3	72.4
Feb. 26	16 55.38	-50 34.2	4.461	4.394	+0.90	-6.1	18.2	79.7
Mar. 8	17 03.69	-51 34.9	4.328	4.393	+0.74	-6.1	18.2	87.2
Mar. 18	17 10.26	-52 35.5	4.195	4.392	+0.55	-6.0	18.1	94.8
Mar. 28	17 14.83	-53 35.4	4.066	4.391	+0.34	-5.9	18.0	102.5
Apr. 7	17 17.13	-54 33.2	3.943	4.390	+0.10	-5.6	17.9	110.2
Apr. 17	17 16.93	-55 26.9	3.829	4.390	-0.16	-5.0	17.9	117.9
Apr. 27	17 14.16	-56 13.8	3.729	4.390	-0.42	-4.2	17.8	125.4
May 7	17 08.86	-56 50.4	3.645	4.389	-0.66	-3.0	17.7	132.4
May 17	17 01.39	-57 13.2	3.580	4.390	-0.84	-1.4	17.7	138.6
May 27	16 52.38	-57 19.3	3.537	4.390	-0.95	+0.4	17.7	143.1
June 6	16 42.68	-57 06.7	3.517	4.390	-0.97	+2.3	17.7	145.4
June 16	16 33.29	-56 35.6	3.521	4.391	-0.89	+4.1	17.6	144.8
June 26	16 25.09	-55 48.3	3.550	4.392	-0.73	+5.5	17.7	141.6
July 6	16 18.77	-54 48.3	3.601	4.393	-0.51	+6.5	17.7	136.4
July 16	16 14.74	-53 40.1	3.673	4.394	-0.27	+7.1	17.7	129.9
July 26	16 13.13	-52 28.1	3.763	4.396	-0.03	+7.3	17.8	122.7
Aug. 5	16 13.89	-51 15.8	3.870	4.397	+0.20	+7.1	17.8	115.1
Aug. 15	16 16.87	-50 06.0	3.988	4.399	+0.41	+6.8	17.9	107.4
Aug. 25	16 21.85	-49 00.6	4.116	4.401	+0.60	+6.3	18.0	99.7
Sept. 4	16 28.58	-48 00.3	4.250	4.404	+0.76	+5.7	18.0	92.1
Sept. 14	16 36.84	-47 05.4	4.387	4.406	+0.90	+5.2	18.1	84.5
Sept. 24	16 46.40	-46 15.6	4.524	4.408	+1.02	+4.7	18.1	77.0
Oct. 4	16 57.08	-45 30.4	4.657	4.411	+1.12	+4.3	18.2	69.7
Oct. 14	17 08.71	-44 48.9	4.786	4.414	+1.21	+4.0	18.3	62.5
Oct. 24	17 21.10	-44 10.4	4.906	4.417	+1.28	+3.7	18.3	55.4
Nov. 3	17 34.13	-43 34.1	5.016	4.421	+1.33	+3.5	18.4	48.4
Nov. 13	17 47.64	-42 59.1	5.114	4.424	+1.37	+3.4	18.4	41.7
Nov. 23	18 01.50	-42 24.8	5.198	4.428	+1.40	+3.4	18.4	35.2
Dec. 3	18 15.61	-41 50.7	5.267	4.431	+1.42	+3.4	18.5	29.0
Dec. 13	18 29.83	-41 16.5	5.320	4.435	+1.42	+3.5	18.5	23.6
Dec. 23	18 44.05	-40 41.7	5.356	4.440	+1.42	+3.5	18.5	19.3
Jan. 2	18 58.16	-40 06.3	5.373	4.444	+1.40	+3.6	18.5	17.3
Jan. 12	19 12.07	-39 30.4	5.372	4.448	+1.37	+3.6	18.5	18.1
Jan. 22	19 25.66	-38 54.1	5.353	4.453	+1.34	+3.6	18.5	21.6
Feb. 1	19 38.84	-38 17.8	5.316	4.458	+1.29	+3.6	18.5	26.7
Feb. 11	19 51.51	-37 41.9	5.260	4.463	+1.24	+3.6	18.4	32.8
Feb. 21	20 03.59	-37 06.9	5.189	4.468	+1.17	+3.4	18.4	39.3
Mar. 2	20 14.98	-36 33.3	5.101	4.473	+1.10	+3.2	18.4	46.2
Mar. 12	20 25.56	-36 01.9	4.999	4.479	+1.01	+3.0	18.3	53.4
Mar. 22	20 35.26	-35 33.4	4.885	4.484	+0.92	+2.7	18.3	60.8

Comet P/2012 O2 (McNaught)

Epoch = 2019 July 16.0 TT  
 T = 2019 May 6.03298 TT  
 Peri. = 183.34672 e = 0.5327919  
 Node = 120.68289 2000.0 a = 3.6209002 AU  
 Incl. = 24.48596 n = 0.14304716  
 q = 1.6917139 AU P = 6.89 years

$$m1 = 10.0 + 5 \log(\Delta) + 40.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	17 24.74	-09 08.7	2.834	2.025	-1.09 +6.7	.	36.0/99	28.5
Jan. 17	17 49.05	-10 00.6	2.745	1.978	-1.16 +6.7	.	36.7/97	31.8
Jan. 27	18 13.99	-10 41.7	2.654	1.933	-1.23 +6.7	.	37.4/95	35.1
Feb. 6	18 39.51	-11 11.7	2.562	1.890	-1.31 +6.6	.	38.0/94	38.4
Feb. 16	19 05.51	-11 31.0	2.469	1.851	-1.38 +6.5	.	38.6/92	41.6
Feb. 26	19 31.90	-11 40.1	2.377	1.815	-1.46 +6.3	.	39.1/91	44.9
Mar. 8	19 58.61	-11 39.8	2.286	1.784	-1.53 +6.0	21.8	39.4/89	48.1
Mar. 18	20 25.52	-11 31.6	2.196	1.756	-1.60 +5.6	21.5	39.7/88	51.4
Mar. 28	20 52.58	-11 17.2	2.108	1.733	-1.66 +5.2	21.2	39.9/88	54.6
Apr. 7	21 19.68	-10 58.6	2.023	1.715	-1.72 +4.7	20.9	39.9/87	57.9
Apr. 17	21 46.73	-10 38.3	1.941	1.702	-1.76 +4.2	20.7	39.8/87	61.2
Apr. 27	22 13.63	-10 18.8	1.861	1.694	-1.80 +3.5	20.5	39.6/87	64.6
May 7	22 40.27	-10 03.0	1.786	1.692	-1.83 +2.8	20.4	39.1/88	68.1
May 17	23 06.51	-09 54.0	1.713	1.695	-1.85 +1.9	20.3	38.4/89	71.8
May 27	23 32.18	-09 54.8	1.645	1.704	-1.86 +0.9	20.3	37.4/91	75.6
June 6	23 57.09	-10 08.6	1.581	1.718	-1.86 -0.2	20.4	36.1/94	79.6
June 16	00 20.98	-10 38.2	1.520	1.737	-1.86 -1.5	20.5	34.5/97	83.9
June 26	00 43.59	-11 26.1	1.464	1.761	-1.84 -3.0	20.7	32.6/100	88.5
July 6	01 04.58	-12 34.4	1.413	1.789	-1.83 -4.7	20.9	30.3/105	93.4
July 16	01 23.56	-14 04.3	1.367	1.822	-1.82 -6.6	21.1	27.7/112	98.6
July 26	01 40.15	-15 55.7	1.327	1.858	-1.82 -8.6	21.4	25.0/119	104.2
Aug. 5	01 53.88	-18 07.0	1.294	1.898	-1.84 -10.7	21.7	22.2/130	110.0
Aug. 15	02 04.32	-20 34.5	1.269	1.941	-1.88 -12.8	22.0	19.5/142	116.1
Aug. 25	02 11.10	-23 11.5	1.254	1.986	-1.94 -14.5	.	17.1/158	122.2
Sept. 4	02 13.92	-25 49.0	1.250	2.034	-2.02 -15.8	.	15.3/177	128.1
Sept. 14	02 12.79	-28 14.5	1.261	2.084	-2.11 -16.4	.	14.0/197	133.3
Sept. 24	02 08.12	-30 15.2	1.287	2.135	-2.19 -16.1	.	13.1/219	137.2
Oct. 4	02 00.73	-31 39.3	1.331	2.188	-2.23 -15.1	.	12.3/241	139.2
Oct. 14	01 51.92	-32 18.8	1.392	2.242	-2.21 -13.7	.	11.5/263	138.8
Oct. 24	01 43.11	-32 12.2	1.472	2.297	-2.14 -11.9	.	11.0/286	136.3
Nov. 3	01 35.53	-31 23.0	1.570	2.352	-2.01 -10.3	.	10.9/310	132.0
Nov. 13	01 30.08	-29 58.8	1.684	2.408	-1.85 -8.8	.	11.3/332	126.5
Nov. 23	01 27.12	-28 08.5	1.814	2.465	-1.69 -7.7	.	12.3/350	120.4
Dec. 3	01 26.70	-26 00.4	1.956	2.522	-1.52 -6.7	.	13.6/5	113.9
Dec. 13	01 28.67	-23 41.7	2.109	2.578	-1.36 -6.0	.	14.9/17	107.2
Dec. 23	01 32.70	-21 17.7	2.271	2.635	-1.22 -5.5	.	16.2/26	100.6
Jan. 2	01 38.51	-18 52.3	2.440	2.692	-1.10 -5.1	.	17.3/33	93.9
Jan. 12	01 45.81	-16 28.5	2.613	2.749	-0.99 -4.7	.	18.3/39	87.3
Jan. 22	01 54.31	-14 08.2	2.788	2.805	-0.90 -4.4	.	19.1/44	80.8
Feb. 1	02 03.83	-11 52.7	2.964	2.862	-0.82 -4.1	.	19.8/48	74.4
Feb. 11	02 14.16	-09 43.2	3.138	2.917	-0.75 -3.9	.	20.2/52	68.1
Feb. 21	02 25.14	-07 40.3	3.308	2.973	-0.69 -3.6	.	20.6/55	61.9
Mar. 2	02 36.67	-05 44.5	3.472	3.028	-0.64 -3.4	.	20.8/58	55.8
Mar. 12	02 48.61	-03 56.2	3.630	3.082	-0.60 -3.2	.	20.9/60	49.8
Mar. 22	03 00.89	-02 15.6	3.778	3.137	-0.56 -3.0	.	21.0/63	43.9



## Comet C/2018 W1 (Catalina)

Epoch = 2019 July 16.0 TT  
 T = 2019 May 11.85656 TT  
 Peri. = 251.25125 e = 0.9375637  
 Node = 233.58954 2000.0 a = 21.7847630 AU  
 Incl. = 83.27731 n = 0.00969337  
 q = 1.3601600 AU P = 101.68 years

$$m1 = 13.8 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	01 27.55	+16 21.9	1.768	2.168	+0.06	-30.1	18.4	100.1
Jan. 17	01 29.55	+11 40.2	1.846	2.073	+0.36	-25.8	18.3	88.7
Jan. 27	01 34.34	+07 40.0	1.930	1.979	+0.61	-22.0	18.2	78.2
Feb. 6	01 41.46	+04 14.9	2.009	1.887	+0.82	-18.9	18.1	68.5
Feb. 16	01 50.54	+01 17.4	2.080	1.799	+1.00	-16.5	17.9	59.8
Feb. 26	02 01.31	-01 20.4	2.135	1.715	+1.16	-15.0	17.8	52.1
Mar. 8	02 13.63	-03 45.7	2.173	1.636	+1.32	-14.1	17.6	45.4
Mar. 18	02 27.46	-06 05.0	2.191	1.565	+1.46	-13.8	17.4	40.0
Mar. 28	02 42.81	-08 23.9	2.187	1.501	+1.62	-14.1	17.3	36.1
Apr. 7	02 59.84	-10 47.7	2.161	1.447	+1.81	-14.8	17.1	34.2
Apr. 17	03 18.84	-13 21.2	2.115	1.406	+2.02	-16.1	16.9	34.3
Apr. 27	03 40.22	-16 08.6	2.051	1.377	+2.29	-17.6	16.7	36.4
May 7	04 04.62	-19 13.3	1.974	1.362	+2.64	-19.5	16.6	39.8
May 17	04 32.85	-22 37.1	1.889	1.362	+3.07	-21.4	16.5	44.3
May 27	05 05.97	-26 18.4	1.806	1.377	+3.62	-22.8	16.5	49.2
June 6	05 45.08	-30 09.1	1.736	1.406	+4.28	-23.0	16.5	54.1
June 16	06 30.96	-33 52.0	1.688	1.449	+4.96	-20.9	16.5	58.7
June 26	07 23.29	-37 00.7	1.674	1.503	+5.52	-15.9	16.7	62.4
July 6	08 19.89	-39 08.7	1.701	1.566	+5.75	-8.8	16.9	64.8
July 16	09 16.84	-40 03.2	1.771	1.638	+5.55	-1.5	17.2	65.6
July 26	10 10.12	-39 51.7	1.881	1.717	+5.02	+4.0	17.5	64.9
Aug. 5	10 57.37	-38 56.2	2.025	1.801	+4.36	+7.1	17.9	62.7
Aug. 15	11 38.08	-37 39.3	2.193	1.889	+3.73	+8.2	18.3	59.3
Aug. 25	12 12.91	-36 17.2	2.378	1.981	+3.20	+8.1	18.6	55.1
Sept. 4	12 42.94	-34 59.0	2.571	2.075	+2.78	+7.4	19.0	50.2
Sept. 14	13 09.18	-33 48.7	2.766	2.171	+2.45	+6.5	19.4	44.8
Sept. 24	13 32.44	-32 47.3	2.958	2.268	+2.19	+5.7	19.7	39.0
Oct. 4	13 53.39	-31 54.2	3.141	2.367	+1.99	+4.9	20.0	33.1
Oct. 14	14 12.46	-31 08.1	3.313	2.465	+1.82	+4.3	20.3	27.0
Oct. 24	14 29.99	-30 27.5	3.469	2.565	+1.68	+3.8	20.6	21.0
Nov. 3	14 46.22	-29 50.9	3.607	2.664	+1.56	+3.5	20.8	15.5
Nov. 13	15 01.29	-29 17.0	3.725	2.763	+1.45	+3.3	21.1	11.7
Nov. 23	15 15.28	-28 44.4	3.821	2.862	+1.34	+3.2	21.3	11.9
Dec. 3	15 28.24	-28 12.0	3.895	2.961	+1.24	+3.3	21.5	16.2
Dec. 13	15 40.14	-27 38.8	3.945	3.060	+1.13	+3.4	21.6	22.6
Dec. 23	15 50.98	-27 03.8	3.972	3.158	+1.02	+3.6	21.8	29.9
Jan. 2	16 00.66	-26 26.2	3.977	3.255	+0.90	+3.9	21.9	37.7
Jan. 12	16 09.09	-25 45.2	3.960	3.352	+0.77	+4.3	22.0	46.0
Jan. 22	16 16.17	-25 00.1	3.924	3.449	+0.63	+4.8	.	54.6
Feb. 1	16 21.75	-24 10.1	3.870	3.545	+0.47	+5.3	.	63.6
Feb. 11	16 25.70	-23 14.5	3.804	3.640	+0.30	+5.9	.	73.0
Feb. 21	16 27.88	-22 12.6	3.728	3.734	+0.12	+6.6	.	82.8
Mar. 2	16 28.16	-21 03.6	3.647	3.828	-0.08	+7.3	.	92.9
Mar. 12	16 26.46	-19 47.2	3.568	3.922	-0.28	+8.1	.	103.5
Mar. 22	16 22.77	-18 23.1	3.497	4.015	-0.48	+8.8	.	114.5

## Comet 222P/LINEAR

Epoch = 2019 July 16.0 TT  
 T = 2019 June 5.05155 TT  
 Peri. = 346.21877 e = 0.7142677  
 Node = 6.81203 2000.0 a = 2.8990891 AU  
 Incl. = 5.09414 n = 0.19966950  
 q = 0.8283634 AU P = 4.94 years

$$m_1 = 15.5 + 5 \log(\Delta) + 15.0 \log(r(t-30))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	16 36.76	-24 56.6	2.838	2.110	+2.30	-5.4	.	35.0
Jan. 17	17 00.53	-25 46.0	2.673	2.017	+2.47	-4.4	.	39.8
Jan. 27	17 26.07	-26 24.5	2.502	1.922	+2.66	-3.1	.	44.2
Feb. 6	17 53.64	-26 49.1	2.329	1.825	+2.88	-1.5	.	48.1
Feb. 16	18 23.49	-26 55.5	2.157	1.726	+3.12	+0.6	21.7	51.6
Feb. 26	18 55.93	-26 38.2	1.988	1.626	+3.40	+3.3	21.3	54.4
Mar. 8	19 31.28	-25 50.3	1.828	1.524	+3.70	+6.8	20.7	56.5
Mar. 18	20 09.71	-24 23.0	1.678	1.421	+4.02	+11.3	20.2	57.6
Mar. 28	20 51.33	-22 06.5	1.546	1.318	+4.33	+16.7	19.6	57.7
Apr. 7	21 35.96	-18 51.6	1.435	1.216	+4.61	+22.9	19.0	56.6
Apr. 17	22 23.07	-14 33.9	1.351	1.118	+4.82	+29.2	18.4	54.3
Apr. 27	23 11.92	-09 18.0	1.299	1.026	+4.95	+34.3	17.9	51.0
May 7	00 01.64	-03 20.5	1.281	0.946	+4.99	+37.0	17.3	46.9
May 17	00 51.47	+02 51.5	1.298	0.882	+4.97	+36.8	16.8	42.7
May 27	01 40.89	+08 48.4	1.345	0.841	+4.91	+33.8	16.3	38.6
June 6	02 29.57	+14 05.2	1.416	0.828	+4.81	+28.8	15.9	35.2
June 16	03 17.02	+18 25.5	1.502	0.847	+4.66	+22.6	15.6	32.6
June 26	04 02.68	+21 42.6	1.595	0.892	+4.44	+16.3	15.4	31.0
July 6	04 45.89	+23 58.7	1.688	0.960	+4.16	+10.5	15.4	30.3
July 16	05 26.07	+25 21.1	1.779	1.043	+3.84	+5.7	15.7	30.7
July 26	06 02.93	+26 00.1	1.863	1.136	+3.50	+1.9	16.1	31.9
Aug. 5	06 36.42	+26 05.9	1.938	1.235	+3.16	-0.9	16.7	34.0
Aug. 15	07 06.60	+25 47.7	2.003	1.337	+2.84	-2.8	17.3	36.8
Aug. 25	07 33.68	+25 13.1	2.055	1.440	+2.55	-4.1	17.9	40.3
Sept. 4	07 57.89	+24 28.4	2.093	1.543	+2.27	-4.8	18.5	44.4
Sept. 14	08 19.41	+23 38.5	2.117	1.645	+2.01	-5.1	19.0	49.1
Sept. 24	08 38.41	+22 47.4	2.127	1.745	+1.77	-5.0	19.5	54.4
Oct. 4	08 54.99	+21 58.5	2.122	1.844	+1.53	-4.6	20.0	60.3
Oct. 14	09 09.18	+21 14.9	2.104	1.940	+1.29	-4.0	20.4	66.8
Oct. 24	09 20.95	+20 39.1	2.073	2.035	+1.04	-3.0	20.7	73.9
Nov. 3	09 30.18	+20 13.7	2.032	2.127	+0.78	-1.9	21.0	81.6
Nov. 13	09 36.69	+20 01.0	1.982	2.217	+0.49	-0.5	21.3	90.1
Nov. 23	09 40.27	+20 02.8	1.929	2.305	+0.19	+1.0	21.6	99.3
Dec. 3	09 40.64	+20 20.3	1.875	2.391	-0.15	+2.6	21.8	109.4
Dec. 13	09 37.63	+20 53.3	1.827	2.475	-0.49	+4.1	22.0	120.3
Dec. 23	09 31.18	+21 39.8	1.791	2.557	-0.83	+5.2	.	132.0
Jan. 2	09 21.52	+22 35.2	1.774	2.636	-1.12	+5.8	.	144.4
Jan. 12	09 09.35	+23 32.8	1.781	2.714	-1.32	+5.6	.	157.2
Jan. 22	08 55.73	+24 25.3	1.817	2.790	-1.39	+4.7	.	169.2
Feb. 1	08 42.03	+25 06.6	1.885	2.864	-1.32	+3.4	.	171.7
Feb. 11	08 29.59	+25 33.5	1.986	2.936	-1.13	+1.9	.	161.0
Feb. 21	08 19.39	+25 46.0	2.115	3.006	-0.87	+0.5	.	149.1
Mar. 2	08 11.99	+25 46.1	2.269	3.075	-0.58	-0.6	.	137.6
Mar. 12	08 07.53	+25 36.4	2.444	3.142	-0.29	-1.4	.	126.8
Mar. 22	08 05.84	+25 19.5	2.635	3.207	-0.03	-2.0	.	116.6

## Comet C/2018 R3 (Lemmon)

Epoch = 2019 July 16.0 TT  
 T = 2019 June 7.25729 TT  
 Peri. = 112.87196  
 Node = 324.62567 2000.0  
 Incl. = 69.72854  
 q = 1.2909609 AU  
 e = 0.9992517

$$m1 = 11.6 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .			m	' .		°
Jan. 7	21 06.90	+02 26.7	3.181	2.479	+0.91	+11.7	18.1	37.9
Jan. 17	21 16.53	+04 30.8	3.142	2.373	+1.02	+13.3	17.8	32.6
Jan. 27	21 27.22	+06 51.6	3.082	2.266	+1.13	+15.1	17.6	28.5
Feb. 6	21 38.99	+09 31.6	3.004	2.161	+1.24	+17.2	17.3	26.0
Feb. 16	21 51.89	+12 33.5	2.907	2.057	+1.36	+19.5	17.0	25.2
Feb. 26	22 06.07	+16 00.3	2.796	1.954	+1.50	+22.2	16.7	26.0
Mar. 8	22 21.82	+19 55.6	2.672	1.854	+1.68	+25.2	16.4	27.9
Mar. 18	22 39.57	+24 22.9	2.540	1.758	+1.91	+28.6	16.1	30.6
Mar. 28	23 00.06	+29 24.8	2.405	1.666	+2.24	+32.2	15.7	33.5
Apr. 7	23 24.53	+35 02.3	2.273	1.579	+2.73	+35.6	15.4	36.2
Apr. 17	23 54.93	+41 10.5	2.152	1.501	+3.48	+38.0	15.0	38.4
Apr. 27	00 34.45	+47 33.6	2.049	1.432	+4.63	+38.0	14.7	40.0
May 7	01 27.81	+53 36.0	1.973	1.374	+6.30	+32.9	14.5	40.6
May 17	02 39.49	+58 13.2	1.930	1.330	+8.19	+19.8	14.3	40.3
May 27	04 06.70	+60 04.1	1.924	1.302	+9.03	-0.3	14.2	38.9
June 6	05 33.36	+58 29.5	1.955	1.291	+7.92	-19.6	14.2	36.6
June 16	06 43.84	+54 14.9	2.018	1.298	+5.98	-31.1	14.3	33.5
June 26	07 35.90	+48 38.8	2.105	1.322	+4.36	-35.6	14.4	29.7
July 6	08 14.24	+42 39.1	2.208	1.362	+3.27	-35.9	14.7	25.4
July 16	08 43.47	+36 45.6	2.320	1.416	+2.56	-34.4	14.9	20.7
July 26	09 06.77	+31 10.8	2.434	1.482	+2.09	-32.3	15.2	15.8
Aug. 5	09 26.09	+25 57.7	2.543	1.559	+1.76	-30.1	15.6	10.9
Aug. 15	09 42.61	+21 05.8	2.644	1.643	+1.53	-28.1	15.9	7.0
Aug. 25	09 57.07	+16 32.5	2.734	1.734	+1.35	-26.4	16.2	6.8
Sept. 4	10 09.94	+12 14.8	2.810	1.829	+1.21	-25.0	16.5	10.9
Sept. 14	10 21.46	+08 09.8	2.871	1.928	+1.08	-23.9	16.7	16.5
Sept. 24	10 31.79	+04 15.0	2.918	2.030	+0.97	-23.0	17.0	22.8
Oct. 4	10 40.98	+00 27.8	2.948	2.134	+0.86	-22.4	17.2	29.5
Oct. 14	10 49.03	-03 13.4	2.963	2.239	+0.74	-21.9	17.5	36.4
Oct. 24	10 55.86	-06 50.5	2.963	2.346	+0.61	-21.5	17.7	43.6
Nov. 3	11 01.34	-10 24.5	2.951	2.452	+0.47	-21.3	17.8	51.1
Nov. 13	11 05.28	-13 56.1	2.927	2.559	+0.30	-21.0	18.0	58.8
Nov. 23	11 07.46	-17 25.3	2.896	2.666	+0.11	-20.8	18.2	66.8
Dec. 3	11 07.59	-20 51.3	2.859	2.773	-0.11	-20.4	18.3	75.0
Dec. 13	11 05.36	-24 12.0	2.820	2.880	-0.36	-19.7	18.4	83.5
Dec. 23	11 00.47	-27 24.0	2.785	2.986	-0.65	-18.5	18.6	92.0
Jan. 2	10 52.66	-30 22.2	2.758	3.092	-0.94	-16.8	18.7	100.5
Jan. 12	10 41.90	-32 59.8	2.743	3.197	-1.23	-14.4	18.8	108.7
Jan. 22	10 28.40	-35 09.6	2.745	3.302	-1.48	-11.2	19.0	116.3
Feb. 1	10 12.80	-36 44.7	2.769	3.406	-1.64	-7.4	19.1	122.8
Feb. 11	09 56.13	-37 41.1	2.817	3.509	-1.68	-3.5	19.3	127.7
Feb. 21	09 39.63	-37 58.9	2.891	3.612	-1.59	+0.2	19.5	130.4
Mar. 2	09 24.51	-37 42.5	2.992	3.714	-1.40	+3.2	19.7	130.7
Mar. 12	09 11.68	-36 59.9	3.117	3.816	-1.14	+5.4	19.9	128.5
Mar. 22	09 01.61	-36 00.0	3.264	3.917	-0.85	+6.6	20.1	124.6

Comet 209P/LINEAR

Epoch = 2019 July 16.0 TT  
 T = 2019 June 12.80662 TT  
 Peri. = 152.50033 e = 0.6733049  
 Node = 62.77144 2000.0 a = 2.9614867 AU  
 Incl. = 21.25845 n = 0.19339239  
 q = 0.9675032 AU P = 5.10 years

$$m1 = 17.1 + 5 \log(\Delta) + 5.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	06 48.83	+48 16.0	1.204	2.132	-2.21	+12.7	19.1	153.9
Jan. 17	06 25.73	+50 04.6	1.154	2.046	-2.37	+8.4	19.0	146.1
Jan. 27	06 02.65	+51 06.8	1.129	1.958	-2.16	+3.6	18.8	135.8
Feb. 6	05 43.30	+51 24.9	1.122	1.870	-1.61	-0.1	18.7	124.9
Feb. 16	05 30.39	+51 12.3	1.127	1.780	-0.88	-2.3	18.6	114.5
Feb. 26	05 24.97	+50 44.1	1.137	1.690	-0.13	-3.2	18.5	105.0
Mar. 8	05 26.97	+50 10.7	1.147	1.599	+0.59	-3.4	18.4	96.4
Mar. 18	05 35.87	+49 36.9	1.152	1.508	+1.24	-3.4	18.3	88.9
Mar. 28	05 50.99	+49 01.6	1.147	1.418	+1.83	-3.8	18.2	82.4
Apr. 7	06 11.79	+48 19.4	1.132	1.330	+2.37	-4.9	18.0	76.9
Apr. 17	06 37.77	+47 21.5	1.104	1.246	+2.86	-7.1	17.8	72.3
Apr. 27	07 08.31	+45 55.9	1.063	1.168	+3.28	-10.7	17.6	68.6
May 7	07 42.71	+43 47.3	1.011	1.098	+3.62	-15.9	17.3	65.9
May 17	08 20.00	+40 38.1	0.948	1.040	+3.84	-23.0	17.1	64.0
May 27	08 59.02	+36 09.0	0.879	0.997	+3.96	-32.0	16.8	63.1
June 6	09 38.75	+30 01.3	0.808	0.972	+3.98	-42.8	16.6	63.3
June 16	10 18.52	+22 01.3	0.744	0.969	+3.97	-54.3	16.4	64.6
June 26	10 58.19	+12 09.4	0.696	0.986	+3.98	-64.6	16.3	67.3
July 6	11 38.29	+00 52.8	0.670	1.022	+4.06	-70.2	16.3	71.3
July 16	12 19.62	-10 48.0	0.675	1.075	+4.23	-68.4	16.4	76.0
July 26	13 02.89	-21 36.9	0.711	1.141	+4.45	-59.5	16.6	80.7
Aug. 5	13 48.48	-30 35.4	0.776	1.217	+4.68	-46.6	17.0	84.5
Aug. 15	14 35.97	-37 20.2	0.866	1.299	+4.81	-33.1	17.4	87.1
Aug. 25	15 24.15	-41 55.6	0.976	1.386	+4.80	-21.1	17.8	88.4
Sept. 4	16 11.47	-44 41.0	1.102	1.475	+4.63	-11.4	18.2	88.5
Sept. 14	16 56.45	-46 00.3	1.242	1.566	+4.32	-4.1	18.5	87.6
Sept. 24	17 38.06	-46 15.3	1.393	1.657	+3.96	+1.3	18.9	85.8
Oct. 4	18 15.97	-45 44.6	1.553	1.747	+3.59	+5.0	19.3	83.3
Oct. 14	18 50.27	-44 42.4	1.721	1.837	+3.24	+7.5	19.6	80.2
Oct. 24	19 21.29	-43 18.7	1.895	1.926	+2.94	+9.3	19.9	76.7
Nov. 3	19 49.49	-41 40.7	2.073	2.014	+2.68	+10.4	20.2	72.7
Nov. 13	20 15.31	-39 53.6	2.254	2.101	+2.47	+11.1	20.5	68.3
Nov. 23	20 39.12	-38 00.8	2.435	2.185	+2.28	+11.5	20.7	63.7
Dec. 3	21 01.26	-36 04.7	2.615	2.269	+2.13	+11.7	21.0	58.9
Dec. 13	21 21.99	-34 07.2	2.792	2.350	+2.00	+11.8	21.2	53.9
Dec. 23	21 41.52	-32 09.5	2.964	2.430	+1.89	+11.7	21.4	48.7
Jan. 2	22 00.03	-30 12.7	3.129	2.508	+1.80	+11.6	21.6	43.5
Jan. 12	22 17.65	-28 17.6	3.285	2.585	+1.72	+11.4	21.7	38.2
Jan. 22	22 34.48	-26 24.9	3.431	2.660	+1.64	+11.1	21.9	33.0
Feb. 1	22 50.61	-24 35.4	3.565	2.733	+1.58	+10.8	22.0	27.9
Feb. 11	23 06.10	-22 49.5	3.685	2.805	+1.52	+10.4	.	23.1
Feb. 21	23 21.01	-21 07.7	3.792	2.875	+1.46	+9.9	.	19.0
Mar. 2	23 35.36	-19 30.7	3.882	2.943	+1.41	+9.4	.	16.2
Mar. 12	23 49.16	-17 59.0	3.956	3.010	+1.35	+8.9	.	15.5
Mar. 22	00 02.45	-16 33.0	4.013	3.075	+1.30	+8.3	.	17.2

## Comet 231P/LINEAR-NEAT

Epoch = 2019 July 16.0 TT  
 T = 2019 June 14.27427 TT  
 Peri. = 42.75520 e = 0.2475624  
 Node = 133.02978 2000.0 a = 4.0169223 AU  
 Incl. = 12.33413 n = 0.12242325  
 q = 3.0224834 AU P = 8.05 years

$$m1 = 13.2 + 5 \log(\Delta) + 7.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	10 40.39	+11 27.1	2.408	3.119	+0.05	+4.1	18.8	128.7
Jan. 17	10 39.94	+12 14.4	2.295	3.108	-0.16	+5.5	18.7	139.3
Jan. 27	10 37.50	+13 15.1	2.204	3.097	-0.35	+6.7	18.6	150.2
Feb. 6	10 33.27	+14 26.2	2.136	3.087	-0.51	+7.5	18.5	161.4
Feb. 16	10 27.72	+15 42.3	2.097	3.077	-0.60	+7.6	18.5	171.7
Feb. 26	10 21.52	+16 57.2	2.086	3.069	-0.63	+7.2	18.4	171.5
Mar. 8	10 15.43	+18 04.6	2.105	3.061	-0.57	+6.1	18.5	161.2
Mar. 18	10 10.25	+18 59.4	2.150	3.053	-0.44	+4.7	18.5	150.1
Mar. 28	10 06.61	+19 38.7	2.219	3.047	-0.26	+3.0	18.6	139.4
Apr. 7	10 04.90	+20 01.6	2.309	3.041	-0.06	+1.4	18.6	129.1
Apr. 17	10 05.31	+20 08.3	2.413	3.036	+0.16	-0.2	18.7	119.5
Apr. 27	10 07.83	+20 00.3	2.530	3.032	+0.36	-1.6	18.8	110.5
May 7	10 12.32	+19 38.9	2.654	3.028	+0.55	-2.8	18.9	102.0
May 17	10 18.59	+19 05.9	2.783	3.026	+0.71	-3.9	19.0	94.0
May 27	10 26.38	+18 22.6	2.913	3.024	+0.85	-4.8	19.1	86.4
June 6	10 35.48	+17 30.5	3.043	3.023	+0.97	-5.7	19.2	79.3
June 16	10 45.68	+16 30.6	3.170	3.022	+1.07	-6.4	19.3	72.4
June 26	10 56.78	+15 24.0	3.292	3.023	+1.15	-7.0	19.4	65.9
July 6	11 08.63	+14 11.6	3.409	3.024	+1.22	-7.5	19.5	59.6
July 16	11 21.10	+12 54.4	3.520	3.027	+1.28	-8.0	19.5	53.5
July 26	11 34.08	+11 33.3	3.622	3.029	+1.32	-8.3	19.6	47.5
Aug. 5	11 47.48	+10 09.0	3.715	3.033	+1.36	-8.6	19.7	41.7
Aug. 15	12 01.23	+08 42.4	3.799	3.038	+1.39	-8.7	19.7	36.0
Aug. 25	12 15.26	+07 14.5	3.872	3.043	+1.42	-8.8	19.8	30.4
Sept. 4	12 29.54	+05 45.9	3.934	3.049	+1.44	-8.9	19.8	24.9
Sept. 14	12 44.02	+04 17.5	3.985	3.056	+1.46	-8.8	19.8	19.6
Sept. 24	12 58.65	+02 50.3	4.024	3.063	+1.47	-8.6	19.9	14.6
Oct. 4	13 13.42	+01 25.0	4.050	3.072	+1.48	-8.4	19.9	10.5
Oct. 14	13 28.27	+00 02.4	4.063	3.081	+1.49	-8.1	19.9	8.6
Oct. 24	13 43.17	-01 16.6	4.063	3.090	+1.49	-7.7	19.9	10.4
Nov. 3	13 58.07	-02 31.2	4.050	3.101	+1.49	-7.2	19.9	14.6
Nov. 13	14 12.92	-03 40.5	4.024	3.112	+1.48	-6.6	19.9	19.9
Nov. 23	14 27.66	-04 43.9	3.984	3.123	+1.46	-6.0	19.9	25.6
Dec. 3	14 42.20	-05 40.8	3.932	3.136	+1.44	-5.3	19.9	31.6
Dec. 13	14 56.47	-06 30.3	3.867	3.148	+1.41	-4.5	19.9	37.9
Dec. 23	15 10.35	-07 12.0	3.790	3.162	+1.36	-3.7	19.8	44.3
Jan. 2	15 23.74	-07 45.6	3.702	3.176	+1.31	-2.9	19.8	51.0
Jan. 12	15 36.48	-08 10.6	3.604	3.191	+1.23	-2.0	19.8	57.8
Jan. 22	15 48.45	-08 26.9	3.497	3.206	+1.15	-1.2	19.7	64.9
Feb. 1	15 59.46	-08 34.5	3.384	3.221	+1.04	-0.3	19.7	72.2
Feb. 11	16 09.33	-08 33.6	3.265	3.238	+0.92	+0.5	19.6	79.7
Feb. 21	16 17.87	-08 24.6	3.143	3.254	+0.77	+1.3	19.5	87.5
Mar. 2	16 24.88	-08 08.1	3.021	3.271	+0.61	+2.0	19.5	95.7
Mar. 12	16 30.17	-07 44.9	2.902	3.289	+0.43	+2.6	19.4	104.1
Mar. 22	16 33.57	-07 16.4	2.789	3.307	+0.23	+3.1	19.3	112.9

Comet P/2000 R2 (LINEAR)

Epoch = 2019 July 16.0 TT  
 T = 2019 June 15.58446 TT  
 Peri. = 176.57288 e = 0.5309767  
 Node = 160.25515 2000.0 a = 3.4647886 AU  
 Incl. = 11.69736 n = 0.15282308  
 q = 1.6250666 AU P = 6.45 years

$$m_1 = 17.6 + 5 \log(\Delta) + 12.5 \log(r(t-15))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	17 56.55	-15° 20.5	3.105	2.197	-0.99 +1.3	.	32.9/ 91	18.7
Jan. 17	18 19.61	-15 19.9	3.013	2.141	-1.06 +0.9	.	33.9/ 89	22.9
Jan. 27	18 43.31	-15 06.0	2.915	2.087	-1.13 +0.6	.	34.9/ 87	27.0
Feb. 6	19 07.60	-14 38.3	2.814	2.033	-1.20 +0.1	.	35.8/ 84	31.0
Feb. 16	19 32.39	-13 56.6	2.709	1.982	-1.27 -0.4	.	36.8/ 82	34.9
Feb. 26	19 57.61	-13 00.7	2.604	1.932	-1.34 -0.9	.	37.7/ 80	38.6
Mar. 8	20 23.21	-11 51.3	2.499	1.885	-1.41 -1.4	.	38.6/ 79	42.1
Mar. 18	20 49.12	-10 29.0	2.395	1.840	-1.48 -2.0	.	39.5/ 77	45.5
Mar. 28	21 15.29	-08 55.1	2.294	1.798	-1.55 -2.5	.	40.2/ 76	48.6
Apr. 7	21 41.68	-07 11.3	2.196	1.760	-1.61 -3.0	.	40.9/ 75	51.6
Apr. 17	22 08.23	-05 19.6	2.102	1.726	-1.67 -3.4	.	41.4/ 74	54.5
Apr. 27	22 34.93	-03 22.7	2.013	1.696	-1.73 -3.8	.	41.8/ 74	57.3
May 7	23 01.72	-01 23.3	1.929	1.671	-1.77 -4.0	21.9	41.9/ 73	60.0
May 17	23 28.53	+00 35.2	1.850	1.651	-1.82 -4.2	21.8	41.9/ 74	62.6
May 27	23 55.30	+02 29.5	1.776	1.636	-1.85 -4.2	21.6	41.5/ 75	65.3
June 6	00 21.90	+04 16.1	1.707	1.628	-1.88 -4.1	21.5	40.8/ 76	68.1
June 16	00 48.17	+05 51.6	1.642	1.625	-1.90 -4.0	21.3	39.8/ 77	71.0
June 26	01 13.93	+07 13.0	1.581	1.628	-1.91 -3.8	21.2	38.5/ 79	74.1
July 6	01 38.92	+08 17.5	1.523	1.637	-1.91 -3.7	21.2	36.7/ 81	77.5
July 16	02 02.84	+09 02.9	1.467	1.652	-1.91 -3.6	21.1	34.5/ 84	81.2
July 26	02 25.36	+09 27.6	1.413	1.673	-1.91 -3.6	21.1	32.0/ 88	85.4
Aug. 5	02 46.09	+09 30.8	1.361	1.698	-1.91 -3.8	21.0	29.0/ 92	90.0
Aug. 15	03 04.58	+09 12.1	1.311	1.728	-1.92 -4.2	21.0	25.5/ 97	95.2
Aug. 25	03 20.44	+08 32.3	1.262	1.763	-1.95 -4.8	21.0	21.7/104	101.1
Sept. 4	03 33.18	+07 32.5	1.216	1.801	-1.99 -5.6	21.0	17.6/113	107.7
Sept. 14	03 42.39	+06 15.2	1.175	1.843	-2.06 -6.6	21.1	13.7/129	115.1
Sept. 24	03 47.75	+04 44.3	1.141	1.888	-2.15 -7.7	21.1	10.7/154	123.3
Oct. 4	03 49.08	+03 05.0	1.116	1.936	-2.25 -8.8	21.2	10.2/187	132.2
Oct. 14	03 46.56	+01 25.4	1.105	1.986	-2.34 -9.6	21.3	11.7/215	141.5
Oct. 24	03 40.78	+00 05.2	1.112	2.038	-2.41 -10.1	21.5	13.6/233	150.5
Nov. 3	03 32.77	-01 17.3	1.139	2.091	-2.43 -10.0	21.7	14.3/246	157.7
Nov. 13	03 23.95	-02 03.1	1.189	2.146	-2.38 -9.5	21.9	13.4/257	159.9
Nov. 23	03 15.72	-02 19.3	1.263	2.201	-2.27 -8.7	.	11.2/270	155.8
Dec. 3	03 09.19	-02 06.7	1.360	2.258	-2.11 -7.7	.	8.3/289	148.2
Dec. 13	03 05.08	-01 29.5	1.478	2.315	-1.93 -6.8	.	6.3/321	139.3
Dec. 23	03 03.63	+00 33.6	1.614	2.373	-1.75 -5.9	.	6.4/ 0	130.4
Jan. 2	03 04.79	+00 35.5	1.765	2.430	-1.58 -5.2	.	8.4/ 27	121.7
Jan. 12	03 08.33	+01 52.9	1.929	2.488	-1.43 -4.5	.	10.7/ 41	113.3
Jan. 22	03 13.95	+03 14.6	2.102	2.546	-1.29 -4.0	.	12.9/ 50	105.3
Feb. 1	03 21.34	+04 37.7	2.283	2.604	-1.17 -3.5	.	14.9/ 56	97.6
Feb. 11	03 30.21	+05 59.7	2.467	2.661	-1.07 -3.1	.	16.4/ 61	90.3
Feb. 21	03 40.30	+07 18.9	2.653	2.719	-0.98 -2.7	.	17.7/ 64	83.1
Mar. 2	03 51.40	+08 34.1	2.839	2.776	-0.90 -2.3	.	18.6/ 67	76.2
Mar. 12	04 03.32	+09 44.1	3.023	2.832	-0.83 -2.0	.	19.4/ 70	69.5
Mar. 22	04 15.90	+10 48.4	3.202	2.888	-0.77 -1.7	.	19.9/ 72	62.9

Comet 261P/Larson

Epoch = 2019 July 16.0 TT  
 T = 2019 June 18.65453 TT  
 Peri. = 67.10938 e = 0.4227581  
 Node = 291.16688 2000.0 a = 3.4879738 AU  
 Incl. = 6.07602 n = 0.15130186  
 q = 2.0134046 AU P = 6.51 years

m1 = 8.0 + 5 log(Delta) + 25.0 log(r) (pre -T)  
 m1 = 11.4 + 5 log(Delta) + 15.0 log(r) (post-T)

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	19 46.46	-20 38.0	3.330	2.363	+2.10	+6.7	19.9	8.7
Jan. 17	20 07.59	-19 25.7	3.307	2.326	+2.12	+7.9	19.8	3.7
Jan. 27	20 28.84	-18 02.0	3.275	2.291	+2.13	+9.0	19.6	1.7
Feb. 6	20 50.17	-16 27.3	3.235	2.257	+2.13	+10.1	19.4	6.3
Feb. 16	21 11.48	-14 42.1	3.186	2.225	+2.13	+11.1	19.2	11.0
Feb. 26	21 32.74	-12 47.0	3.132	2.194	+2.12	+12.0	19.0	15.6
Mar. 8	21 53.92	-10 42.8	3.071	2.165	+2.11	+12.9	18.8	20.0
Mar. 18	22 14.98	-08 30.7	3.005	2.139	+2.10	+13.6	18.6	24.4
Mar. 28	22 35.91	-06 11.7	2.936	2.114	+2.09	+14.2	18.5	28.6
Apr. 7	22 56.73	-03 47.2	2.862	2.092	+2.08	+14.7	18.3	32.8
Apr. 17	23 17.43	-01 18.5	2.786	2.072	+2.06	+15.0	18.1	36.8
Apr. 27	23 38.02	+01 12.8	2.708	2.055	+2.05	+15.2	18.0	40.9
May 7	23 58.51	+03 45.4	2.628	2.041	+2.04	+15.3	17.8	44.9
May 17	00 18.88	+06 17.5	2.547	2.030	+2.03	+15.1	17.7	48.9
May 27	00 39.12	+08 47.5	2.465	2.021	+2.02	+14.8	17.6	52.9
June 6	00 59.22	+11 13.9	2.381	2.016	+2.00	+14.4	17.5	56.9
June 16	01 19.10	+13 35.2	2.298	2.014	+1.97	+13.8	17.4	61.1
June 26	01 38.69	+15 49.9	2.213	2.014	+1.94	+13.1	17.7	65.4
July 6	01 57.87	+17 56.8	2.129	2.018	+1.89	+12.2	17.6	69.8
July 16	02 16.48	+19 54.7	2.043	2.025	+1.82	+11.3	17.5	74.5
July 26	02 34.30	+21 42.8	1.958	2.035	+1.73	+10.2	17.5	79.5
Aug. 5	02 51.08	+23 20.4	1.872	2.047	+1.61	+9.2	17.4	84.8
Aug. 15	03 06.48	+24 47.1	1.787	2.063	+1.45	+8.1	17.4	90.6
Aug. 25	03 20.13	+26 02.7	1.704	2.081	+1.25	+6.9	17.3	96.8
Sept. 4	03 31.58	+27 07.0	1.622	2.102	+1.01	+5.8	17.3	103.6
Sept. 14	03 40.38	+27 59.6	1.545	2.125	+0.72	+4.6	17.3	111.1
Sept. 24	03 46.08	+28 39.8	1.473	2.151	+0.38	+3.3	17.2	119.3
Oct. 4	03 48.31	+29 06.3	1.411	2.179	+0.02	+1.8	17.2	128.4
Oct. 14	03 46.95	+29 17.0	1.362	2.208	-0.33	+0.1	17.2	138.2
Oct. 24	03 42.26	+29 09.9	1.329	2.240	-0.63	-1.8	17.3	148.8
Nov. 3	03 34.96	+28 43.7	1.316	2.273	-0.83	-3.6	17.3	159.6
Nov. 13	03 26.30	+27 59.9	1.328	2.307	-0.88	-5.2	17.5	169.1
Nov. 23	03 17.74	+27 03.4	1.365	2.343	-0.80	-6.1	17.6	169.6
Dec. 3	03 10.60	+26 01.5	1.428	2.380	-0.59	-6.2	17.8	160.4
Dec. 13	03 05.86	+25 02.1	1.516	2.418	-0.32	-5.5	18.1	149.8
Dec. 23	03 03.95	+24 11.4	1.626	2.458	-0.03	-4.4	18.3	139.3
Jan. 2	03 04.94	+23 32.9	1.755	2.498	+0.25	-3.1	18.6	129.4
Jan. 12	03 08.65	+23 07.5	1.899	2.538	+0.51	-1.8	18.9	120.0
Jan. 22	03 14.72	+22 54.4	2.055	2.579	+0.73	-0.7	19.1	111.2
Feb. 1	03 22.84	+22 51.7	2.219	2.621	+0.91	+0.2	19.4	102.9
Feb. 11	03 32.67	+22 57.1	2.390	2.663	+1.06	+0.9	19.7	95.0
Feb. 21	03 43.91	+23 08.3	2.563	2.706	+1.19	+1.4	19.9	87.4
Mar. 2	03 56.31	+23 23.1	2.737	2.748	+1.30	+1.6	20.2	80.2
Mar. 12	04 09.64	+23 39.5	2.909	2.791	+1.38	+1.7	20.4	73.3
Mar. 22	04 23.73	+23 55.8	3.079	2.834	+1.44	+1.6	20.6	66.6

Comet P/1999 R028 (LONEOS)

Epoch = 2019 July 16.0 TT  
 T = 2019 June 30.87965 TT  
 Peri. = 232.07612  
 Node = 137.06806 2000.0  
 Incl. = 7.52266  
 q = 1.1233563 AU  
 e = 0.6722085  
 a = 3.4270452 AU  
 n = 0.15535467  
 P = 6.34 years

$$m_1 = 20.0 + 5 \log(\Delta) + 12.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	18 00.96	-19 06.9	3.229	2.303	-0.83 +1.2	.	29.8/ 91	16.5
Jan. 17	18 22.40	-19 09.3	3.108	2.221	-0.92 +0.9	.	31.1/ 89	21.4
Jan. 27	18 44.82	-18 59.9	2.978	2.139	-1.01 +0.5	.	32.6/ 87	26.2
Feb. 6	19 08.25	-18 37.6	2.841	2.055	-1.12 -0.1	.	34.2/ 85	30.7
Feb. 16	19 32.71	-18 01.2	2.699	1.971	-1.23 -0.7	.	36.0/ 83	34.9
Feb. 26	19 58.29	-17 09.3	2.554	1.887	-1.36 -1.5	.	38.1/ 81	38.8
Mar. 8	20 25.06	-16 00.6	2.409	1.803	-1.50 -2.5	.	40.4/ 79	42.2
Mar. 18	20 53.10	-14 33.8	2.267	1.719	-1.64 -3.6	.	42.9/ 77	45.3
Mar. 28	21 22.55	-12 47.9	2.129	1.636	-1.80 -4.9	.	45.8/ 75	47.8
Apr. 7	21 53.54	-10 42.0	1.999	1.554	-1.95 -6.2	.	49.0/ 74	49.8
Apr. 17	22 26.19	-08 15.9	1.880	1.476	-2.11 -7.7	.	52.3/ 73	51.2
Apr. 27	23 00.61	-05 30.7	1.774	1.401	-2.26 -9.1	.	55.7/ 72	52.0
May 7	23 36.87	-02 29.1	1.684	1.331	-2.39 -10.2	.	58.9/ 71	52.2
May 17	00 14.89	+00 44.0	1.612	1.268	-2.49 -11.0	.	61.6/ 71	51.9
May 27	00 54.53	+04 01.2	1.559	1.214	-2.55 -11.2	22.0	63.6/ 72	51.1
June 6	01 35.44	+07 13.2	1.526	1.171	-2.56 -10.8	21.8	64.3/ 73	50.1
June 16	02 17.10	+10 10.1	1.511	1.141	-2.53 -9.9	21.6	63.9/ 75	49.0
June 26	02 58.90	+12 43.2	1.514	1.125	-2.44 -8.5	21.5	62.4/ 77	48.0
July 6	03 40.11	+14 46.1	1.529	1.125	-2.31 -7.0	21.6	59.8/ 80	47.4
July 16	04 20.05	+16 15.8	1.555	1.141	-2.15 -5.5	21.7	56.6/ 83	47.2
July 26	04 58.12	+17 12.8	1.586	1.171	-1.97 -4.1	21.9	53.0/ 86	47.6
Aug. 5	05 33.86	+17 39.8	1.619	1.215	-1.79 -3.0	.	49.1/ 88	48.6
Aug. 15	06 06.97	+17 41.3	1.651	1.269	-1.61 -2.1	.	45.2/ 91	50.2
Aug. 25	06 37.29	+17 22.5	1.678	1.332	-1.45 -1.5	.	41.3/ 94	52.5
Sept. 4	07 04.78	+16 48.5	1.699	1.402	-1.31 -1.0	.	37.4/ 96	55.6
Sept. 14	07 29.43	+16 04.3	1.712	1.477	-1.18 -0.8	.	33.7/ 98	59.3
Sept. 24	07 51.29	+15 14.3	1.716	1.556	-1.08 -0.6	.	29.9/100	63.6
Oct. 4	08 10.37	+14 22.6	1.710	1.637	-1.01 -0.6	.	26.0/101	68.7
Oct. 14	08 26.63	+13 32.9	1.694	1.720	-0.95 -0.5	.	22.0/102	74.5
Oct. 24	08 40.03	+12 48.7	1.669	1.804	-0.92 -0.5	.	17.7/103	81.0
Nov. 3	08 50.41	+12 13.3	1.636	1.889	-0.92 -0.4	.	13.0/103	88.4
Nov. 13	08 57.59	+11 50.0	1.597	1.973	-0.93 -0.3	.	8.0/101	96.6
Nov. 23	09 01.37	+11 41.8	1.557	2.057	-0.98 -0.1	.	2.7/ 88	105.7
Dec. 3	09 01.54	+11 51.1	1.519	2.140	-1.04 +0.2	.	3.4/306	115.8
Dec. 13	08 58.04	+12 19.2	1.488	2.223	-1.13 +0.6	.	8.9/296	126.8
Dec. 23	08 51.07	+13 05.3	1.471	2.304	-1.23 +1.0	.	13.9/293	138.8
Jan. 2	08 41.19	+14 06.1	1.474	2.385	-1.32 +1.3	.	17.5/292	151.5
Jan. 12	08 29.46	+15 15.7	1.503	2.465	-1.39 +1.5	.	19.1/292	164.6
Jan. 22	08 17.22	+16 26.8	1.560	2.543	-1.41 +1.6	.	18.6/292	176.4
Feb. 1	08 05.84	+17 32.8	1.648	2.620	-1.40 +1.5	.	16.1/292	168.3
Feb. 11	07 56.49	+18 29.6	1.765	2.696	-1.34 +1.4	.	12.4/294	156.0
Feb. 21	07 49.81	+19 15.1	1.907	2.771	-1.26 +1.3	.	8.2/299	144.2
Mar. 2	07 46.03	+19 49.4	2.072	2.844	-1.16 +1.1	.	4.2/313	133.2
Mar. 12	07 45.06	+20 13.3	2.254	2.916	-1.06 +1.0	.	2.0/ 20	122.9
Mar. 22	07 46.61	+20 27.9	2.449	2.987	-0.96 +1.0	.	4.0/ 76	113.3



## Comet 31P/Schwassmann-Wachmann

Epoch = 2019 July 16.0 TT  
 T = 2019 July 6.12942 TT  
 Peri. = 18.35269 e = 0.1928989  
 Node = 114.11191 2000.0 a = 4.2440609 AU  
 Incl. = 4.54711 n = 0.11272797  
 q = 3.4253862 AU P = 8.74 years

$$m1 = 6.4 + 5 \log(\Delta) + 17.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	06 46.97	+21 42.5	2.522	3.502	-0.73	+1.9	17.9	174.6
Jan. 17	06 39.93	+22 01.1	2.542	3.494	-0.66	+1.8	17.9	162.9
Jan. 27	06 33.90	+22 18.2	2.590	3.486	-0.52	+1.6	18.0	151.3
Feb. 6	06 29.44	+22 33.4	2.664	3.479	-0.34	+1.4	18.0	140.2
Feb. 16	06 26.96	+22 46.4	2.760	3.472	-0.13	+1.2	18.1	129.5
Feb. 26	06 26.62	+22 57.4	2.872	3.466	+0.09	+1.0	18.1	119.3
Mar. 8	06 28.44	+23 06.2	2.997	3.460	+0.30	+0.8	18.2	109.7
Mar. 18	06 32.31	+23 12.6	3.131	3.455	+0.49	+0.5	18.3	100.6
Mar. 28	06 38.04	+23 16.3	3.268	3.450	+0.67	+0.2	18.4	92.0
Apr. 7	06 45.42	+23 16.7	3.407	3.445	+0.82	-0.2	18.5	83.8
Apr. 17	06 54.23	+23 13.4	3.543	3.441	+0.95	-0.6	18.5	76.0
Apr. 27	07 04.26	+23 05.9	3.675	3.437	+1.06	-1.0	18.6	68.5
May 7	07 15.31	+22 53.9	3.801	3.434	+1.15	-1.5	18.7	61.4
May 17	07 27.20	+22 36.9	3.919	3.431	+1.23	-2.0	18.7	54.5
May 27	07 39.76	+22 14.7	4.027	3.429	+1.29	-2.5	18.8	47.8
June 6	07 52.86	+21 47.3	4.124	3.428	+1.33	-3.0	18.8	41.3
June 16	08 06.37	+21 14.6	4.210	3.426	+1.37	-3.6	18.9	34.9
June 26	08 20.16	+20 36.6	4.283	3.426	+1.39	-4.1	18.9	28.7
July 6	08 34.15	+19 53.7	4.343	3.425	+1.41	-4.6	18.9	22.5
July 16	08 48.25	+19 06.1	4.389	3.426	+1.41	-5.0	19.0	16.4
July 26	09 02.39	+18 14.1	4.421	3.426	+1.41	-5.4	19.0	10.3
Aug. 5	09 16.49	+17 18.1	4.438	3.428	+1.41	-5.8	19.0	4.4
Aug. 15	09 30.49	+16 18.9	4.441	3.429	+1.39	-6.1	19.0	2.4
Aug. 25	09 44.35	+15 16.8	4.429	3.431	+1.38	-6.3	19.0	8.2
Sept. 4	09 58.00	+14 12.6	4.402	3.434	+1.35	-6.5	19.0	14.3
Sept. 14	10 11.39	+13 07.0	4.361	3.437	+1.32	-6.6	19.0	20.6
Sept. 24	10 24.47	+12 00.8	4.305	3.441	+1.29	-6.6	19.0	27.0
Oct. 4	10 37.19	+10 54.9	4.235	3.445	+1.25	-6.5	18.9	33.5
Oct. 14	10 49.47	+09 50.1	4.152	3.449	+1.20	-6.4	18.9	40.1
Oct. 24	11 01.24	+08 47.5	4.056	3.454	+1.15	-6.1	18.9	47.0
Nov. 3	11 12.42	+07 48.1	3.948	3.460	+1.08	-5.7	18.8	54.0
Nov. 13	11 22.90	+06 53.1	3.831	3.466	+1.01	-5.2	18.8	61.3
Nov. 23	11 32.57	+06 03.6	3.704	3.472	+0.92	-4.6	18.7	68.8
Dec. 3	11 41.29	+05 20.8	3.571	3.479	+0.81	-3.9	18.6	76.7
Dec. 13	11 48.91	+04 46.1	3.434	3.486	+0.70	-3.0	18.6	84.8
Dec. 23	11 55.27	+04 20.6	3.295	3.494	+0.56	-2.0	18.5	93.4
Jan. 2	12 00.19	+04 05.5	3.158	3.502	+0.41	-0.9	18.4	102.3
Jan. 12	12 03.50	+04 01.8	3.026	3.510	+0.24	+0.3	18.3	111.7
Jan. 22	12 05.07	+04 09.9	2.903	3.519	+0.06	+1.5	18.3	121.5
Feb. 1	12 04.80	+04 29.9	2.794	3.528	-0.13	+2.6	18.2	131.8
Feb. 11	12 02.75	+05 00.6	2.703	3.538	-0.30	+3.6	18.2	142.5
Feb. 21	11 59.06	+05 40.1	2.635	3.548	-0.45	+4.3	18.1	153.6
Mar. 2	11 54.05	+06 25.1	2.593	3.558	-0.55	+4.7	18.1	164.6
Mar. 12	11 48.23	+07 11.6	2.579	3.569	-0.60	+4.6	18.1	173.9
Mar. 22	11 42.18	+07 55.2	2.595	3.580	-0.59	+4.0	18.2	169.6

Comet C/2018 X2 (Fitzsimmons)

Epoch = 2019 July 16.0 TT  
 T = 2019 July 8.47913 TT  
 Peri. = 162.06793  
 Node = 340.81698 2000.0  
 Incl. = 23.06958  
 q = 2.1253644 AU  
 e = 0.9869071

$$m1 = 11.9 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	03 40.04	+51 34.9	2.231	2.965	-0.32	-7.5	18.4	130.5
Jan. 17	03 38.60	+50 16.6	2.240	2.891	+0.07	-8.1	18.3	122.6
Jan. 27	03 41.03	+48 55.4	2.263	2.819	+0.45	-8.1	18.2	114.6
Feb. 6	03 47.19	+47 35.6	2.297	2.749	+0.81	-7.8	18.1	106.8
Feb. 16	03 56.80	+46 20.2	2.338	2.680	+1.14	-7.3	18.0	99.2
Feb. 26	04 09.46	+45 09.6	2.385	2.615	+1.42	-6.8	18.0	92.1
Mar. 8	04 24.82	+44 02.8	2.434	2.551	+1.67	-6.5	17.9	85.3
Mar. 18	04 42.51	+42 57.8	2.483	2.491	+1.88	-6.5	17.8	78.9
Mar. 28	05 02.17	+41 52.1	2.533	2.434	+2.06	-6.7	17.8	72.9
Apr. 7	05 23.46	+40 42.8	2.581	2.381	+2.21	-7.2	17.7	67.3
Apr. 17	05 46.05	+39 27.1	2.628	2.332	+2.32	-8.0	17.7	62.0
Apr. 27	06 09.59	+38 02.7	2.673	2.287	+2.39	-9.0	17.6	57.0
May 7	06 33.78	+36 27.5	2.718	2.247	+2.44	-10.2	17.6	52.3
May 17	06 58.30	+34 40.3	2.761	2.212	+2.46	-11.4	17.6	47.8
May 27	07 22.88	+32 40.3	2.803	2.183	+2.45	-12.7	17.5	43.5
June 6	07 47.30	+30 27.4	2.846	2.159	+2.43	-14.0	17.5	39.3
June 16	08 11.37	+28 02.1	2.888	2.142	+2.38	-15.2	17.5	35.3
June 26	08 34.95	+25 25.5	2.931	2.130	+2.33	-16.2	17.5	31.4
July 6	08 57.97	+22 38.8	2.974	2.126	+2.27	-17.2	17.5	27.6
July 16	09 20.35	+19 43.7	3.018	2.127	+2.20	-17.9	17.6	23.7
July 26	09 42.09	+16 41.9	3.062	2.135	+2.14	-18.5	17.6	19.9
Aug. 5	10 03.20	+13 35.2	3.106	2.150	+2.08	-18.9	17.7	16.1
Aug. 15	10 23.69	+10 25.3	3.149	2.170	+2.02	-19.1	17.8	12.3
Aug. 25	10 43.60	+07 13.8	3.192	2.197	+1.96	-19.2	17.8	8.4
Sept. 4	11 02.97	+04 02.3	3.232	2.229	+1.91	-19.1	17.9	4.8
Sept. 14	11 21.82	+00 52.1	3.270	2.266	+1.86	-18.9	18.0	3.0
Sept. 24	11 40.20	-02 15.6	3.305	2.309	+1.81	-18.6	18.1	5.7
Oct. 4	11 58.13	-05 19.9	3.335	2.356	+1.77	-18.2	18.2	9.9
Oct. 14	12 15.61	-08 19.9	3.360	2.407	+1.72	-17.7	18.3	14.5
Oct. 24	12 32.66	-11 14.9	3.379	2.462	+1.68	-17.2	18.5	19.4
Nov. 3	12 49.25	-14 04.4	3.390	2.521	+1.63	-16.6	18.6	24.5
Nov. 13	13 05.34	-16 47.9	3.394	2.583	+1.58	-16.0	18.7	29.8
Nov. 23	13 20.89	-19 25.3	3.390	2.647	+1.52	-15.4	18.8	35.4
Dec. 3	13 35.82	-21 56.6	3.376	2.714	+1.45	-14.8	18.9	41.3
Dec. 13	13 50.01	-24 21.5	3.354	2.784	+1.37	-14.1	19.0	47.4
Dec. 23	14 03.35	-26 40.2	3.324	2.855	+1.28	-13.5	19.1	53.8
Jan. 2	14 15.67	-28 53.0	3.286	2.928	+1.17	-13.0	19.1	60.4
Jan. 12	14 26.77	-30 59.9	3.240	3.003	+1.04	-12.4	19.2	67.4
Jan. 22	14 36.45	-33 01.1	3.189	3.079	+0.88	-11.8	19.3	74.7
Feb. 1	14 44.45	-34 56.3	3.134	3.156	+0.70	-11.2	19.4	82.2
Feb. 11	14 50.51	-36 45.2	3.077	3.234	+0.49	-10.5	19.4	90.1
Feb. 21	14 54.38	-38 27.0	3.022	3.313	+0.26	-9.7	19.5	98.3
Mar. 2	14 55.84	-39 59.9	2.971	3.392	+0.01	-8.7	19.6	106.8
Mar. 12	14 54.76	-41 21.8	2.928	3.473	-0.25	-7.5	19.6	115.4
Mar. 22	14 51.18	-42 29.8	2.898	3.554	-0.49	-5.9	19.7	124.1

Comet C/2018 A6 (Gibbs)

Epoch = 2019 July 16.0 TT  
 T = 2019 July 14.26417 TT  
 Peri. = 264.52695 e = 0.8035094  
 Node = 340.38605 2000.0 a = 15.3584014 AU  
 Incl. = 76.95479 n = 0.01637514  
 q = 3.0177815 AU P = 60.19 years

$$m1 = -0.5 + 5 \log(\Delta) + 22.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion	m1	Elong.
2019/20	h m	° ' "			m		°
Jan. 7	11 24.42	-43 23.0	3.259	3.438	-0.64 -22.9	14.1	92.1
Jan. 17	11 16.22	-47 11.8	3.117	3.398	-1.06 -22.7	13.9	98.1
Jan. 27	11 03.33	-50 53.9	2.994	3.359	-1.58 -21.4	13.7	103.3
Feb. 6	10 44.84	-54 17.4	2.892	3.323	-2.18 -18.7	13.5	107.4
Feb. 16	10 20.36	-57 07.1	2.814	3.287	-2.76 -14.5	13.4	110.1
Feb. 26	09 50.67	-59 08.2	2.761	3.254	-3.18 -9.0	13.2	111.3
Mar. 8	09 18.16	-60 10.7	2.732	3.223	-3.27 -2.9	13.1	110.9
Mar. 18	08 46.47	-60 14.7	2.724	3.193	-2.99 +2.5	13.0	109.2
Mar. 28	08 18.87	-59 31.2	2.736	3.166	-2.45 +6.3	12.9	106.4
Apr. 7	07 57.18	-58 16.9	2.762	3.140	-1.82 +8.4	12.9	102.9
Apr. 17	07 41.66	-56 49.1	2.798	3.117	-1.23 +8.9	12.8	99.0
Apr. 27	07 31.66	-55 21.7	2.841	3.096	-0.73 +8.3	12.8	95.1
May 7	07 26.26	-54 04.5	2.886	3.078	-0.32 +6.9	12.8	91.2
May 17	07 24.55	-53 04.3	2.930	3.062	0.00 +4.9	12.8	87.7
May 27	07 25.76	-52 25.0	2.971	3.048	+0.26 +2.7	12.8	84.7
June 6	07 29.32	-52 09.0	3.006	3.037	+0.47 +0.2	12.7	82.1
June 16	07 34.77	-52 17.9	3.035	3.028	+0.63 -2.3	12.7	80.0
June 26	07 41.77	-52 52.3	3.057	3.022	+0.78 -4.9	12.7	78.5
July 6	07 50.11	-53 52.9	3.072	3.019	+0.90 -7.5	12.7	77.5
July 16	07 59.64	-55 19.8	3.080	3.018	+1.01 -10.1	12.7	76.9
July 26	08 10.27	-57 12.9	3.084	3.020	+1.13 -12.7	12.7	76.8
Aug. 5	08 22.06	-59 32.1	3.085	3.024	+1.24 -15.3	12.8	77.1
Aug. 15	08 35.10	-62 16.6	3.084	3.031	+1.38 -17.8	12.8	77.5
Aug. 25	08 49.75	-65 25.1	3.085	3.040	+1.57 -20.1	12.8	78.0
Sept. 4	09 06.67	-68 55.6	3.090	3.052	+1.86 -22.2	12.9	78.5
Sept. 14	09 27.26	-72 44.9	3.101	3.067	+2.36 -23.8	12.9	78.7
Sept. 24	09 54.95	-76 48.0	3.121	3.084	+3.43 -24.8	13.0	78.6
Oct. 4	10 39.52	-80 55.7	3.151	3.103	+6.30 -24.3	13.1	78.1
Oct. 14	12 18.16	-84 40.7	3.194	3.125	+16.74 -18.1	13.2	77.0
Oct. 24	16 20.27	-85 56.3	3.251	3.149	+25.76 +8.8	13.3	75.3
Nov. 3	19 13.48	-83 03.6	3.320	3.175	+9.34 +23.3	13.4	73.0
Nov. 13	20 19.25	-78 57.2	3.401	3.203	+4.35 +25.5	13.5	70.2
Nov. 23	20 54.31	-74 40.9	3.492	3.233	+2.76 +25.5	13.7	66.8
Dec. 3	21 18.44	-70 28.8	3.592	3.265	+2.08 +24.7	13.8	63.0
Dec. 13	21 37.51	-66 26.2	3.698	3.299	+1.73 +23.6	14.0	58.9
Dec. 23	21 53.79	-62 35.6	3.805	3.335	+1.52 +22.4	14.2	54.7
Jan. 2	22 08.35	-58 58.0	3.913	3.372	+1.38 +21.0	14.3	50.4
Jan. 12	22 21.71	-55 34.3	4.017	3.411	+1.28 +19.6	14.5	46.2
Jan. 22	22 34.16	-52 24.3	4.114	3.452	+1.20 +18.2	14.7	42.4
Feb. 1	22 45.86	-49 28.1	4.203	3.494	+1.13 +16.9	14.8	39.1
Feb. 11	22 56.91	-46 45.3	4.280	3.537	+1.07 +15.6	15.0	36.6
Feb. 21	23 07.35	-44 15.6	4.344	3.582	+1.01 +14.3	15.2	35.2
Mar. 2	23 17.20	-41 58.8	4.392	3.628	+0.95 +13.0	15.3	35.2
Mar. 12	23 26.44	-39 54.5	4.424	3.675	+0.89 +11.8	15.4	36.6
Mar. 22	23 35.05	-38 02.4	4.440	3.723	+0.82 +10.5	15.6	39.3

## Comet P/2007 T4 (Gibbs)

Epoch = 2019 July 16.0 TT  
 T = 2019 July 23.65264 TT  
 Peri. = 42.42394 e = 0.6180856  
 Node = 37.05887 2000.0 a = 5.2499311 AU  
 Incl. = 23.85877 n = 0.08193579  
 q = 2.0050243 AU P = 12.03 years

$$m_1 = 12.0 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	23 43.82	-12 43.5	2.948	2.693	-0.50 -7.9	20.8	20.1/44	65.5
Jan. 17	23 53.99	-10 17.7	3.013	2.638	-0.50 -8.2	20.7	21.8/47	58.6
Jan. 27	00 05.36	-07 47.7	3.070	2.583	-0.51 -8.5	20.6	23.4/50	52.0
Feb. 6	00 17.82	-05 13.9	3.118	2.530	-0.52 -8.7	20.5	24.9/51	45.7
Feb. 16	00 31.26	-02 36.9	3.157	2.478	-0.53 -9.0	20.4	26.2/53	39.7
Feb. 26	00 45.61	+00 03.0	3.186	2.428	-0.55 -9.3	20.3	27.5/54	33.9
Mar. 8	01 00.82	+02 45.2	3.205	2.379	-0.57 -9.5	20.2	28.6/55	28.4
Mar. 18	01 16.87	+05 29.1	3.215	2.333	-0.61 -9.8	20.1	29.6/56	23.1
Mar. 28	01 33.76	+08 14.0	3.216	2.288	-0.64 -10.0	19.9	30.6/57	18.0
Apr. 7	01 51.51	+10 59.1	3.209	2.246	-0.68 -10.2	19.8	31.5/58	13.2
Apr. 17	02 10.15	+13 43.4	3.193	2.206	-0.73 -10.3	19.7	32.3/60	8.6
Apr. 27	02 29.73	+16 25.8	3.171	2.169	-0.79 -10.3	19.6	33.1/61	4.5
May 7	02 50.31	+19 05.0	3.143	2.136	-0.85 -10.3	19.4	33.8/62	2.6
May 17	03 11.94	+21 39.6	3.109	2.105	-0.92 -10.1	19.3	34.5/64	5.5
May 27	03 34.68	+24 07.7	3.072	2.079	-1.00 -9.8	19.2	35.1/66	9.3
June 6	03 58.58	+26 27.6	3.031	2.056	-1.08 -9.3	19.1	35.6/68	13.2
June 16	04 23.64	+28 37.3	2.987	2.037	-1.16 -8.7	19.0	36.0/70	16.9
June 26	04 49.85	+30 34.6	2.942	2.022	-1.25 -7.9	18.9	36.3/72	20.6
July 6	05 17.15	+32 17.6	2.895	2.012	-1.33 -6.9	18.9	36.5/75	24.3
July 16	05 45.39	+33 44.4	2.848	2.006	-1.40 -5.8	18.8	36.6/78	27.9
July 26	06 14.38	+34 53.4	2.800	2.005	-1.46 -4.4	18.8	36.5/81	31.5
Aug. 5	06 43.87	+35 44.0	2.753	2.008	-1.50 -3.0	18.7	36.3/83	35.0
Aug. 15	07 13.51	+36 15.8	2.706	2.016	-1.52 -1.5	18.7	35.9/86	38.6
Aug. 25	07 42.99	+36 29.7	2.659	2.029	-1.52 +0.1	18.7	35.3/89	42.3
Sept. 4	08 11.95	+36 27.1	2.611	2.045	-1.49 +1.6	18.7	34.5/92	46.1
Sept. 14	08 40.06	+36 10.5	2.563	2.066	-1.45 +3.1	18.8	33.4/94	50.0
Sept. 24	09 07.07	+35 42.8	2.515	2.091	-1.39 +4.4	18.8	32.2/96	54.1
Oct. 4	09 32.75	+35 07.4	2.465	2.119	-1.32 +5.7	18.9	30.7/97	58.4
Oct. 14	09 56.89	+34 28.2	2.413	2.151	-1.24 +6.8	18.9	29.0/98	62.9
Oct. 24	10 19.37	+33 48.8	2.359	2.186	-1.17 +7.9	19.0	27.1/98	67.8
Nov. 3	10 40.05	+33 12.9	2.303	2.224	-1.09 +8.9	19.0	24.9/97	72.9
Nov. 13	10 58.80	+32 44.1	2.245	2.265	-1.03 +9.8	19.1	22.4/96	78.4
Nov. 23	11 15.47	+32 25.3	2.186	2.309	-0.97 +10.6	19.1	19.6/93	84.4
Dec. 3	11 29.87	+32 19.4	2.125	2.354	-0.93 +11.5	19.2	16.6/89	90.7
Dec. 13	11 41.77	+32 28.2	2.066	2.402	-0.91 +12.4	19.3	13.3/83	97.5
Dec. 23	11 50.93	+32 52.4	2.009	2.451	-0.90 +13.2	19.4	10.0/71	104.8
Jan. 2	11 57.03	+33 31.7	1.957	2.502	-0.91 +14.0	19.4	7.1/49	112.4
Jan. 12	11 59.82	+34 23.3	1.913	2.555	-0.94 +14.7	19.5	5.8/11	120.4
Jan. 22	11 59.10	+35 22.4	1.881	2.609	-0.99 +15.2	19.6	6.9/332	128.4
Feb. 1	11 54.89	+36 21.5	1.864	2.663	-1.06 +15.4	19.7	9.2/307	136.1
Feb. 11	11 47.55	+37 11.4	1.867	2.719	-1.14 +15.2	19.9	11.3/291	142.8
Feb. 21	11 37.85	+37 43.0	1.891	2.775	-1.20 +14.6	20.0	12.7/278	147.3
Mar. 2	11 26.92	+37 49.0	1.940	2.832	-1.24 +13.7	20.2	13.2/266	148.4
Mar. 12	11 16.08	+37 26.3	2.014	2.890	-1.25 +12.7	20.4	12.9/253	145.8
Mar. 22	11 06.50	+36 36.2	2.112	2.948	-1.22 +11.5	20.7	12.1/238	140.3

Comet 200P/Larsen

Epoch = 2019 July 16.0 TT  
 T = 2019 July 28.49002 TT  
 Peri. = 133.97692 e = 0.3317316  
 Node = 234.80221 2000.0 a = 4.9339822 AU  
 Incl. = 12.10563 n = 0.08993064  
 q = 3.2972244 AU P = 10.96 years

$$m_1 = 5.7 + 5 \log(\Delta) + 20.0 \log(r(t-160))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	21 24.74	-04 47.1	4.206	3.473	+1.29	+4.8	20.4	37.1
Jan. 17	21 37.75	-03 55.5	4.268	3.457	+1.32	+5.5	20.4	30.5
Jan. 27	21 51.06	-02 57.4	4.315	3.441	+1.34	+6.1	20.4	24.3
Feb. 6	22 04.57	-01 53.4	4.348	3.426	+1.36	+6.7	20.3	18.3
Feb. 16	22 18.23	+00 44.0	4.367	3.412	+1.37	+7.2	20.3	13.1
Feb. 26	22 31.94	+00 29.9	4.371	3.399	+1.37	+7.6	20.2	9.5
Mar. 8	22 45.68	+01 47.6	4.361	3.386	+1.37	+8.0	20.2	9.5
Mar. 18	22 59.36	+03 08.4	4.337	3.375	+1.36	+8.2	20.1	13.0
Mar. 28	23 12.95	+04 31.4	4.298	3.364	+1.35	+8.4	20.0	18.0
Apr. 7	23 26.41	+05 56.0	4.247	3.353	+1.34	+8.5	20.0	23.6
Apr. 17	23 39.67	+07 21.2	4.182	3.344	+1.31	+8.5	19.9	29.4
Apr. 27	23 52.69	+08 46.2	4.105	3.335	+1.29	+8.5	19.8	35.3
May 7	00 05.42	+10 10.5	4.017	3.328	+1.25	+8.3	19.7	41.4
May 17	00 17.79	+11 33.0	3.919	3.321	+1.21	+8.1	19.6	47.5
May 27	00 29.72	+12 53.0	3.811	3.315	+1.17	+7.8	19.5	53.8
June 6	00 41.13	+14 09.8	3.695	3.310	+1.11	+7.5	19.4	60.2
June 16	00 51.91	+15 22.5	3.573	3.305	+1.04	+7.0	19.3	66.7
June 26	01 01.93	+16 30.2	3.444	3.302	+0.96	+6.5	19.2	73.5
July 6	01 11.04	+17 32.1	3.312	3.300	+0.86	+5.8	19.0	80.5
July 16	01 19.09	+18 27.1	3.177	3.298	+0.74	+5.1	18.9	87.8
July 26	01 25.88	+19 14.2	3.043	3.297	+0.60	+4.2	18.8	95.4
Aug. 5	01 31.22	+19 52.0	2.911	3.297	+0.45	+3.2	18.6	103.4
Aug. 15	01 34.93	+20 19.2	2.784	3.299	+0.28	+2.1	18.5	111.9
Aug. 25	01 36.86	+20 34.2	2.667	3.301	+0.09	+0.8	18.4	120.8
Sept. 4	01 36.91	+20 35.6	2.561	3.304	-0.10	-0.7	18.3	130.2
Sept. 14	01 35.12	+20 22.0	2.472	3.307	-0.27	-2.2	18.2	140.1
Sept. 24	01 31.69	+19 53.1	2.402	3.312	-0.42	-3.7	18.1	150.4
Oct. 4	01 26.98	+19 09.4	2.357	3.318	-0.52	-5.1	18.0	160.7
Oct. 14	01 21.57	+18 13.4	2.338	3.324	-0.55	-6.1	18.0	169.5
Oct. 24	01 16.11	+17 09.0	2.348	3.331	-0.52	-6.7	18.0	169.7
Nov. 3	01 11.25	+16 01.3	2.386	3.340	-0.43	-6.7	18.0	160.9
Nov. 13	01 07.59	+14 56.0	2.452	3.349	-0.28	-6.2	18.0	150.4
Nov. 23	01 05.50	+13 57.9	2.542	3.358	-0.11	-5.3	18.1	139.9
Dec. 3	01 05.21	+13 10.5	2.654	3.369	+0.07	-4.1	18.2	129.6
Dec. 13	01 06.79	+12 35.8	2.783	3.380	+0.26	-2.7	18.3	119.7
Dec. 23	01 10.16	+12 14.4	2.925	3.393	+0.43	-1.4	18.4	110.2
Jan. 2	01 15.20	+12 05.8	3.076	3.406	+0.59	-0.2	18.5	101.1
Jan. 12	01 21.73	+12 08.9	3.233	3.419	+0.73	+0.9	18.6	92.5
Jan. 22	01 29.57	+12 22.3	3.391	3.434	+0.85	+1.8	18.7	84.2
Feb. 1	01 38.55	+12 44.2	3.549	3.449	+0.95	+2.6	18.8	76.2
Feb. 11	01 48.50	+13 13.0	3.703	3.465	+1.04	+3.2	18.9	68.5
Feb. 21	01 59.28	+13 47.1	3.851	3.481	+1.12	+3.6	19.0	61.0
Mar. 2	02 10.77	+14 24.8	3.991	3.498	+1.18	+3.9	19.1	53.8
Mar. 12	02 22.85	+15 04.9	4.121	3.516	+1.24	+4.1	19.2	46.8
Mar. 22	02 35.42	+15 45.9	4.240	3.534	+1.28	+4.1	19.3	39.9

## Comet P/2006 F4 (Spacewatch)

Epoch = 2019 July 16.0 TT  
 T = 2019 Aug. 3.06623 TT  
 Peri. = 31.16914  
 Node = 184.03305 2000.0  
 Incl. = 12.38922  
 q = 2.333882 AU

e = 0.3381126  
 a = 3.5261106 AU  
 n = 0.14885388  
 P = 6.62 years

$$m_1 = 11.2 + 5 \log(\Delta) + 17.5 \log(r)$$

Oh TT 2019/20	R. A. (2000) h m	Decl. ° '	Delta	r	Variation for T=+1 day		m1	Mot./PA	Elong. °
Jan. 7	11 31.85	-05 03.4	2.171	2.677	-1.21	+3.4	20.4	8.2/108	110.4
Jan. 17	11 36.18	-05 21.4	2.023	2.648	-1.32	+3.7	20.1	4.9/100	119.4
Jan. 27	11 38.44	-05 20.7	1.888	2.621	-1.42	+4.1	19.9	2.0/53	128.9
Feb. 6	11 38.48	-04 58.6	1.767	2.594	-1.53	+4.5	19.7	3.9/333	139.1
Feb. 16	11 36.30	-04 13.3	1.666	2.568	-1.64	+4.9	19.5	7.6/320	149.9
Feb. 26	11 32.19	-03 05.5	1.587	2.544	-1.72	+5.2	19.3	10.9/317	161.2
Mar. 8	11 26.67	-01 38.4	1.533	2.520	-1.78	+5.4	19.2	13.1/317	172.2
Mar. 18	11 20.59	+00 01.0	1.507	2.497	-1.80	+5.4	19.0	13.7/319	172.9
Mar. 28	11 14.93	+01 43.4	1.507	2.476	-1.78	+5.1	19.0	12.6/323	162.0
Apr. 7	11 10.58	+03 19.3	1.534	2.455	-1.73	+4.7	19.0	10.2/331	150.7
Apr. 17	11 08.28	+04 40.8	1.582	2.437	-1.65	+4.2	19.0	7.3/348	139.8
Apr. 27	11 08.41	+05 43.0	1.649	2.419	-1.57	+3.7	19.0	5.5/24	129.7
May 7	11 11.08	+06 23.7	1.730	2.403	-1.49	+3.3	19.1	6.7/64	120.3
May 17	11 16.20	+06 43.0	1.822	2.389	-1.41	+3.0	19.1	9.5/85	111.7
May 27	11 23.53	+06 42.2	1.921	2.376	-1.33	+2.8	19.2	12.6/95	103.8
June 6	11 32.81	+06 23.3	2.025	2.364	-1.27	+2.6	19.3	15.5/100	96.4
June 16	11 43.77	+05 48.6	2.131	2.355	-1.21	+2.5	19.4	18.1/104	89.6
June 26	11 56.14	+05 00.3	2.238	2.347	-1.17	+2.5	19.4	20.3/106	83.3
July 6	12 09.70	+04 00.6	2.345	2.341	-1.12	+2.5	19.5	22.2/107	77.3
July 16	12 24.28	+02 51.4	2.450	2.337	-1.09	+2.5	19.6	23.7/108	71.6
July 26	12 39.71	+01 34.8	2.553	2.334	-1.06	+2.5	19.7	25.1/109	66.1
Aug. 5	12 55.90	+00 12.6	2.653	2.334	-1.03	+2.5	19.8	26.2/109	60.9
Aug. 15	13 12.73	-01 13.5	2.749	2.335	-1.01	+2.4	19.8	27.2/109	55.8
Aug. 25	13 30.15	-02 41.8	2.841	2.338	-0.99	+2.4	19.9	28.0/109	50.9
Sept. 4	13 48.09	-04 10.6	2.928	2.343	-0.97	+2.3	20.0	28.6/108	46.0
Sept. 14	14 06.51	-05 38.4	3.011	2.350	-0.95	+2.2	20.1	29.2/107	41.3
Sept. 24	14 25.35	-07 03.7	3.088	2.358	-0.94	+2.1	20.2	29.6/106	36.5
Oct. 4	14 44.60	-08 25.0	3.159	2.369	-0.93	+1.9	20.3	29.9/105	31.9
Oct. 14	15 04.19	-09 41.0	3.223	2.380	-0.91	+1.7	20.3	30.1/104	27.2
Oct. 24	15 24.08	-10 50.3	3.281	2.394	-0.90	+1.5	20.4	30.2/103	22.7
Nov. 3	15 44.22	-11 51.9	3.332	2.409	-0.89	+1.2	20.5	30.3/101	18.2
Nov. 13	16 04.53	-12 44.8	3.374	2.426	-0.88	+1.0	20.6	30.2/99	14.0
Nov. 23	16 24.94	-13 28.0	3.409	2.444	-0.86	+0.7	20.7	30.0/97	10.4
Dec. 3	16 45.36	-14 01.0	3.434	2.463	-0.85	+0.5	20.7	29.8/95	8.4
Dec. 13	17 05.70	-14 23.3	3.451	2.484	-0.84	+0.2	20.8	29.5/93	9.2
Dec. 23	17 25.86	-14 34.7	3.458	2.506	-0.82	0.0	20.9	29.1/91	12.4
Jan. 2	17 45.72	-14 35.3	3.455	2.529	-0.81	-0.2	20.9	28.5/89	16.7
Jan. 12	18 05.18	-14 25.2	3.442	2.553	-0.79	-0.5	21.0	27.9/87	21.6
Jan. 22	18 24.12	-14 05.0	3.419	2.578	-0.77	-0.6	21.1	27.2/85	26.7
Feb. 1	18 42.45	-13 35.4	3.385	2.604	-0.76	-0.8	21.1	26.4/83	32.1
Feb. 11	19 00.04	-12 57.1	3.342	2.631	-0.75	-0.9	21.2	25.4/80	37.7
Feb. 21	19 16.81	-12 11.3	3.289	2.659	-0.74	-1.0	21.2	24.4/78	43.4
Mar. 2	19 32.65	-11 19.0	3.226	2.688	-0.73	-1.1	21.3	23.2/76	49.3
Mar. 12	19 47.45	-10 21.6	3.155	2.717	-0.72	-1.2	21.3	21.8/74	55.4
Mar. 22	20 01.11	-09 20.4	3.076	2.747	-0.72	-1.2	21.3	20.2/72	61.7

Comet 264P/Larsen

Epoch = 2019 July 16.0 TT  
 T = 2019 Aug. 4.96895 TT  
 Peri. = 346.63329 e = 0.3737621  
 Node = 220.90284 2000.0 a = 3.8938183 AU  
 Incl. = 25.15059 n = 0.12827456  
 q = 2.4384566 AU P = 7.68 years

$$m1 = 11.0 + 5 \log(\Delta) + 17.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	10 41.48	-23 43.6	2.289	2.795	+0.17	-8.6	20.6	110.9
Jan. 17	10 42.24	-25 01.9	2.159	2.766	-0.04	-6.8	20.4	118.4
Jan. 27	10 40.83	-25 59.4	2.040	2.737	-0.26	-4.4	20.2	126.0
Feb. 6	10 37.34	-26 30.4	1.937	2.709	-0.45	-1.4	20.0	133.3
Feb. 16	10 32.15	-26 29.1	1.850	2.683	-0.59	+2.0	19.8	139.9
Feb. 26	10 25.92	-25 52.4	1.784	2.657	-0.65	+5.7	19.7	145.1
Mar. 8	10 19.53	-24 40.0	1.740	2.632	-0.61	+9.1	19.6	147.6
Mar. 18	10 13.98	-22 56.3	1.720	2.609	-0.47	+11.8	19.5	146.6
Mar. 28	10 10.14	-20 49.9	1.723	2.587	-0.27	+13.5	19.4	142.5
Apr. 7	10 08.60	-18 31.3	1.747	2.566	-0.01	+14.1	19.4	136.3
Apr. 17	10 09.67	-16 11.6	1.792	2.546	+0.25	+13.7	19.4	129.0
Apr. 27	10 13.38	-13 59.9	1.854	2.528	+0.51	+12.5	19.4	121.4
May 7	10 19.56	-12 02.6	1.930	2.512	+0.75	+10.8	19.4	113.7
May 17	10 27.97	-10 23.7	2.017	2.497	+0.95	+8.8	19.5	106.3
May 27	10 38.29	-09 04.7	2.112	2.483	+1.13	+6.8	19.5	99.1
June 6	10 50.23	-08 05.6	2.214	2.471	+1.27	+4.8	19.6	92.3
June 16	11 03.53	-07 25.6	2.319	2.461	+1.39	+3.0	19.7	85.7
June 26	11 17.93	-07 02.9	2.427	2.453	+1.49	+1.4	19.7	79.5
July 6	11 33.24	-06 55.6	2.534	2.447	+1.58	0.0	19.8	73.4
July 16	11 49.31	-07 01.8	2.641	2.442	+1.64	-1.3	19.9	67.6
July 26	12 05.99	-07 19.2	2.746	2.439	+1.70	-2.3	20.0	62.0
Aug. 5	12 23.19	-07 45.8	2.847	2.438	+1.75	-3.1	20.0	56.5
Aug. 15	12 40.84	-08 19.7	2.945	2.439	+1.79	-3.7	20.1	51.1
Aug. 25	12 58.86	-08 58.9	3.037	2.442	+1.82	-4.1	20.2	45.8
Sept. 4	13 17.21	-09 41.6	3.123	2.447	+1.85	-4.4	20.3	40.6
Sept. 14	13 35.86	-10 26.0	3.203	2.453	+1.88	-4.5	20.3	35.4
Sept. 24	13 54.76	-11 10.5	3.276	2.462	+1.90	-4.4	20.4	30.2
Oct. 4	14 13.89	-11 53.4	3.341	2.472	+1.92	-4.2	20.5	25.1
Oct. 14	14 33.20	-12 33.4	3.397	2.483	+1.94	-3.8	20.6	20.0
Oct. 24	14 52.66	-13 08.9	3.444	2.497	+1.95	-3.3	20.6	15.0
Nov. 3	15 12.22	-13 38.7	3.482	2.512	+1.96	-2.6	20.7	10.2
Nov. 13	15 31.82	-14 01.6	3.510	2.528	+1.96	-1.9	20.8	6.4
Nov. 23	15 51.39	-14 16.5	3.527	2.546	+1.95	-1.0	20.8	5.9
Dec. 3	16 10.86	-14 22.5	3.533	2.566	+1.94	-0.1	20.9	9.4
Dec. 13	16 30.13	-14 18.9	3.529	2.587	+1.91	+0.9	21.0	14.4
Dec. 23	16 49.12	-14 05.1	3.514	2.609	+1.88	+2.0	21.0	19.7
Jan. 2	17 07.71	-13 40.7	3.488	2.633	+1.83	+3.0	21.1	25.2
Jan. 12	17 25.79	-13 05.5	3.452	2.657	+1.78	+4.1	21.1	30.9
Jan. 22	17 43.25	-12 19.5	3.406	2.683	+1.71	+5.2	21.2	36.8
Feb. 1	17 59.96	-11 22.9	3.349	2.710	+1.63	+6.2	21.2	42.7
Feb. 11	18 15.81	-10 16.0	3.285	2.737	+1.53	+7.2	21.2	48.8
Feb. 21	18 30.67	-08 59.4	3.212	2.766	+1.43	+8.2	21.3	55.0
Mar. 2	18 44.41	-07 33.7	3.132	2.795	+1.31	+9.0	21.3	61.4
Mar. 12	18 56.89	-05 59.8	3.046	2.825	+1.17	+9.8	21.3	67.9
Mar. 22	19 07.98	-04 18.7	2.956	2.856	+1.03	+10.5	21.3	74.5

Comet 163P/NEAT

Epoch = 2019 July 16.0 TT  
 T = 2019 Aug. 5.24037 TT  
 Peri. = 349.70132 e = 0.4520054  
 Node = 102.09183 2000.0 a = 3.7712472 AU  
 Incl. = 12.70767 n = 0.13457878  
 q = 2.0666231 AU P = 7.32 years

$$m1 = 12.9 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion	m1	Elong.
2019/20	h m	° ' "			m		°
Jan. 7	00 17.10	-11 19.8	2.717	2.616	+1.01 +10.9	21.3	73.6
Jan. 17	00 27.84	-09 28.2	2.798	2.574	+1.15 +11.5	21.3	66.8
Jan. 27	00 39.90	-07 31.1	2.872	2.533	+1.27 +12.0	21.2	60.3
Feb. 6	00 53.14	-05 29.6	2.939	2.492	+1.38 +12.3	21.2	54.1
Feb. 16	01 07.45	-03 24.9	2.998	2.453	+1.49 +12.6	21.1	48.2
Feb. 26	01 22.73	-01 18.1	3.048	2.414	+1.58 +12.7	21.1	42.6
Mar. 8	01 38.90	+00 49.6	3.090	2.377	+1.67 +12.8	21.0	37.3
Mar. 18	01 55.93	+02 57.1	3.123	2.341	+1.75 +12.7	20.9	32.1
Mar. 28	02 13.76	+05 03.1	3.148	2.307	+1.83 +12.5	20.8	27.3
Apr. 7	02 32.39	+07 06.6	3.165	2.274	+1.91 +12.2	20.8	22.6
Apr. 17	02 51.78	+09 06.1	3.175	2.243	+1.98 +11.7	20.7	18.2
Apr. 27	03 11.92	+11 00.4	3.178	2.215	+2.05 +11.1	20.6	14.0
May 7	03 32.78	+12 48.2	3.174	2.188	+2.13 +10.4	20.5	10.2
May 17	03 54.35	+14 28.0	3.164	2.163	+2.19 +9.5	20.4	6.9
May 27	04 16.57	+15 58.7	3.148	2.142	+2.26 +8.5	20.4	5.3
June 6	04 39.40	+17 19.1	3.128	2.122	+2.31 +7.4	20.3	6.3
June 16	05 02.77	+18 28.0	3.103	2.106	+2.36 +6.2	20.2	9.0
June 26	05 26.58	+19 24.7	3.073	2.092	+2.40 +5.0	20.1	12.4
July 6	05 50.73	+20 08.4	3.040	2.081	+2.43 +3.6	20.1	15.9
July 16	06 15.09	+20 38.8	3.002	2.073	+2.44 +2.3	20.0	19.6
July 26	06 39.53	+20 56.0	2.961	2.068	+2.44 +1.0	20.0	23.4
Aug. 5	07 03.92	+21 00.2	2.916	2.067	+2.43 -0.3	20.0	27.2
Aug. 15	07 28.09	+20 52.2	2.868	2.068	+2.40 -1.4	19.9	31.1
Aug. 25	07 51.92	+20 33.1	2.815	2.073	+2.36 -2.5	19.9	35.2
Sept. 4	08 15.28	+20 04.2	2.759	2.080	+2.30 -3.4	19.9	39.4
Sept. 14	08 38.04	+19 27.4	2.698	2.091	+2.24 -4.1	19.9	43.8
Sept. 24	09 00.10	+18 44.5	2.634	2.105	+2.16 -4.5	19.9	48.3
Oct. 4	09 21.36	+17 57.8	2.565	2.121	+2.08 -4.8	19.8	53.1
Oct. 14	09 41.69	+17 09.7	2.492	2.140	+1.98 -4.8	19.8	58.1
Oct. 24	10 01.02	+16 22.7	2.415	2.162	+1.87 -4.5	19.8	63.5
Nov. 3	10 19.22	+15 39.5	2.334	2.187	+1.75 -4.0	19.8	69.1
Nov. 13	10 36.15	+15 02.9	2.250	2.213	+1.62 -3.2	19.8	75.1
Nov. 23	10 51.66	+14 35.7	2.164	2.242	+1.47 -2.1	19.8	81.5
Dec. 3	11 05.55	+14 20.6	2.076	2.273	+1.29 -0.7	19.8	88.4
Dec. 13	11 17.60	+14 20.4	1.989	2.305	+1.09 +0.9	19.8	95.7
Dec. 23	11 27.55	+14 37.4	1.904	2.339	+0.87 +2.7	19.8	103.6
Jan. 2	11 35.09	+15 13.2	1.824	2.375	+0.61 +4.7	19.8	112.1
Jan. 12	11 39.97	+16 08.2	1.752	2.412	+0.33 +6.5	19.9	121.1
Jan. 22	11 41.98	+17 21.0	1.692	2.451	+0.04 +8.1	19.9	130.7
Feb. 1	11 41.02	+18 47.3	1.649	2.490	-0.25 +9.1	19.9	140.6
Feb. 11	11 37.30	+20 20.2	1.626	2.531	-0.51 +9.3	20.0	150.3
Feb. 21	11 31.33	+21 50.4	1.626	2.572	-0.69 +8.5	20.1	158.6
Mar. 2	11 23.93	+23 08.2	1.652	2.614	-0.78 +6.8	20.3	162.3
Mar. 12	11 16.20	+24 05.5	1.705	2.657	-0.75 +4.4	20.4	159.0
Mar. 22	11 09.17	+24 38.1	1.783	2.700	-0.63 +1.8	20.6	151.3



Comet 168P/Hergenrother

Epoch = 2019 July 16.0 TT  
 T = 2019 Aug. 5.58236 TT  
 Peri. = 14.99908 e = 0.6204805  
 Node = 355.46899 2000.0 a = 3.5804587 AU  
 Incl. = 21.61041 n = 0.14547758  
 q = 1.3588539 AU P = 6.77 years

$$m_1 = 13.5 + 5 \log(\Delta) + 12.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	18 17.53	-39 08.4	3.440	2.539	+2.38	+1.0	21.2	20.1
Jan. 17	18 41.63	-38 52.8	3.337	2.468	+2.44	+2.2	21.0	23.7
Jan. 27	19 06.32	-38 25.1	3.225	2.397	+2.50	+3.5	20.8	27.7
Feb. 6	19 31.51	-37 43.9	3.105	2.326	+2.54	+4.9	20.5	31.8
Feb. 16	19 57.05	-36 48.2	2.977	2.254	+2.57	+6.4	20.3	36.0
Feb. 26	20 22.84	-35 37.0	2.845	2.182	+2.59	+8.0	20.0	40.0
Mar. 8	20 48.78	-34 09.2	2.709	2.110	+2.60	+9.7	19.7	44.0
Mar. 18	21 14.75	-32 24.2	2.571	2.039	+2.60	+11.5	19.4	47.7
Mar. 28	21 40.70	-30 21.1	2.433	1.968	+2.59	+13.3	19.1	51.2
Apr. 7	22 06.59	-27 59.1	2.295	1.897	+2.58	+15.3	18.8	54.5
Apr. 17	22 32.36	-25 17.6	2.161	1.829	+2.57	+17.3	18.4	57.5
Apr. 27	22 58.04	-22 15.9	2.030	1.762	+2.56	+19.3	18.1	60.2
May 7	23 23.66	-18 53.1	1.905	1.697	+2.56	+21.4	17.8	62.7
May 17	23 49.25	-15 08.9	1.786	1.636	+2.56	+23.6	17.4	64.8
May 27	00 14.89	-11 03.0	1.675	1.578	+2.57	+25.8	17.1	66.7
June 6	00 40.71	-06 35.4	1.572	1.525	+2.59	+27.9	16.8	68.4
June 16	01 06.81	-01 47.4	1.479	1.478	+2.63	+29.9	16.5	69.9
June 26	01 33.37	+03 19.0	1.396	1.437	+2.69	+31.5	16.2	71.1
July 6	02 00.54	+08 40.2	1.324	1.404	+2.76	+32.7	16.0	72.4
July 16	02 28.50	+14 10.6	1.264	1.380	+2.85	+33.3	15.8	73.6
July 26	02 57.42	+19 43.2	1.214	1.364	+2.95	+33.1	15.6	74.9
Aug. 5	03 27.37	+25 09.4	1.174	1.359	+3.05	+31.9	15.5	76.4
Aug. 15	03 58.32	+30 20.5	1.144	1.363	+3.15	+30.0	15.5	78.1
Aug. 25	04 30.10	+35 08.8	1.122	1.377	+3.21	+27.3	15.5	80.2
Sept. 4	05 02.26	+39 28.8	1.106	1.401	+3.21	+24.3	15.5	82.8
Sept. 14	05 34.09	+43 18.1	1.095	1.433	+3.13	+21.3	15.6	85.9
Sept. 24	06 04.70	+46 38.0	1.086	1.473	+2.95	+18.5	15.8	89.6
Oct. 4	06 32.95	+49 33.1	1.079	1.519	+2.65	+16.4	15.9	93.8
Oct. 14	06 57.61	+52 09.1	1.072	1.572	+2.22	+14.8	16.1	98.7
Oct. 24	07 17.42	+54 32.6	1.067	1.629	+1.66	+13.9	16.3	104.3
Nov. 3	07 30.98	+56 47.8	1.064	1.690	+0.96	+13.1	16.5	110.5
Nov. 13	07 36.92	+58 54.4	1.065	1.754	+0.13	+12.0	16.7	117.1
Nov. 23	07 34.13	+60 46.3	1.073	1.821	-0.79	+9.9	16.9	124.0
Dec. 3	07 22.22	+62 09.8	1.092	1.889	-1.65	+6.1	17.1	130.8
Dec. 13	07 02.88	+62 48.0	1.124	1.959	-2.20	+0.8	17.4	136.6
Dec. 23	06 40.12	+62 28.8	1.173	2.030	-2.27	-5.2	17.7	140.4
Jan. 2	06 18.98	+61 12.4	1.241	2.102	-1.86	-10.3	18.0	141.5
Jan. 12	06 03.23	+59 12.9	1.330	2.173	-1.21	-13.6	18.3	139.5
Jan. 22	05 54.05	+56 49.2	1.439	2.245	-0.57	-15.0	18.7	135.0
Feb. 1	05 50.96	+54 17.9	1.567	2.317	-0.01	-15.1	19.0	129.0
Feb. 11	05 52.86	+51 50.1	1.712	2.389	+0.41	-14.3	19.4	122.2
Feb. 21	05 58.52	+49 31.5	1.871	2.460	+0.73	-13.3	19.7	115.1
Mar. 2	06 06.99	+47 23.9	2.043	2.530	+0.97	-12.1	20.1	107.9
Mar. 12	06 17.48	+45 27.2	2.224	2.600	+1.14	-11.1	20.4	100.8
Mar. 22	06 29.42	+43 40.0	2.411	2.670	+1.26	-10.3	20.7	93.9

Comet P/2012 K3 (Gibbs)

Epoch = 2019 July 16.0 TT  
 T = 2019 Aug. 17.43126 TT  
 Peri. = 172.11572 e = 0.4237907  
 Node = 125.81046 2000.0 a = 3.6255906 AU  
 Incl. = 13.19351 n = 0.14276966  
 q = 2.0890990 AU P = 6.90 years

$$m_1 = 12.0 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	16 03.49	-09 53.1	3.230	2.648	-0.82 +3.7	20.9	25.7/99	46.3
Jan. 17	16 20.70	-10 27.7	3.096	2.608	-0.87 +3.7	20.7	25.5/97	52.0
Jan. 27	16 37.86	-10 53.5	2.956	2.568	-0.93 +3.8	20.5	25.3/95	57.7
Feb. 6	16 54.87	-11 10.3	2.811	2.530	-0.99 +3.8	20.3	24.8/93	63.5
Feb. 16	17 11.58	-11 18.2	2.662	2.492	-1.06 +3.8	20.1	24.2/91	69.3
Feb. 26	17 27.84	-11 17.6	2.513	2.454	-1.14 +3.9	19.8	23.5/89	75.2
Mar. 8	17 43.49	-11 09.1	2.362	2.418	-1.22 +3.9	19.6	22.4/87	81.2
Mar. 18	17 58.31	-10 53.5	2.213	2.383	-1.32 +4.0	19.4	21.2/85	87.3
Mar. 28	18 12.13	-10 32.5	2.065	2.350	-1.43 +4.0	19.1	19.6/83	93.6
Apr. 7	18 24.68	-10 07.8	1.922	2.318	-1.55 +4.1	18.9	17.5/82	100.1
Apr. 17	18 35.70	-09 41.9	1.784	2.287	-1.68 +4.2	18.6	15.1/80	106.9
Apr. 27	18 44.92	-09 17.8	1.653	2.258	-1.83 +4.3	18.4	12.2/80	114.0
May 7	18 52.03	-08 59.1	1.530	2.231	-2.00 +4.5	18.2	8.7/81	121.6
May 17	18 56.73	-08 50.1	1.418	2.206	-2.19 +4.6	17.9	4.9/88	129.7
May 27	18 58.84	-08 55.3	1.320	2.183	-2.38 +4.7	17.7	1.7/148	138.3
June 6	18 58.24	-09 19.1	1.237	2.162	-2.58 +4.8	17.5	4.7/221	147.4
June 16	18 55.12	-10 04.8	1.172	2.144	-2.75 +4.9	17.3	8.6/227	156.8
June 26	18 50.05	-11 13.2	1.129	2.128	-2.87 +5.1	17.2	11.8/227	165.5
July 6	18 43.88	-12 42.1	1.107	2.115	-2.94 +5.4	17.1	13.5/223	169.4
July 16	18 37.86	-14 25.8	1.109	2.104	-2.93 +5.7	17.1	13.5/216	163.8
July 26	18 33.18	-16 16.7	1.133	2.096	-2.85 +6.0	17.1	12.3/204	154.6
Aug. 5	18 30.86	-18 07.3	1.178	2.091	-2.73 +6.2	17.2	10.8/185	145.0
Aug. 15	18 31.58	-19 51.2	1.241	2.089	-2.58 +6.2	17.3	10.4/160	135.7
Aug. 25	18 35.54	-21 24.1	1.319	2.090	-2.42 +6.0	17.4	11.7/137	127.0
Sept. 4	18 42.69	-22 43.1	1.411	2.094	-2.27 +5.5	17.6	14.1/120	118.9
Sept. 14	18 52.79	-23 46.8	1.512	2.100	-2.13 +4.9	17.7	16.8/109	111.4
Sept. 24	19 05.42	-24 34.2	1.622	2.109	-2.00 +4.2	17.9	19.3/102	104.4
Oct. 4	19 20.19	-25 05.0	1.738	2.121	-1.88 +3.4	18.1	21.6/96	97.9
Oct. 14	19 36.69	-25 19.1	1.859	2.136	-1.77 +2.6	18.3	23.4/91	91.7
Oct. 24	19 54.51	-25 16.8	1.984	2.153	-1.67 +1.7	18.5	25.0/88	85.8
Nov. 3	20 13.33	-24 58.7	2.112	2.172	-1.58 +0.9	18.7	26.3/84	80.0
Nov. 13	20 32.82	-24 25.6	2.241	2.194	-1.48 +0.2	18.9	27.3/81	74.5
Nov. 23	20 52.71	-23 38.6	2.371	2.218	-1.40 -0.5	19.1	28.1/79	69.1
Dec. 3	21 12.80	-22 38.9	2.500	2.245	-1.31 -1.1	19.3	28.7/77	63.7
Dec. 13	21 32.91	-21 28.2	2.627	2.273	-1.23 -1.6	19.4	29.0/75	58.5
Dec. 23	21 52.91	-20 07.8	2.752	2.302	-1.16 -2.0	19.6	29.3/73	53.2
Jan. 2	22 12.71	-18 39.4	2.873	2.334	-1.09 -2.3	19.8	29.4/72	48.1
Jan. 12	22 32.24	-17 04.6	2.990	2.367	-1.02 -2.6	20.0	29.4/71	42.9
Jan. 22	22 51.46	-15 25.1	3.101	2.401	-0.97 -2.8	20.2	29.4/70	37.8
Feb. 1	23 10.35	-13 42.2	3.206	2.437	-0.91 -3.0	20.3	29.2/69	32.8
Feb. 11	23 28.89	-11 57.5	3.303	2.473	-0.86 -3.1	20.5	28.9/69	27.7
Feb. 21	23 47.08	-10 12.3	3.393	2.511	-0.82 -3.1	20.6	28.6/68	22.8
Mar. 2	00 04.94	-08 27.9	3.473	2.549	-0.77 -3.1	20.8	28.2/68	18.1
Mar. 12	00 22.45	-06 45.4	3.543	2.588	-0.74 -3.1	20.9	27.7/69	13.7
Mar. 22	00 39.62	-05 05.8	3.603	2.628	-0.70 -3.0	21.1	27.2/69	10.2

## Comet 25D/Neujmin

Epoch = 2019 July 16.0 TT  
 T = 2019 Aug. 18.21434 TT  
 Peri. = 215.22693 e = 0.5821705  
 Node = 307.54780 2000.0 a = 3.0896385 AU  
 Incl. = 5.31889 n = 0.18148577  
 q = 1.2909421 AU P = 5.43 years

$$m_1 = 15.5 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° ' "			for T=+1 day			°
Jan. 7	01 46.68	+17 38.3	2.106	2.542	-0.68 -4.1	21.2	4.3/106	104.9
Jan. 17	01 50.81	+17 33.2	2.178	2.476	-0.66 -3.8	21.1	8.0/88	95.6
Jan. 27	01 57.54	+17 42.9	2.249	2.409	-0.65 -3.6	21.1	11.6/82	87.1
Feb. 6	02 06.64	+18 05.5	2.318	2.341	-0.66 -3.3	21.0	15.0/79	79.1
Feb. 16	02 17.91	+18 39.1	2.379	2.272	-0.68 -3.1	20.9	18.0/78	71.7
Feb. 26	02 31.19	+19 21.4	2.433	2.203	-0.70 -2.9	20.9	20.8/77	64.9
Mar. 8	02 46.36	+20 09.9	2.477	2.133	-0.74 -2.8	20.8	23.3/77	58.5
Mar. 18	03 03.35	+21 02.1	2.510	2.063	-0.79 -2.6	20.6	25.7/78	52.6
Mar. 28	03 22.09	+21 55.4	2.533	1.993	-0.85 -2.3	20.5	27.9/79	47.1
Apr. 7	03 42.58	+22 47.1	2.546	1.923	-0.92 -2.0	20.4	30.1/80	42.1
Apr. 17	04 04.80	+23 34.4	2.548	1.854	-1.00 -1.6	20.2	32.1/82	37.4
Apr. 27	04 28.74	+24 14.0	2.541	1.785	-1.09 -1.1	20.0	34.2/84	33.2
May 7	04 54.40	+24 42.8	2.526	1.718	-1.18 -0.4	19.9	36.3/86	29.3
May 17	05 21.73	+24 57.1	2.503	1.653	-1.27 +0.4	19.7	38.4/89	25.8
May 27	05 50.63	+24 53.5	2.476	1.590	-1.37 +1.5	19.5	40.5/92	22.7
June 6	06 20.98	+24 28.5	2.444	1.531	-1.46 +2.7	19.3	42.6/95	20.0
June 16	06 52.58	+23 39.0	2.411	1.476	-1.55 +4.0	19.1	44.7/98	17.7
June 26	07 25.16	+22 22.7	2.377	1.426	-1.62 +5.6	18.9	46.7/101	15.7
July 6	07 58.45	+20 37.9	2.346	1.382	-1.67 +7.1	18.8	48.7/104	14.1
July 16	08 32.16	+18 24.8	2.318	1.346	-1.71 +8.7	18.6	50.4/107	12.8
July 26	09 06.00	+15 44.7	2.296	1.318	-1.73 +10.1	18.5	51.9/109	11.8
Aug. 5	09 39.76	+12 40.6	2.281	1.300	-1.74 +11.3	18.4	53.0/112	11.0
Aug. 15	10 13.24	+09 17.1	2.275	1.291	-1.73 +12.2	18.4	53.7/113	10.4
Aug. 25	10 46.35	+05 39.8	2.278	1.293	-1.71 +12.8	18.4	53.9/114	9.8
Sept. 4	11 19.03	+01 54.9	2.291	1.305	-1.69 +12.9	18.5	53.6/115	9.2
Sept. 14	11 51.25	-01 51.0	2.314	1.327	-1.65 +12.6	18.6	52.9/115	8.5
Sept. 24	12 23.02	-05 31.9	2.346	1.358	-1.62 +11.9	18.7	51.8/115	7.6
Oct. 4	12 54.36	-09 02.2	2.386	1.397	-1.58 +10.9	18.8	50.3/114	6.5
Oct. 14	13 25.27	-12 17.6	2.434	1.443	-1.53 +9.8	19.0	48.6/113	5.2
Oct. 24	13 55.73	-15 14.8	2.486	1.495	-1.48 +8.5	19.2	46.7/111	3.9
Nov. 3	14 25.72	-17 51.6	2.541	1.551	-1.42 +7.1	19.4	44.8/109	3.2
Nov. 13	14 55.16	-20 06.6	2.597	1.612	-1.36 +5.8	19.6	42.8/107	4.3
Nov. 23	15 23.97	-21 59.7	2.653	1.676	-1.29 +4.5	19.9	40.8/104	6.7
Dec. 3	15 52.06	-23 31.1	2.705	1.742	-1.22 +3.3	20.1	38.8/102	9.9
Dec. 13	16 19.29	-24 41.9	2.752	1.809	-1.15 +2.2	20.3	36.9/99	13.5
Dec. 23	16 45.55	-25 33.5	2.792	1.878	-1.08 +1.3	20.5	35.0/97	17.6
Jan. 2	17 10.74	-26 07.6	2.824	1.948	-1.00 +0.5	20.6	33.1/94	22.0
Jan. 12	17 34.72	-26 26.2	2.846	2.018	-0.93 -0.2	20.8	31.3/92	26.8
Jan. 22	17 57.41	-26 31.3	2.858	2.088	-0.87 -0.7	21.0	29.5/90	31.8
Feb. 1	18 18.71	-26 25.3	2.858	2.158	-0.80 -1.2	21.1	27.6/88	37.2
Feb. 11	18 38.53	-26 10.2	2.847	2.227	-0.75 -1.6	21.2	25.6/86	42.9
Feb. 21	18 56.81	-25 48.2	2.823	2.296	-0.70 -1.9	21.4	23.6/84	48.8
Mar. 2	19 13.47	-25 21.6	2.788	2.365	-0.66 -2.2	21.5	21.5/82	55.1
Mar. 12	19 28.40	-24 52.3	2.742	2.433	-0.62 -2.4	21.6	19.2/81	61.7
Mar. 22	19 41.53	-24 22.4	2.685	2.500	-0.60 -2.5	21.6	16.8/80	68.6

## Comet C/2018 W2 (Africano)

Epoch = 2019 July 16.0 TT  
 T = 2019 Sept. 5.77384 TT  
 Peri. = 158.00568  
 Node = 181.84914 2000.0  
 Incl. = 116.61706  
 q = 1.4540733 AU  
 e = 1.0002765

$$m1 = 10.8 + 5 \log(\Delta) + 7.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	13 47.38	+56 35.0	3.038	3.407	+1.26	+25.5	17.2	103.7
Jan. 17	14 00.22	+61 05.7	2.877	3.307	+1.32	+28.9	17.0	107.4
Jan. 27	14 13.84	+66 07.5	2.745	3.207	+1.42	+31.6	16.8	109.2
Feb. 6	14 28.84	+71 32.7	2.645	3.106	+1.62	+33.4	16.6	108.8
Feb. 16	14 46.83	+77 09.9	2.578	3.005	+2.12	+33.8	16.4	106.1
Feb. 26	15 14.45	+82 44.9	2.542	2.904	+4.16	+32.8	16.3	101.4
Mar. 8	17 02.52	+87 54.5	2.532	2.803	+40.35	+24.8	16.2	95.3
Mar. 18	01 44.38	+86 31.8	2.544	2.703	+10.33	-27.2	16.1	88.2
Mar. 28	02 39.40	+82 06.1	2.569	2.602	+2.82	-25.3	16.0	80.8
Apr. 7	03 01.77	+78 07.1	2.600	2.502	+1.77	-22.2	15.9	73.2
Apr. 17	03 17.64	+74 39.1	2.630	2.403	+1.41	-19.1	15.8	66.0
Apr. 27	03 30.90	+71 40.5	2.653	2.305	+1.24	-16.3	15.6	59.2
May 7	03 42.69	+69 08.7	2.662	2.209	+1.12	-13.8	15.5	53.1
May 17	03 53.35	+67 00.6	2.653	2.114	+1.01	-11.6	15.4	48.0
May 27	04 02.99	+65 12.9	2.623	2.022	+0.91	-9.7	15.2	44.1
June 6	04 11.58	+63 43.1	2.568	1.933	+0.80	-8.1	15.0	41.8
June 16	04 18.96	+62 28.5	2.486	1.848	+0.66	-6.7	14.8	41.2
June 26	04 24.90	+61 26.8	2.377	1.768	+0.50	-5.5	14.5	42.6
July 6	04 29.06	+60 36.1	2.238	1.694	+0.30	-4.5	14.3	45.8
July 16	04 30.83	+59 54.4	2.071	1.628	+0.02	-3.8	14.0	50.6
July 26	04 29.35	+59 18.8	1.876	1.570	-0.37	-3.3	13.6	56.8
Aug. 5	04 23.16	+58 45.4	1.656	1.523	-0.97	-3.5	13.3	64.4
Aug. 15	04 09.68	+58 04.7	1.414	1.487	-1.89	-5.2	12.8	73.5
Aug. 25	03 44.54	+56 52.4	1.157	1.464	-3.41	-10.9	12.4	84.6
Sept. 4	03 00.50	+53 57.6	0.897	1.454	-5.77	-29.3	11.8	99.3
Sept. 14	01 50.68	+45 45.3	0.658	1.459	-8.30	-83.2	11.1	121.0
Sept. 24	00 23.93	+24 49.8	0.506	1.477	-8.49	175.6	10.6	154.7
Oct. 4	23 09.16	-05 10.0	0.538	1.508	-6.02	155.4	10.8	156.1
Oct. 14	22 20.89	-24 46.6	0.734	1.552	-3.52	-77.3	11.6	126.7
Oct. 24	21 53.77	-34 14.5	0.998	1.606	-1.87	-37.7	12.3	107.4
Nov. 3	21 40.07	-39 01.9	1.281	1.670	-0.85	-20.3	13.0	93.7
Nov. 13	21 34.69	-41 42.9	1.564	1.741	-0.21	-12.0	13.6	82.7
Nov. 23	21 34.66	-43 21.2	1.837	1.819	+0.22	-7.7	14.1	73.3
Dec. 3	21 38.29	-44 25.9	2.096	1.902	+0.52	-5.3	14.5	65.0
Dec. 13	21 44.51	-45 11.8	2.335	1.990	+0.74	-3.9	14.9	57.6
Dec. 23	21 52.64	-45 47.4	2.553	2.081	+0.90	-3.2	15.2	51.1
Jan. 2	22 02.24	-46 17.7	2.748	2.175	+1.03	-2.9	15.5	45.5
Jan. 12	22 13.00	-46 46.6	2.917	2.270	+1.13	-2.9	15.8	41.1
Jan. 22	22 24.69	-47 16.7	3.062	2.368	+1.22	-3.2	16.0	38.2
Feb. 1	22 37.19	-47 50.4	3.182	2.467	+1.29	-3.7	16.3	36.9
Feb. 11	22 50.36	-48 29.8	3.278	2.566	+1.35	-4.3	16.4	37.5
Feb. 21	23 04.18	-49 16.7	3.351	2.667	+1.42	-5.2	16.6	39.7
Mar. 2	23 18.61	-50 13.1	3.403	2.767	+1.48	-6.2	16.8	43.4
Mar. 12	23 33.65	-51 20.6	3.436	2.868	+1.54	-7.4	16.9	48.0
Mar. 22	23 49.36	-52 40.9	3.453	2.969	+1.61	-8.8	17.0	53.4

## Comet C/2018 KJ3 (Lemmon)

Epoch = 2019 July 16.0 TT  
 T = 2019 Sept. 9.52502 TT  
 Peri. = 217.63067  
 Node = 91.59373 2000.0  
 Incl. = 136.70625  
 q = 3.6283275 AU  
 e = 0.9959838

$$m1 = 4.8 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .5			m	'		°
Jan. 7	18 35.52	-19 21.5	5.204	4.234	+0.46	-4.5	17.8	8.6
Jan. 17	18 40.11	-20 06.2	5.120	4.190	+0.45	-4.5	17.7	17.1
Jan. 27	18 44.48	-20 51.6	5.008	4.147	+0.42	-4.6	17.6	26.2
Feb. 6	18 48.46	-21 38.9	4.869	4.106	+0.37	-4.9	17.4	35.4
Feb. 16	18 51.82	-22 29.6	4.706	4.065	+0.29	-5.3	17.3	44.8
Feb. 26	18 54.34	-23 25.3	4.522	4.027	+0.19	-5.9	17.2	54.4
Mar. 8	18 55.72	-24 27.8	4.320	3.989	+0.06	-6.7	17.0	64.2
Mar. 18	18 55.64	-25 39.0	4.104	3.954	-0.10	-7.7	16.8	74.3
Mar. 28	18 53.68	-27 01.0	3.881	3.919	-0.32	-8.9	16.6	84.8
Apr. 7	18 49.37	-28 35.4	3.657	3.887	-0.58	-10.2	16.5	95.7
Apr. 17	18 42.11	-30 23.2	3.439	3.856	-0.91	-11.5	16.3	107.2
Apr. 27	18 31.28	-32 23.5	3.235	3.827	-1.31	-12.6	16.1	119.1
May 7	18 16.23	-34 32.7	3.055	3.799	-1.76	-13.1	15.9	131.5
May 17	17 56.50	-36 43.0	2.908	3.774	-2.23	-12.7	15.8	144.1
May 27	17 32.17	-38 42.3	2.804	3.750	-2.66	-10.8	15.7	155.6
June 6	17 04.12	-40 16.5	2.750	3.729	-2.94	-7.6	15.6	162.2
June 16	16 34.29	-41 14.6	2.748	3.709	-2.99	-3.6	15.5	158.0
June 26	16 05.13	-41 33.8	2.796	3.691	-2.79	0.0	15.5	147.1
July 6	15 38.84	-41 20.4	2.890	3.676	-2.41	+2.7	15.6	134.6
July 16	15 16.80	-40 46.5	3.021	3.663	-1.95	+4.0	15.7	122.0
July 26	14 59.37	-40 04.4	3.177	3.651	-1.50	+4.3	15.7	110.0
Aug. 5	14 46.28	-39 23.6	3.350	3.642	-1.09	+3.7	15.8	98.6
Aug. 15	14 36.94	-38 50.2	3.530	3.636	-0.75	+2.8	15.9	87.8
Aug. 25	14 30.69	-38 27.1	3.710	3.631	-0.48	+1.7	16.0	77.7
Sept. 4	14 26.95	-38 15.7	3.883	3.629	-0.26	+0.5	16.1	68.1
Sept. 14	14 25.17	-38 16.1	4.043	3.629	-0.09	-0.7	16.2	59.0
Sept. 24	14 24.91	-38 27.9	4.186	3.631	+0.04	-1.8	16.3	50.5
Oct. 4	14 25.83	-38 50.4	4.308	3.635	+0.14	-2.8	16.4	42.6
Oct. 14	14 27.59	-39 23.1	4.406	3.642	+0.21	-3.8	16.4	35.6
Oct. 24	14 29.91	-40 05.3	4.480	3.650	+0.25	-4.7	16.5	29.8
Nov. 3	14 32.55	-40 56.6	4.526	3.661	+0.27	-5.6	16.5	26.1
Nov. 13	14 35.24	-41 56.8	4.544	3.674	+0.26	-6.5	16.6	25.3
Nov. 23	14 37.72	-43 05.6	4.536	3.690	+0.23	-7.4	16.6	27.7
Dec. 3	14 39.70	-44 23.1	4.500	3.707	+0.16	-8.2	16.6	32.5
Dec. 13	14 40.83	-45 49.0	4.440	3.726	+0.05	-9.1	16.6	39.0
Dec. 23	14 40.71	-47 23.4	4.356	3.748	-0.10	-9.9	16.6	46.5
Jan. 2	14 38.83	-49 05.7	4.254	3.771	-0.31	-10.6	16.6	54.7
Jan. 12	14 34.56	-50 54.9	4.136	3.796	-0.59	-11.2	16.6	63.3
Jan. 22	14 27.13	-52 48.8	4.007	3.824	-0.95	-11.5	16.6	72.2
Feb. 1	14 15.58	-54 43.1	3.875	3.853	-1.42	-11.2	16.5	81.4
Feb. 11	13 58.92	-56 30.5	3.745	3.883	-1.98	-10.0	16.5	90.7
Feb. 21	13 36.34	-58 00.2	3.624	3.916	-2.60	-7.4	16.5	99.8
Mar. 2	13 07.77	-58 57.3	3.522	3.950	-3.15	-3.3	16.5	108.5
Mar. 12	12 34.61	-59 06.0	3.445	3.985	-3.46	+2.3	16.5	116.2
Mar. 22	11 59.86	-58 15.6	3.400	4.022	-3.42	+8.4	16.5	122.3

Comet 260P/McNaught

Epoch = 2019 July 16.0 TT  
 T = 2019 Sept. 9.95708 TT  
 Peri. = 18.38745 e = 0.6087842  
 Node = 349.35561 2000.0 a = 3.6213486 AU  
 Incl. = 15.05216 n = 0.14302059  
 q = 1.4167288 AU P = 6.89 years

$$m_1 = 12.0 + 5 \log(\Delta) + 15.0 \log(r(t-15))$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	17 48.09	-34 44.9	3.663	2.773	+2.03	-0.8	21.7	21.7
Jan. 17	18 08.63	-34 50.1	3.547	2.707	+2.08	-0.1	21.5	26.9
Jan. 27	18 29.66	-34 47.3	3.420	2.639	+2.13	+0.7	21.2	32.2
Feb. 6	18 51.12	-34 35.9	3.282	2.571	+2.17	+1.6	21.0	37.5
Feb. 16	19 12.92	-34 15.3	3.136	2.503	+2.20	+2.6	20.7	42.8
Feb. 26	19 35.00	-33 44.9	2.983	2.434	+2.22	+3.6	20.4	48.0
Mar. 8	19 57.28	-33 04.4	2.825	2.365	+2.24	+4.6	20.1	53.0
Mar. 18	20 19.70	-32 13.3	2.663	2.296	+2.25	+5.7	19.8	58.0
Mar. 28	20 42.21	-31 11.3	2.499	2.226	+2.25	+6.8	19.5	62.8
Apr. 7	21 04.77	-29 58.0	2.334	2.157	+2.26	+8.0	19.2	67.4
Apr. 17	21 27.32	-28 33.0	2.171	2.088	+2.25	+9.2	18.8	71.8
Apr. 27	21 49.86	-26 55.7	2.010	2.020	+2.25	+10.4	18.4	76.1
May 7	22 12.36	-25 05.5	1.853	1.953	+2.25	+11.8	18.0	80.2
May 17	22 34.80	-23 01.5	1.701	1.887	+2.24	+13.2	17.6	84.1
May 27	22 57.18	-20 42.4	1.556	1.823	+2.23	+14.8	17.2	87.7
June 6	23 19.48	-18 06.7	1.417	1.761	+2.22	+16.5	16.8	91.2
June 16	23 41.66	-15 12.6	1.287	1.701	+2.21	+18.5	16.3	94.5
June 26	00 03.73	-11 57.7	1.165	1.646	+2.20	+20.7	15.9	97.7
July 6	00 25.60	-08 19.4	1.053	1.594	+2.17	+23.2	15.5	100.7
July 16	00 47.17	-04 15.2	0.952	1.548	+2.14	+26.0	15.0	103.6
July 26	01 08.36	+00 17.6	0.861	1.507	+2.09	+28.9	14.6	106.5
Aug. 5	01 28.92	+05 19.9	0.782	1.473	+2.01	+31.9	14.2	109.5
Aug. 15	01 48.56	+10 51.1	0.715	1.446	+1.90	+34.6	13.9	112.6
Aug. 25	02 06.87	+16 47.3	0.659	1.428	+1.73	+36.7	13.6	115.9
Sept. 4	02 23.18	+22 59.5	0.617	1.418	+1.49	+37.6	13.3	119.6
Sept. 14	02 36.67	+29 14.2	0.586	1.417	+1.16	+36.9	13.1	123.6
Sept. 24	02 46.36	+35 13.2	0.568	1.426	+0.72	+34.2	13.0	128.0
Oct. 4	02 51.17	+40 34.9	0.562	1.442	+0.19	+29.3	13.0	132.7
Oct. 14	02 50.62	+44 57.9	0.568	1.467	-0.34	+22.4	13.1	137.4
Oct. 24	02 45.23	+48 05.1	0.587	1.500	-0.74	+14.1	13.3	141.7
Nov. 3	02 37.00	+49 47.8	0.618	1.539	-0.86	+5.7	13.5	145.0
Nov. 13	02 29.12	+50 11.5	0.662	1.585	-0.65	-1.4	13.8	146.5
Nov. 23	02 24.30	+49 33.9	0.721	1.635	-0.25	-6.3	14.2	145.8
Dec. 3	02 24.00	+48 17.2	0.795	1.690	+0.24	-8.9	14.6	143.0
Dec. 13	02 28.41	+46 42.9	0.884	1.749	+0.68	-9.7	15.0	138.7
Dec. 23	02 36.83	+45 06.1	0.988	1.810	+1.03	-9.4	15.5	133.3
Jan. 2	02 48.45	+43 35.5	1.107	1.874	+1.31	-8.5	16.0	127.4
Jan. 12	03 02.50	+42 15.6	1.239	1.940	+1.51	-7.4	16.4	121.2
Jan. 22	03 18.29	+41 07.0	1.383	2.007	+1.66	-6.3	16.9	114.9
Feb. 1	03 35.35	+40 08.8	1.538	2.075	+1.76	-5.3	17.4	108.7
Feb. 11	03 53.30	+39 19.2	1.702	2.144	+1.83	-4.6	17.8	102.5
Feb. 21	04 11.84	+38 35.8	1.874	2.213	+1.88	-4.1	18.2	96.3
Mar. 2	04 30.76	+37 56.7	2.051	2.282	+1.91	-3.7	18.6	90.3
Mar. 12	04 49.89	+37 20.0	2.233	2.352	+1.92	-3.6	19.0	84.3
Mar. 22	05 09.07	+36 44.0	2.417	2.421	+1.92	-3.6	19.4	78.3

## Comet P/2008 Y1 (Boattini)

Epoch = 2019 July 16.0 TT  
 T = 2019 Sept. 10.64803 TT  
 Peri. = 162.80803 e = 0.7361869  
 Node = 259.33648 2000.0 a = 4.8057200 AU  
 Incl. = 8.91859 n = 0.09355486  
 q = 1.2678119 AU P = 10.54 years

$$m_1 = 13.2 + 5 \log(\Delta) + 20.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	20 22.28	-13 55.9	3.915	3.003	-0.43 -2.1	.	21.3/76	19.2
Jan. 17	20 36.75	-13 01.1	3.873	2.923	-0.47 -2.3	.	22.4/75	13.0
Jan. 27	20 51.80	-11 58.0	3.815	2.843	-0.50 -2.6	.	23.5/73	7.8
Feb. 6	21 07.37	-10 46.4	3.741	2.761	-0.54 -2.9	.	24.6/72	5.5
Feb. 16	21 23.45	-09 26.1	3.651	2.678	-0.59 -3.3	.	25.6/71	8.6
Feb. 26	21 39.99	-07 56.9	3.548	2.595	-0.64 -3.6	.	26.7/69	13.5
Mar. 8	21 57.03	-06 18.8	3.432	2.511	-0.69 -4.1	.	27.8/68	18.6
Mar. 18	22 14.57	-04 31.7	3.305	2.427	-0.76 -4.5	.	28.9/67	23.7
Mar. 28	22 32.66	-02 35.5	3.170	2.342	-0.83 -5.0	.	30.2/66	28.5
Apr. 7	22 51.40	+00 30.3	3.027	2.257	-0.91 -5.6	.	31.5/66	33.2
Apr. 17	23 10.86	+01 43.8	2.879	2.172	-1.01 -6.1	.	32.9/65	37.5
Apr. 27	23 31.19	+04 06.7	2.729	2.086	-1.12 -6.7	21.8	34.6/65	41.6
May 7	23 52.58	+06 38.0	2.577	2.001	-1.24 -7.3	21.3	36.3/65	45.4
May 17	00 15.24	+09 16.8	2.427	1.917	-1.39 -7.7	20.8	38.3/65	48.8
May 27	00 39.43	+12 02.0	2.280	1.834	-1.56 -8.1	20.3	40.5/65	51.7
June 6	01 05.48	+14 51.3	2.139	1.753	-1.75 -8.3	19.7	42.9/67	54.3
June 16	01 33.72	+17 41.4	2.006	1.674	-1.96 -8.1	19.2	45.5/68	56.5
June 26	02 04.54	+20 27.5	1.883	1.599	-2.20 -7.4	18.7	48.2/70	58.1
July 6	02 38.23	+23 02.5	1.772	1.528	-2.44 -6.1	18.1	50.9/73	59.3
July 16	03 14.95	+25 17.5	1.674	1.463	-2.66 -4.1	17.6	53.4/77	60.1
July 26	03 54.60	+27 02.1	1.591	1.404	-2.84 -1.4	17.2	55.5/81	60.5
Aug. 5	04 36.64	+28 05.6	1.524	1.354	-2.95 +2.0	16.8	57.0/86	60.6
Aug. 15	05 20.05	+28 19.8	1.472	1.315	-2.95 +5.6	16.4	57.7/91	60.6
Aug. 25	06 03.53	+27 41.0	1.435	1.286	-2.84 +9.0	16.2	57.5/96	60.6
Sept. 4	06 45.67	+26 11.6	1.410	1.271	-2.64 +11.7	16.0	56.3/102	60.7
Sept. 14	07 25.32	+23 59.1	1.396	1.269	-2.40 +13.5	16.0	54.3/106	61.2
Sept. 24	08 01.79	+21 14.4	1.390	1.280	-2.14 +14.4	16.1	51.5/110	62.2
Oct. 4	08 34.74	+18 09.0	1.388	1.304	-1.90 +14.4	16.2	48.2/113	63.8
Oct. 14	09 04.11	+14 53.3	1.388	1.340	-1.69 +13.9	16.5	44.5/116	66.0
Oct. 24	09 30.02	+11 35.9	1.388	1.387	-1.52 +13.0	16.8	40.4/119	68.9
Nov. 3	09 52.58	+08 23.2	1.384	1.443	-1.39 +11.9	17.1	36.1/121	72.6
Nov. 13	10 11.87	+05 20.2	1.377	1.506	-1.30 +10.8	17.5	31.6/124	77.1
Nov. 23	10 27.93	+02 30.3	1.365	1.575	-1.24 +9.7	17.8	26.8/127	82.4
Dec. 3	10 40.67	+00 03.6	1.347	1.649	-1.22 +8.7	18.2	21.7/131	88.5
Dec. 13	10 49.95	-02 18.7	1.326	1.727	-1.23 +7.9	18.6	16.5/138	95.6
Dec. 23	10 55.59	-04 12.4	1.303	1.807	-1.28 +7.3	18.9	11.4/152	103.5
Jan. 2	10 57.40	-05 41.4	1.281	1.890	-1.35 +6.9	19.3	7.4/184	112.5
Jan. 12	10 55.37	-06 42.4	1.264	1.973	-1.45 +6.8	19.6	7.5/234	122.3
Jan. 22	10 49.75	-07 12.6	1.257	2.058	-1.56 +7.1	20.0	11.1/264	133.0
Feb. 1	10 41.18	-07 10.6	1.266	2.143	-1.66 +7.5	20.3	14.7/278	144.1
Feb. 11	10 30.81	-06 38.6	1.295	2.229	-1.72 +8.0	20.7	16.8/286	154.9
Feb. 21	10 20.00	-05 42.8	1.349	2.314	-1.72 +8.4	21.1	17.0/293	163.3
Mar. 2	10 10.12	-04 32.3	1.430	2.399	-1.68 +8.6	21.6	15.3/299	164.3
Mar. 12	10 02.25	-03 17.5	1.537	2.483	-1.59 +8.5	22.0	12.2/307	157.3
Mar. 22	09 56.93	-02 06.8	1.669	2.567	-1.47 +8.2	.	8.7/319	147.8

## Comet P/2010 U2 (Hill)

Epoch = 2019 July 16.0 TT  
 T = 2019 Sept. 15.25871 TT  
 Peri. = 44.33022 e = 0.4009891  
 Node = 357.08222 2000.0 a = 4.2864848 AU  
 Incl. = 16.82721 n = 0.11105859  
 q = 2.5676511 AU P = 8.87 years

$$m_1 = 6.3 + 5 \log(\Delta) + 25.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	22 02.28	-16 42.5	3.721	3.046	-0.51 -5.5	21.2	21.3/60	40.9
Jan. 17	22 15.39	-14 55.3	3.776	3.014	-0.50 -5.6	21.2	22.3/61	34.3
Jan. 27	22 28.94	-13 04.1	3.818	2.982	-0.50 -5.8	21.1	23.1/61	27.8
Feb. 6	22 42.84	-11 09.0	3.847	2.952	-0.50 -6.0	21.0	23.8/61	21.5
Feb. 16	22 57.02	-09 10.3	3.862	2.922	-0.50 -6.2	20.9	24.4/60	15.4
Feb. 26	23 11.43	-07 08.4	3.864	2.892	-0.51 -6.3	20.8	24.9/60	9.4
Mar. 8	23 26.02	-05 03.6	3.854	2.864	-0.52 -6.5	20.7	25.3/60	3.6
Mar. 18	23 40.75	-02 56.4	3.830	2.836	-0.53 -6.7	20.5	25.6/60	2.5
Mar. 28	23 55.59	+00 47.3	3.794	2.810	-0.54 -6.8	20.4	25.9/60	8.1
Apr. 7	00 10.54	+01 23.4	3.747	2.784	-0.56 -7.0	20.3	26.0/60	13.7
Apr. 17	00 25.56	+03 35.2	3.688	2.760	-0.58 -7.1	20.2	26.1/60	19.2
Apr. 27	00 40.64	+05 47.4	3.619	2.737	-0.60 -7.3	20.0	26.1/60	24.6
May 7	00 55.76	+07 59.8	3.541	2.715	-0.62 -7.4	19.9	26.1/59	30.0
May 17	01 10.90	+10 11.9	3.454	2.694	-0.65 -7.5	19.8	25.9/59	35.4
May 27	01 26.04	+12 23.2	3.359	2.675	-0.68 -7.6	19.6	25.7/59	40.8
June 6	01 41.14	+14 33.4	3.257	2.657	-0.72 -7.7	19.5	25.4/59	46.2
June 16	01 56.14	+16 42.1	3.148	2.641	-0.76 -7.7	19.3	25.0/59	51.6
June 26	02 10.98	+18 49.1	3.035	2.626	-0.81 -7.7	19.2	24.4/59	57.1
July 6	02 25.59	+20 54.3	2.917	2.613	-0.87 -7.7	19.1	23.7/58	62.7
July 16	02 39.82	+22 57.5	2.796	2.601	-0.93 -7.6	18.9	22.8/58	68.5
July 26	02 53.55	+24 58.8	2.673	2.591	-1.00 -7.5	18.8	21.8/56	74.3
Aug. 5	03 06.59	+26 58.2	2.549	2.583	-1.07 -7.4	18.6	20.5/55	80.5
Aug. 15	03 18.68	+28 56.0	2.426	2.576	-1.16 -7.3	18.5	19.1/52	86.8
Aug. 25	03 29.56	+30 52.3	2.304	2.572	-1.26 -7.2	18.4	17.4/48	93.5
Sept. 4	03 38.86	+32 47.2	2.185	2.569	-1.37 -7.0	18.2	15.4/42	100.5
Sept. 14	03 46.18	+34 40.3	2.073	2.568	-1.49 -6.9	18.1	13.5/34	107.9
Sept. 24	03 51.10	+36 30.6	1.968	2.568	-1.62 -6.9	18.0	11.6/21	115.8
Oct. 4	03 53.16	+38 16.0	1.874	2.571	-1.76 -6.9	17.9	10.1/2	123.9
Oct. 14	03 52.07	+39 52.8	1.795	2.575	-1.90 -7.2	17.8	9.6/340	132.4
Oct. 24	03 47.75	+41 16.0	1.732	2.581	-2.03 -7.7	17.8	10.0/317	140.8
Nov. 3	03 40.51	+42 19.3	1.690	2.589	-2.12 -8.4	17.8	10.7/298	148.6
Nov. 13	03 31.28	+42 57.5	1.670	2.598	-2.17 -9.3	17.8	11.1/282	154.4
Nov. 23	03 21.37	+43 08.5	1.675	2.610	-2.15 -10.1	17.8	10.6/268	156.2
Dec. 3	03 12.33	+42 53.9	1.706	2.622	-2.08 -10.6	17.9	9.2/253	153.0
Dec. 13	03 05.49	+42 20.4	1.760	2.637	-1.97 -10.8	18.1	7.1/235	146.4
Dec. 23	03 01.68	+41 35.9	1.836	2.653	-1.84 -10.6	18.2	5.2/205	138.4
Jan. 2	03 01.24	+40 48.2	1.931	2.670	-1.71 -10.1	18.4	5.0/161	129.9
Jan. 12	03 04.13	+40 03.6	2.042	2.689	-1.59 -9.4	18.6	6.7/128	121.4
Jan. 22	03 10.03	+39 25.2	2.166	2.709	-1.48 -8.5	18.8	9.3/112	113.2
Feb. 1	03 18.57	+38 54.5	2.300	2.731	-1.39 -7.6	19.0	11.8/103	105.3
Feb. 11	03 29.36	+38 31.4	2.441	2.754	-1.31 -6.6	19.2	14.1/98	97.8
Feb. 21	03 42.02	+38 14.6	2.587	2.778	-1.25 -5.7	19.5	16.0/95	90.5
Mar. 2	03 56.24	+38 02.7	2.735	2.803	-1.19 -4.8	19.7	17.7/93	83.6
Mar. 12	04 11.73	+37 53.7	2.883	2.829	-1.13 -4.0	19.9	19.1/92	77.0
Mar. 22	04 28.24	+37 45.9	3.029	2.857	-1.09 -3.2	20.1	20.2/92	70.6



## Comet P/2000 S4 (LINEAR-Spacewatch)

Epoch = 2019 July 16.0 TT  
 T = 2019 Sept. 21.17231 TT  
 Peri. = 173.07911 e = 0.6812758  
 Node = 173.80291 2000.0 a = 7.1077395 AU  
 Incl. = 28.37747 n = 0.05201239  
 q = 2.2654086 AU P = 18.95 years

$$m_1 = 4.6 + 5 \log(\Delta) + 40.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	18 24.73	-01 36.3	4.103	3.226	-0.60 +1.0	.	23.4/ 89	23.6
Jan. 17	18 40.44	-01 26.0	4.020	3.168	-0.63 +1.0	.	23.8/ 86	26.3
Jan. 27	18 56.36	-01 06.1	3.925	3.111	-0.66 +1.0	.	24.1/ 84	30.0
Feb. 6	19 12.40	+00 36.8	3.820	3.055	-0.70 +1.0	.	24.4/ 82	34.2
Feb. 16	19 28.48	+00 01.6	3.706	2.999	-0.74 +1.1	.	24.5/ 80	38.7
Feb. 26	19 44.53	+00 48.6	3.584	2.945	-0.78 +1.1	.	24.6/ 78	43.4
Mar. 8	20 00.47	+01 43.6	3.455	2.891	-0.83 +1.1	.	24.5/ 76	48.2
Mar. 18	20 16.23	+02 45.8	3.321	2.838	-0.88 +1.2	.	24.3/ 74	53.2
Mar. 28	20 31.73	+03 54.1	3.181	2.787	-0.94 +1.2	.	24.0/ 73	58.2
Apr. 7	20 46.91	+05 07.3	3.038	2.737	-0.99 +1.4	.	23.6/ 71	63.2
Apr. 17	21 01.67	+06 24.0	2.892	2.689	-1.06 +1.5	.	23.0/ 70	68.4
Apr. 27	21 15.95	+07 42.5	2.744	2.642	-1.13 +1.7	.	22.2/ 69	73.6
May 7	21 29.64	+09 01.0	2.595	2.597	-1.21 +1.9	.	21.2/ 69	78.9
May 17	21 42.63	+10 17.1	2.447	2.555	-1.30 +2.1	.	20.0/ 68	84.4
May 27	21 54.82	+11 28.2	2.300	2.514	-1.40 +2.4	.	18.4/ 69	90.0
June 6	22 06.03	+12 31.4	2.156	2.476	-1.51 +2.7	22.0	16.6/ 70	96.0
June 16	22 16.09	+13 22.7	2.015	2.441	-1.64 +3.0	21.6	14.3/ 72	102.2
June 26	22 24.84	+13 58.1	1.879	2.408	-1.77 +3.3	21.2	11.8/ 78	108.8
July 6	22 32.03	+14 12.4	1.751	2.378	-1.92 +3.5	20.9	9.1/ 90	115.9
July 16	22 37.50	+13 59.7	1.631	2.352	-2.08 +3.7	20.5	7.2/115	123.7
July 26	22 41.12	+13 14.3	1.523	2.328	-2.24 +3.8	20.2	7.6/150	132.0
Aug. 5	22 42.85	+11 50.7	1.429	2.309	-2.39 +3.8	19.9	10.7/174	141.1
Aug. 15	22 42.87	+09 45.5	1.354	2.292	-2.51 +3.7	19.7	14.8/184	150.8
Aug. 25	22 41.61	+07 00.4	1.301	2.280	-2.61 +3.6	19.5	18.7/188	160.6
Sept. 4	22 39.68	+03 42.6	1.274	2.271	-2.65 +3.6	19.4	21.3/188	168.6
Sept. 14	22 37.95	+00 06.8	1.274	2.266	-2.63 +3.7	19.3	22.0/185	167.5
Sept. 24	22 37.22	-03 29.1	1.301	2.266	-2.57 +4.0	19.4	20.9/180	158.6
Oct. 4	22 38.16	-06 48.0	1.356	2.269	-2.46 +4.2	19.5	18.7/171	148.3
Oct. 14	22 41.21	-09 37.2	1.433	2.276	-2.33 +4.4	19.7	16.3/157	138.1
Oct. 24	22 46.48	-11 50.8	1.531	2.286	-2.18 +4.4	19.9	14.8/140	128.4
Nov. 3	22 53.92	-13 27.6	1.645	2.301	-2.03 +4.3	20.2	14.7/122	119.5
Nov. 13	23 03.32	-14 29.8	1.771	2.319	-1.89 +4.0	20.5	15.7/107	111.1
Nov. 23	23 14.37	-15 01.5	1.907	2.341	-1.76 +3.6	20.8	17.3/ 96	103.3
Dec. 3	23 26.80	-15 07.1	2.050	2.366	-1.63 +3.2	21.1	19.0/ 88	96.0
Dec. 13	23 40.33	-14 50.9	2.197	2.395	-1.52 +2.7	21.5	20.5/ 83	89.2
Dec. 23	23 54.71	-14 17.3	2.347	2.426	-1.41 +2.3	21.8	21.9/ 79	82.6
Jan. 2	00 09.76	-13 29.6	2.498	2.460	-1.32 +2.0	.	23.0/ 76	76.4
Jan. 12	00 25.30	-12 31.3	2.649	2.497	-1.23 +1.6	.	23.9/ 75	70.4
Jan. 22	00 41.19	-11 25.2	2.797	2.537	-1.15 +1.3	.	24.6/ 74	64.6
Feb. 1	00 57.36	-10 13.9	2.943	2.578	-1.08 +1.1	.	25.1/ 73	59.0
Feb. 11	01 13.70	-08 59.5	3.084	2.622	-1.02 +0.9	.	25.5/ 73	53.6
Feb. 21	01 30.16	-07 44.2	3.220	2.668	-0.96 +0.8	.	25.7/ 73	48.4
Mar. 2	01 46.70	-06 29.6	3.350	2.716	-0.91 +0.7	.	25.7/ 73	43.3
Mar. 12	02 03.25	-05 17.2	3.473	2.765	-0.86 +0.6	.	25.7/ 74	38.5
Mar. 22	02 19.78	-04 08.5	3.588	2.816	-0.81 +0.5	.	25.6/ 75	33.8

Comet P/2005 GF8 = 2018 X1 (LONEOS)

Epoch = 2019 July 16.0 TT  
 T = 2019 Sept. 29.20703 TT  
 Peri. = 285.38739 e = 0.5167901  
 Node = 314.89770 2000.0 a = 5.8586130 AU  
 Incl. = 1.19227 n = 0.06950433  
 q = 2.8309398 AU P = 14.18 years

$$m_1 = 14.0 + 5 \log(\Delta) + 5.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	13 03.68	-07 44.5	3.281	3.401	+0.74	-5.0	19.2	88.5
Jan. 17	13 10.53	-08 30.9	3.102	3.364	+0.62	-4.2	19.1	96.8
Jan. 27	13 16.08	-09 09.3	2.927	3.328	+0.48	-3.4	18.9	105.5
Feb. 6	13 20.12	-09 38.7	2.759	3.293	+0.31	-2.4	18.8	114.5
Feb. 16	13 22.44	-09 58.0	2.602	3.259	+0.13	-1.3	18.6	124.0
Feb. 26	13 22.93	-10 06.6	2.459	3.225	-0.05	-0.2	18.5	133.9
Mar. 8	13 21.54	-10 03.9	2.334	3.193	-0.24	+0.9	18.4	144.2
Mar. 18	13 18.38	-09 50.3	2.231	3.161	-0.40	+1.9	18.2	155.0
Mar. 28	13 13.77	-09 27.2	2.153	3.131	-0.52	+2.8	18.1	166.1
Apr. 7	13 08.22	-08 56.9	2.102	3.102	-0.58	+3.3	18.1	177.0
Apr. 17	13 02.39	-08 23.3	2.078	3.074	-0.57	+3.4	18.0	171.0
Apr. 27	12 57.00	-07 50.6	2.082	3.047	-0.49	+3.1	18.0	159.9
May 7	12 52.71	-07 23.1	2.111	3.021	-0.35	+2.3	18.0	149.0
May 17	12 50.03	-07 04.4	2.163	2.997	-0.17	+1.3	18.1	138.7
May 27	12 49.27	-06 56.8	2.233	2.974	+0.03	+0.1	18.1	128.8
June 6	12 50.54	-07 01.5	2.318	2.953	+0.24	-1.2	18.2	119.6
June 16	12 53.86	-07 18.5	2.414	2.933	+0.44	-2.4	18.3	110.9
June 26	12 59.08	-07 47.3	2.518	2.915	+0.62	-3.5	18.3	102.7
July 6	13 06.08	-08 26.7	2.627	2.899	+0.79	-4.5	18.4	95.0
July 16	13 14.68	-09 15.3	2.739	2.884	+0.94	-5.3	18.5	87.8
July 26	13 24.70	-10 11.6	2.851	2.871	+1.07	-6.0	18.6	80.9
Aug. 5	13 35.99	-11 14.2	2.963	2.860	+1.20	-6.5	18.6	74.3
Aug. 15	13 48.44	-12 21.4	3.072	2.850	+1.30	-6.9	18.7	67.9
Aug. 25	14 01.90	-13 31.8	3.177	2.843	+1.40	-7.2	18.8	61.8
Sept. 4	14 16.30	-14 44.0	3.278	2.837	+1.49	-7.3	18.8	55.8
Sept. 14	14 31.54	-15 56.5	3.373	2.833	+1.57	-7.2	18.9	50.0
Sept. 24	14 47.53	-17 08.0	3.462	2.831	+1.64	-7.0	19.0	44.3
Oct. 4	15 04.22	-18 17.1	3.544	2.831	+1.70	-6.7	19.0	38.6
Oct. 14	15 21.52	-19 22.7	3.618	2.833	+1.76	-6.3	19.1	32.9
Oct. 24	15 39.37	-20 23.6	3.684	2.837	+1.81	-5.8	19.1	27.3
Nov. 3	15 57.68	-21 18.7	3.740	2.842	+1.85	-5.2	19.1	21.7
Nov. 13	16 16.38	-22 07.1	3.788	2.850	+1.89	-4.4	19.2	16.1
Nov. 23	16 35.37	-22 48.0	3.825	2.859	+1.91	-3.7	19.2	10.5
Dec. 3	16 54.54	-23 20.8	3.852	2.871	+1.92	-2.8	19.2	4.8
Dec. 13	17 13.79	-23 45.1	3.868	2.883	+1.92	-1.9	19.2	1.2
Dec. 23	17 33.00	-24 00.6	3.873	2.898	+1.91	-1.1	19.3	6.8
Jan. 2	17 52.05	-24 07.4	3.866	2.915	+1.89	-0.2	19.3	12.6
Jan. 12	18 10.81	-24 05.8	3.849	2.933	+1.86	+0.6	19.3	18.5
Jan. 22	18 29.16	-23 56.1	3.820	2.952	+1.81	+1.4	19.3	24.5
Feb. 1	18 46.99	-23 39.1	3.779	2.973	+1.75	+2.1	19.3	30.6
Feb. 11	19 04.15	-23 15.6	3.728	2.996	+1.68	+2.7	19.2	36.7
Feb. 21	19 20.56	-22 46.6	3.667	3.020	+1.59	+3.2	19.2	43.0
Mar. 2	19 36.08	-22 13.3	3.595	3.046	+1.50	+3.5	19.2	49.5
Mar. 12	19 50.61	-21 36.9	3.515	3.072	+1.39	+3.8	19.2	56.0
Mar. 22	20 04.05	-20 58.8	3.427	3.101	+1.28	+3.8	19.1	62.8

## Comet 175P/Hergenrother

Epoch = 2019 July 16.0 TT  
 T = 2019 Sept. 30.77899 TT  
 Peri. = 56.18747 e = 0.4321401  
 Node = 123.53335 2000.0 a = 3.4274595 AU  
 Incl. = 6.07729 n = 0.15532651  
 q = 1.9463168 AU P = 6.35 years

$$m_1 = 12.6 + 5 \log(\Delta) + 12.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° '			m	'		°
Jan. 7	05 28.76	+18 16.4	1.842	2.769	-0.84	+1.7	19.5	156.0
Jan. 17	05 21.18	+18 35.6	1.865	2.725	-0.64	+2.1	19.4	144.2
Jan. 27	05 15.97	+18 58.6	1.911	2.680	-0.37	+2.5	19.4	133.0
Feb. 6	05 13.59	+19 25.3	1.974	2.636	-0.07	+2.9	19.3	122.3
Feb. 16	05 14.24	+19 55.1	2.049	2.592	+0.23	+3.1	19.3	112.4
Feb. 26	05 17.86	+20 26.7	2.132	2.549	+0.52	+3.2	19.3	103.3
Mar. 8	05 24.26	+20 59.0	2.219	2.505	+0.78	+3.2	19.3	94.8
Mar. 18	05 33.21	+21 30.3	2.307	2.463	+1.02	+3.0	19.3	86.9
Mar. 28	05 44.43	+21 58.8	2.392	2.421	+1.24	+2.6	19.3	79.6
Apr. 7	05 57.67	+22 22.9	2.474	2.379	+1.43	+2.1	19.3	72.8
Apr. 17	06 12.71	+22 41.0	2.551	2.339	+1.59	+1.4	19.2	66.5
Apr. 27	06 29.30	+22 51.5	2.621	2.300	+1.74	+0.6	19.2	60.5
May 7	06 47.24	+22 53.0	2.684	2.261	+1.86	-0.4	19.2	55.0
May 17	07 06.35	+22 44.3	2.741	2.225	+1.97	-1.5	19.1	49.7
May 27	07 26.42	+22 24.4	2.790	2.189	+2.06	-2.6	19.1	44.7
June 6	07 47.32	+21 52.5	2.832	2.156	+2.13	-3.9	19.0	40.0
June 16	08 08.87	+21 08.2	2.867	2.124	+2.19	-5.1	19.0	35.5
June 26	08 30.93	+20 11.1	2.896	2.094	+2.23	-6.4	18.9	31.2
July 6	08 53.38	+19 01.5	2.919	2.067	+2.26	-7.6	18.9	27.1
July 16	09 16.11	+17 39.6	2.937	2.042	+2.28	-8.8	18.8	23.1
July 26	09 39.01	+16 06.0	2.949	2.019	+2.30	-10.0	18.8	19.3
Aug. 5	10 02.03	+14 21.8	2.958	1.999	+2.31	-11.0	18.7	15.6
Aug. 15	10 25.10	+12 27.9	2.962	1.983	+2.31	-11.9	18.7	12.1
Aug. 25	10 48.18	+10 25.9	2.963	1.969	+2.31	-12.6	18.6	8.6
Sept. 4	11 11.28	+08 17.2	2.960	1.958	+2.31	-13.2	18.6	5.4
Sept. 14	11 34.35	+06 03.6	2.955	1.951	+2.31	-13.6	18.6	3.2
Sept. 24	11 57.42	+03 46.9	2.947	1.947	+2.31	-13.8	18.6	4.1
Oct. 4	12 20.48	+01 29.1	2.936	1.946	+2.31	-13.8	18.6	7.0
Oct. 14	12 43.54	+00 47.9	2.922	1.949	+2.30	-13.6	18.6	10.4
Oct. 24	13 06.58	-03 02.1	2.906	1.955	+2.30	-13.2	18.6	14.0
Nov. 3	13 29.62	-05 11.6	2.886	1.965	+2.30	-12.6	18.6	17.8
Nov. 13	13 52.61	-07 14.4	2.863	1.977	+2.30	-11.9	18.6	21.7
Nov. 23	14 15.53	-09 09.1	2.836	1.993	+2.29	-11.0	18.6	25.7
Dec. 3	14 38.32	-10 54.0	2.805	2.012	+2.27	-9.9	18.6	29.9
Dec. 13	15 00.88	-12 28.0	2.770	2.033	+2.24	-8.8	18.7	34.3
Dec. 23	15 23.13	-13 50.2	2.729	2.057	+2.20	-7.5	18.7	38.8
Jan. 2	15 44.93	-15 00.0	2.683	2.084	+2.15	-6.3	18.7	43.6
Jan. 12	16 06.13	-15 57.1	2.632	2.113	+2.08	-5.0	18.8	48.5
Jan. 22	16 26.57	-16 41.8	2.575	2.144	+2.00	-3.8	18.8	53.7
Feb. 1	16 46.06	-17 14.5	2.511	2.177	+1.89	-2.6	18.8	59.1
Feb. 11	17 04.39	-17 36.3	2.443	2.212	+1.76	-1.6	18.8	64.8
Feb. 21	17 21.38	-17 48.2	2.369	2.248	+1.62	-0.7	18.9	70.9
Mar. 2	17 36.79	-17 51.8	2.291	2.286	+1.44	0.0	18.9	77.2
Mar. 12	17 50.38	-17 48.9	2.209	2.325	+1.25	+0.6	18.9	83.9
Mar. 22	18 01.91	-17 41.5	2.126	2.365	+1.03	+0.9	18.9	91.1

## Comet P/2014 U2 (Kowalski)

Epoch = 2019 July 16.0 TT  
 T = 2019 Oct. 11.51981 TT  
 Peri. = 37.63912  
 Node = 354.23363 2000.0  
 Incl. = 7.28093  
 q = 1.1163697 AU

e = 0.6153761  
 a = 2.9024970 AU  
 n = 0.19931795  
 P = 4.94 years

H = 19.8 , G = 0.15

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	V	Mot./PA	Elong.
2019/20	h m	° ' "			for T=+1 day			°
Jan. 7	17 56.03	-28 57.9	3.841	2.920	-0.58 -0.2	.	22.6/ 91	17.8
Jan. 17	18 13.39	-28 58.7	3.729	2.858	-0.62 -0.5	.	23.0/ 90	24.0
Jan. 27	18 31.06	-28 53.5	3.602	2.794	-0.67 -0.8	.	23.4/ 88	30.1
Feb. 6	18 48.97	-28 42.1	3.461	2.729	-0.72 -1.2	.	23.8/ 87	36.3
Feb. 16	19 07.05	-28 24.3	3.309	2.663	-0.78 -1.7	.	24.1/ 85	42.3
Feb. 26	19 25.26	-27 59.9	3.146	2.595	-0.85 -2.3	.	24.4/ 84	48.3
Mar. 8	19 43.56	-27 29.1	2.975	2.526	-0.92 -3.0	.	24.6/ 82	54.2
Mar. 18	20 01.89	-26 52.0	2.797	2.455	-1.00 -3.7	.	24.9/ 81	60.0
Mar. 28	20 20.23	-26 08.6	2.614	2.384	-1.09 -4.6	.	25.2/ 79	65.7
Apr. 7	20 38.58	-25 19.1	2.429	2.311	-1.19 -5.7	.	25.4/ 78	71.3
Apr. 17	20 56.90	-24 23.7	2.241	2.236	-1.31 -6.9	.	25.7/ 77	76.8
Apr. 27	21 15.24	-23 22.5	2.055	2.161	-1.45 -8.4	.	26.1/ 76	82.1
May 7	21 33.61	-22 15.6	1.870	2.084	-1.62 -10.1	.	26.5/ 75	87.4
May 17	21 52.03	-21 02.7	1.689	2.007	-1.81 -12.2	.	27.0/ 74	92.5
May 27	22 10.61	-19 43.4	1.514	1.929	-2.04 -14.8	.	27.7/ 73	97.5
June 6	22 29.41	-18 16.8	1.345	1.850	-2.33 -17.9	.	28.5/ 71	102.4
June 16	22 48.56	-16 41.4	1.185	1.772	-2.67 -21.8	.	29.7/ 70	107.0
June 26	23 08.29	-14 54.5	1.034	1.693	-3.10 -26.6	.	31.4/ 69	111.3
July 6	23 28.82	-12 52.2	0.893	1.615	-3.64 -32.5	22.0	33.6/ 67	115.4
July 16	23 50.55	-10 28.0	0.763	1.538	-4.32 -40.0	21.6	37.0/ 64	118.9
July 26	00 14.08	-07 32.3	0.646	1.464	-5.18 -49.1	21.2	41.8/ 62	121.9
Aug. 5	00 40.17	-03 51.6	0.543	1.393	-6.27 -60.0	20.7	48.8/ 59	124.0
Aug. 15	01 10.01	+00 52.4	0.454	1.326	-7.64 -71.9	20.2	58.7/ 56	124.9
Aug. 25	01 45.24	+06 59.1	0.381	1.265	-9.30 -81.8	19.8	71.3/ 54	124.2
Sept. 4	02 27.65	+14 34.7	0.327	1.213	-11.16 -83.2	19.5	84.4/ 54	121.6
Sept. 14	03 18.71	+23 08.7	0.293	1.170	-12.82 -66.8	19.3	92.7/ 56	117.2
Sept. 24	04 17.76	+31 18.0	0.280	1.138	-13.58 -30.2	19.3	90.3/ 61	112.0
Oct. 4	05 19.89	+37 29.7	0.284	1.120	-12.89 +12.5	19.4	77.8/ 68	107.8
Oct. 14	06 17.55	+41 11.9	0.299	1.117	-11.11 +44.9	19.5	61.1/ 75	105.8
Oct. 24	07 04.77	+42 58.5	0.320	1.128	-9.28 +62.9	19.7	44.6/ 81	106.3
Nov. 3	07 39.06	+43 41.0	0.343	1.152	-8.11 +70.7	19.8	29.5/ 85	109.4
Nov. 13	08 00.59	+43 56.9	0.366	1.190	-7.70 +72.7	19.8	16.1/ 86	114.6
Nov. 23	08 10.26	+44 05.0	0.388	1.238	-7.88 +70.6	19.9	3.8/ 81	121.9
Dec. 3	08 09.06	+44 06.7	0.413	1.295	-8.37 +64.7	19.9	7.1/266	130.9
Dec. 13	07 59.00	+43 51.2	0.443	1.358	-8.81 +55.0	19.9	15.2/259	141.1
Dec. 23	07 43.35	+43 05.2	0.484	1.428	-8.83 +42.7	20.0	19.9/251	151.4
Jan. 2	07 26.33	+41 43.1	0.539	1.500	-8.29 +30.5	20.1	20.7/241	159.5
Jan. 12	07 11.90	+39 52.6	0.612	1.576	-7.33 +20.7	20.4	18.3/229	161.5
Jan. 22	07 02.17	+37 49.3	0.704	1.653	-6.22 +14.1	20.9	14.9/213	156.3
Feb. 1	06 57.65	+35 46.7	0.815	1.732	-5.17 +10.2	21.5	12.1/190	148.2
Feb. 11	06 57.86	+33 52.9	0.943	1.811	-4.28 +8.0	22.0	11.2/164	139.5
Feb. 21	07 01.88	+32 10.4	1.087	1.889	-3.54 +6.9	.	12.1/143	131.0
Mar. 2	07 08.86	+30 38.2	1.244	1.968	-2.95 +6.3	.	13.9/129	122.9
Mar. 12	07 18.09	+29 14.3	1.413	2.045	-2.48 +6.0	.	15.6/121	115.3
Mar. 22	07 28.92	+27 56.3	1.591	2.122	-2.11 +5.7	.	17.1/116	108.0

## Comet P/2009 SK280 (Spacewatch-Hill)

Epoch = 2019 July 16.0 TT  
 T = 2019 Oct. 23.88693 TT  
 Peri. = 327.95324 e = 0.1196936  
 Node = 36.41715 2000.0 a = 4.7810222 AU  
 Incl. = 16.79930 n = 0.09428073  
 q = 4.2087644 AU P = 10.45 years

$$m_1 = 4.8 + 5 \log(\Delta) + 20.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	21 58.71	-26 19.5	5.016	4.290	-0.39 -2.6	21.0	15.7/62	38.5
Jan. 17	22 09.10	-25 04.3	5.093	4.284	-0.38 -2.6	21.0	16.2/62	31.5
Jan. 27	22 19.76	-23 48.6	5.153	4.279	-0.37 -2.7	21.0	16.6/63	24.8
Feb. 6	22 30.61	-22 32.5	5.196	4.274	-0.36 -2.8	21.0	16.9/63	18.7
Feb. 16	22 41.56	-21 16.7	5.222	4.270	-0.35 -2.9	21.0	17.1/64	13.9
Feb. 26	22 52.52	-20 01.5	5.229	4.265	-0.35 -3.0	21.0	17.1/64	11.9
Mar. 8	23 03.43	-18 47.5	5.218	4.260	-0.34 -3.1	21.0	17.1/65	13.8
Mar. 18	23 14.21	-17 35.1	5.189	4.256	-0.34 -3.2	21.0	16.9/65	18.4
Mar. 28	23 24.81	-16 25.0	5.143	4.252	-0.34 -3.3	20.9	16.6/66	24.2
Apr. 7	23 35.15	-15 17.7	5.080	4.248	-0.34 -3.4	20.9	16.1/66	30.5
Apr. 17	23 45.18	-14 13.8	5.001	4.244	-0.34 -3.5	20.9	15.6/67	37.2
Apr. 27	23 54.81	-13 13.9	4.907	4.241	-0.34 -3.6	20.8	14.9/67	44.0
May 7	00 03.99	-12 18.6	4.800	4.237	-0.34 -3.7	20.7	14.0/68	50.9
May 17	00 12.61	-11 28.6	4.681	4.234	-0.35 -3.9	20.7	13.1/69	58.1
May 27	00 20.60	-10 44.5	4.552	4.231	-0.35 -4.0	20.6	11.9/70	65.4
June 6	00 27.85	-10 06.8	4.415	4.228	-0.36 -4.2	20.5	10.6/71	72.8
June 16	00 34.24	-09 36.3	4.272	4.226	-0.37 -4.3	20.5	9.1/73	80.5
June 26	00 39.65	-09 13.2	4.126	4.223	-0.38 -4.5	20.4	7.4/75	88.5
July 6	00 43.95	-08 58.1	3.979	4.221	-0.39 -4.7	20.3	5.5/79	96.7
July 16	00 46.99	-08 51.2	3.835	4.219	-0.41 -4.9	20.2	3.4/86	105.3
July 26	00 48.68	-08 52.2	3.698	4.217	-0.42 -5.1	20.1	1.4/112	114.2
Aug. 5	00 48.88	-09 00.9	3.571	4.215	-0.44 -5.3	20.1	1.6/217	123.4
Aug. 15	00 47.57	-09 16.1	3.458	4.214	-0.46 -5.5	20.0	3.7/240	132.9
Aug. 25	00 44.77	-09 36.1	3.363	4.212	-0.48 -5.6	19.9	5.7/247	142.7
Sept. 4	00 40.60	-09 58.9	3.291	4.211	-0.49 -5.7	19.9	7.5/252	152.5
Sept. 14	00 35.33	-10 21.5	3.244	4.210	-0.50 -5.8	19.8	8.7/256	161.5
Sept. 24	00 29.31	-10 40.8	3.225	4.210	-0.51 -5.8	19.8	9.4/260	167.1
Oct. 4	00 23.01	-10 54.1	3.236	4.209	-0.51 -5.7	19.8	9.3/264	164.6
Oct. 14	00 16.94	-10 58.7	3.276	4.209	-0.50 -5.6	19.9	8.5/270	156.4
Oct. 24	00 11.56	-10 53.4	3.343	4.209	-0.49 -5.4	19.9	7.2/279	146.6
Nov. 3	00 07.26	-10 37.3	3.435	4.209	-0.48 -5.3	20.0	5.7/293	136.4
Nov. 13	00 04.32	-10 10.6	3.548	4.209	-0.46 -5.1	20.0	4.5/316	126.3
Nov. 23	00 02.88	-09 34.0	3.677	4.210	-0.44 -4.9	20.1	4.2/348	116.4
Dec. 3	00 02.98	-08 48.7	3.819	4.210	-0.42 -4.7	20.2	5.2/16	106.7
Dec. 13	00 04.58	-07 55.6	3.969	4.211	-0.40 -4.6	20.3	6.7/32	97.4
Dec. 23	00 07.56	-06 56.1	4.123	4.212	-0.38 -4.4	20.4	8.3/41	88.4
Jan. 2	00 11.81	-05 51.1	4.277	4.214	-0.37 -4.3	20.4	9.9/47	79.7
Jan. 12	00 17.17	-04 41.7	4.428	4.215	-0.36 -4.2	20.5	11.4/51	71.2
Jan. 22	00 23.51	-03 28.7	4.571	4.217	-0.34 -4.1	20.6	12.6/54	63.0
Feb. 1	00 30.68	-02 13.0	4.706	4.219	-0.33 -4.0	20.7	13.7/56	55.0
Feb. 11	00 38.55	+00 55.2	4.828	4.221	-0.33 -3.9	20.7	14.6/57	47.2
Feb. 21	00 47.02	+00 23.9	4.937	4.223	-0.32 -3.8	20.8	15.4/59	39.6
Mar. 2	00 55.97	+01 43.8	5.031	4.226	-0.31 -3.7	20.8	15.9/60	32.2
Mar. 12	01 05.31	+03 03.9	5.109	4.228	-0.31 -3.7	20.9	16.3/61	24.9
Mar. 22	01 14.96	+04 23.5	5.169	4.231	-0.31 -3.6	20.9	16.7/62	17.7

## Comet P/2006 S1 (Christensen)

Epoch = 2019 July 16.0 TT  
 T = 2019 Oct. 25.49072 TT  
 Peri. = 133.61696 e = 0.5994643  
 Node = 207.89066 2000.0 a = 3.5432639 AU  
 Incl. = 12.32370 n = 0.14777427  
 q = 1.4192037 AU P = 6.67 years

$$m1 = 17.2 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot. /PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	15 52.27	-16 52.8	3.636	3.046	-0.64 +0.5	.	20.5/96	46.7
Jan. 17	16 06.48	-17 11.4	3.463	2.984	-0.69 +0.4	.	20.4/94	53.5
Jan. 27	16 20.59	-17 22.3	3.281	2.921	-0.75 +0.2	.	20.1/92	60.3
Feb. 6	16 34.49	-17 24.7	3.092	2.857	-0.82 +0.1	.	19.6/89	67.1
Feb. 16	16 48.02	-17 18.1	2.897	2.792	-0.90 -0.1	.	19.1/86	74.0
Feb. 26	17 01.05	-17 01.7	2.700	2.727	-0.99 -0.4	.	18.3/83	81.0
Mar. 8	17 13.40	-16 34.9	2.502	2.661	-1.10 -0.7	.	17.4/79	88.1
Mar. 18	17 24.84	-15 57.2	2.305	2.594	-1.21 -1.0	.	16.3/74	95.3
Mar. 28	17 35.15	-15 08.0	2.113	2.527	-1.35 -1.3	.	15.0/68	102.7
Apr. 7	17 44.06	-14 07.0	1.926	2.459	-1.51 -1.8	.	13.5/60	110.3
Apr. 17	17 51.24	-12 53.7	1.749	2.391	-1.68 -2.2	.	12.0/48	118.1
Apr. 27	17 56.38	-11 28.2	1.582	2.323	-1.88 -2.8	.	10.8/32	126.2
May 7	17 59.10	-09 51.0	1.429	2.254	-2.11 -3.4	.	10.5/10	134.5
May 17	17 59.13	-08 03.9	1.293	2.186	-2.35 -4.2	.	11.4/348	142.9
May 27	17 56.30	-06 10.1	1.175	2.118	-2.59 -5.1	.	13.3/330	150.9
June 6	17 50.69	-04 15.3	1.077	2.050	-2.82 -6.2	22.0	15.3/317	157.1
June 16	17 42.83	-02 27.9	1.001	1.983	-2.99 -7.6	21.7	16.5/307	159.1
June 26	17 33.74	+00 57.3	0.947	1.918	-3.08 -9.2	21.3	15.9/299	155.3
July 6	17 24.79	+00 07.2	0.912	1.853	-3.09 -10.7	21.0	13.2/291	147.7
July 16	17 17.59	+00 39.7	0.895	1.791	-3.01 -12.0	20.8	8.7/279	139.0
July 26	17 13.44	+00 39.4	0.891	1.731	-2.89 -12.8	20.5	3.6/241	130.2
Aug. 5	17 13.26	+00 09.0	0.898	1.674	-2.75 -13.0	20.3	5.6/143	122.1
Aug. 15	17 17.56	+00 45.8	0.911	1.621	-2.63 -12.8	20.1	12.1/123	114.7
Aug. 25	17 26.41	-01 58.2	0.927	1.572	-2.54 -12.1	20.0	18.7/115	108.3
Sept. 4	17 39.73	-03 21.5	0.947	1.529	-2.50 -11.3	19.8	25.1/110	102.9
Sept. 14	17 57.32	-04 49.0	0.968	1.492	-2.49 -10.3	19.7	30.9/106	98.2
Sept. 24	18 18.85	-06 14.3	0.990	1.462	-2.52 -9.2	19.7	36.1/103	94.3
Oct. 4	18 43.97	-07 31.0	1.016	1.439	-2.58 -8.3	19.6	40.7/100	91.1
Oct. 14	19 12.23	-08 32.9	1.046	1.425	-2.65 -7.6	19.6	44.4/97	88.4
Oct. 24	19 43.01	-09 14.6	1.083	1.419	-2.72 -7.2	19.7	47.3/94	86.1
Nov. 3	20 15.66	-09 31.9	1.127	1.422	-2.76 -7.0	19.8	49.4/90	84.1
Nov. 13	20 49.39	-09 22.4	1.181	1.434	-2.76 -6.9	19.9	50.4/87	82.2
Nov. 23	21 23.44	-08 46.4	1.245	1.454	-2.73 -7.0	20.1	50.6/84	80.4
Dec. 3	21 57.15	-07 46.1	1.321	1.482	-2.65 -7.1	20.4	50.1/82	78.5
Dec. 13	22 30.01	-06 25.2	1.408	1.517	-2.53 -7.0	20.7	48.9/79	76.4
Dec. 23	23 01.67	-04 48.8	1.507	1.559	-2.39 -6.8	21.0	47.4/77	74.2
Jan. 2	23 31.99	-03 01.5	1.617	1.606	-2.24 -6.5	21.3	45.7/76	71.6
Jan. 12	00 00.93	-01 08.2	1.736	1.658	-2.08 -6.0	21.7	43.8/75	68.8
Jan. 22	00 28.54	+00 47.2	1.864	1.714	-1.93 -5.4	.	42.0/74	65.7
Feb. 1	00 54.96	+02 41.7	1.998	1.773	-1.78 -4.8	.	40.3/74	62.4
Feb. 11	01 20.30	+04 32.6	2.138	1.834	-1.64 -4.1	.	38.6/74	58.9
Feb. 21	01 44.68	+06 17.8	2.281	1.898	-1.51 -3.4	.	37.1/74	55.1
Mar. 2	02 08.25	+07 56.1	2.426	1.963	-1.39 -2.8	.	35.6/75	51.2
Mar. 12	02 31.08	+09 26.2	2.572	2.030	-1.29 -2.2	.	34.3/76	47.1
Mar. 22	02 53.26	+10 47.4	2.716	2.098	-1.19 -1.7	.	33.1/77	42.8

## Comet 76P/West-Kohoutek-Ikemura

Epoch = 2019 July 16.0 TT  
 T = 2019 Oct. 26.14850 TT  
 Peri. = 0.02681 e = 0.5381756  
 Node = 84.12515 2000.0 a = 3.4748863 AU  
 Incl. = 30.45710 n = 0.15215743  
 q = 1.6047873 AU P = 6.48 years

$$m1 = 13.8 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	22 09.07	-36 13.8	3.634	2.963	+1.52	+9.8	.	41.0
Jan. 17	22 24.57	-34 33.8	3.646	2.907	+1.58	+10.2	.	35.9
Jan. 27	22 40.67	-32 49.9	3.644	2.850	+1.64	+10.6	.	31.4
Feb. 6	22 57.27	-31 02.2	3.629	2.793	+1.69	+11.0	.	27.6
Feb. 16	23 14.31	-29 11.0	3.602	2.735	+1.72	+11.3	.	24.6
Feb. 26	23 31.72	-27 16.5	3.562	2.677	+1.76	+11.6	.	22.8
Mar. 8	23 49.48	-25 19.1	3.511	2.618	+1.79	+11.9	.	22.1
Mar. 18	00 07.57	-23 19.2	3.450	2.559	+1.83	+12.1	.	22.5
Mar. 28	00 25.97	-21 17.2	3.379	2.501	+1.86	+12.3	.	24.0
Apr. 7	00 44.69	-19 13.6	3.301	2.442	+1.89	+12.4	.	26.1
Apr. 17	01 03.73	-17 09.1	3.215	2.383	+1.92	+12.5	22.0	28.6
Apr. 27	01 23.11	-15 04.1	3.123	2.324	+1.96	+12.5	21.8	31.5
May 7	01 42.84	-12 59.1	3.026	2.266	+1.99	+12.5	21.5	34.4
May 17	02 02.94	-10 54.9	2.925	2.208	+2.03	+12.4	21.3	37.4
May 27	02 23.42	-08 52.0	2.821	2.151	+2.07	+12.2	21.0	40.3
June 6	02 44.31	-06 51.0	2.715	2.095	+2.11	+12.0	20.8	43.3
June 16	03 05.60	-04 52.4	2.608	2.040	+2.15	+11.7	20.5	46.1
June 26	03 27.31	-02 56.6	2.500	1.986	+2.19	+11.4	20.3	49.0
July 6	03 49.43	-01 04.1	2.392	1.935	+2.23	+11.1	20.0	51.8
July 16	04 11.95	+00 45.1	2.284	1.885	+2.27	+10.7	19.7	54.5
July 26	04 34.86	+02 30.9	2.177	1.838	+2.31	+10.4	19.5	57.3
Aug. 5	04 58.14	+04 13.8	2.070	1.795	+2.35	+10.1	19.2	60.1
Aug. 15	05 21.75	+05 54.2	1.964	1.754	+2.38	+10.0	18.9	63.0
Aug. 25	05 45.69	+07 33.4	1.860	1.718	+2.41	+9.9	18.7	66.0
Sept. 4	06 09.90	+09 12.8	1.757	1.686	+2.43	+10.0	18.4	69.1
Sept. 14	06 34.34	+10 54.4	1.656	1.658	+2.46	+10.4	18.2	72.4
Sept. 24	06 59.00	+12 40.9	1.558	1.636	+2.48	+11.0	18.0	76.0
Oct. 4	07 23.80	+14 35.4	1.462	1.620	+2.48	+12.0	17.8	79.9
Oct. 14	07 48.66	+16 41.9	1.370	1.609	+2.49	+13.5	17.6	84.1
Oct. 24	08 13.50	+19 04.7	1.282	1.605	+2.48	+15.4	17.4	88.7
Nov. 3	08 38.15	+21 48.5	1.201	1.607	+2.45	+17.7	17.3	93.7
Nov. 13	09 02.38	+24 57.8	1.128	1.615	+2.39	+20.5	17.2	99.1
Nov. 23	09 25.88	+28 35.7	1.065	1.628	+2.29	+23.4	17.1	104.9
Dec. 3	09 48.15	+32 43.3	1.014	1.648	+2.14	+26.3	17.1	111.0
Dec. 13	10 08.56	+37 17.1	0.976	1.673	+1.91	+28.5	17.1	117.2
Dec. 23	10 26.26	+42 08.6	0.955	1.703	+1.58	+29.6	17.2	123.0
Jan. 2	10 40.15	+47 03.4	0.951	1.738	+1.14	+29.0	17.3	128.0
Jan. 12	10 49.11	+51 42.7	0.964	1.777	+0.58	+26.3	17.5	131.6
Jan. 22	10 52.15	+55 46.7	0.996	1.819	-0.05	+21.7	17.7	133.5
Feb. 1	10 48.93	+58 57.4	1.044	1.865	-0.64	+15.6	18.0	133.5
Feb. 11	10 40.58	+61 02.0	1.108	1.913	-1.03	+8.6	18.2	131.8
Feb. 21	10 29.58	+61 56.9	1.186	1.964	-1.12	+1.8	18.6	128.9
Mar. 2	10 19.12	+61 46.4	1.276	2.017	-0.90	-4.2	18.9	125.1
Mar. 12	10 11.79	+60 42.1	1.378	2.071	-0.51	-8.8	19.2	120.8
Mar. 22	10 08.63	+58 57.8	1.490	2.127	-0.08	-12.2	19.6	116.1

## Comet 68P/Klemola

Epoch = 2019 July 16.0 TT  
 T = 2019 Nov. 9.02888 TT  
 Peri. = 153.04879 e = 0.6377112  
 Node = 175.08899 2000.0 a = 4.9514147 AU  
 Incl. = 11.11021 n = 0.08945613  
 q = 1.7938421 AU P = 11.02 years

$$m1 = 10.5 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	15 58.26	-12 50.9	3.903	3.304	+1.34	-2.0	18.6	46.5
Jan. 17	16 11.58	-13 07.6	3.731	3.241	+1.33	-1.3	18.5	53.3
Jan. 27	16 24.75	-13 16.7	3.549	3.177	+1.30	-0.5	18.3	60.2
Feb. 6	16 37.64	-13 17.8	3.361	3.114	+1.27	+0.3	18.1	67.2
Feb. 16	16 50.10	-13 10.5	3.167	3.050	+1.22	+1.2	17.8	74.2
Feb. 26	17 01.98	-12 54.6	2.971	2.986	+1.15	+2.1	17.6	81.3
Mar. 8	17 13.10	-12 29.8	2.774	2.922	+1.06	+3.0	17.4	88.5
Mar. 18	17 23.25	-11 56.2	2.579	2.858	+0.95	+3.8	17.1	95.9
Mar. 28	17 32.22	-11 14.1	2.388	2.794	+0.82	+4.7	16.9	103.4
Apr. 7	17 39.74	-10 23.9	2.204	2.730	+0.66	+5.4	16.6	111.2
Apr. 17	17 45.54	-09 26.7	2.030	2.667	+0.48	+6.1	16.3	119.1
Apr. 27	17 49.37	-08 23.8	1.867	2.604	+0.26	+6.5	16.0	127.4
May 7	17 50.98	-07 17.6	1.719	2.541	+0.03	+6.7	15.7	135.8
May 17	17 50.22	-06 11.4	1.588	2.480	-0.21	+6.5	15.4	144.2
May 27	17 47.12	-05 09.3	1.477	2.419	-0.43	+5.8	15.2	152.1
June 6	17 41.91	-04 16.8	1.386	2.359	-0.62	+4.5	14.9	158.3
June 16	17 35.21	-03 39.6	1.319	2.301	-0.72	+2.7	14.7	160.3
June 26	17 27.94	-03 22.5	1.274	2.244	-0.72	+0.5	14.5	156.8
July 6	17 21.18	-03 28.8	1.251	2.189	-0.60	-2.0	14.4	149.6
July 16	17 16.09	-03 58.8	1.247	2.136	-0.38	-4.2	14.3	141.2
July 26	17 13.54	-04 50.3	1.260	2.086	-0.09	-6.2	14.2	132.5
Aug. 5	17 14.15	-05 59.1	1.287	2.038	+0.25	-7.6	14.1	124.2
Aug. 15	17 18.22	-07 20.0	1.324	1.993	+0.60	-8.6	14.1	116.5
Aug. 25	17 25.76	-08 47.8	1.369	1.952	+0.94	-9.0	14.1	109.4
Sept. 4	17 36.66	-10 17.5	1.419	1.915	+1.27	-8.9	14.1	102.8
Sept. 14	17 50.70	-11 44.2	1.475	1.883	+1.56	-8.3	14.1	96.9
Sept. 24	18 07.56	-13 03.6	1.534	1.854	+1.83	-7.4	14.1	91.5
Oct. 4	18 26.96	-14 11.9	1.597	1.831	+2.07	-6.1	14.1	86.5
Oct. 14	18 48.54	-15 05.7	1.663	1.814	+2.26	-4.5	14.2	81.8
Oct. 24	19 11.91	-15 42.2	1.733	1.801	+2.42	-2.6	14.2	77.5
Nov. 3	19 36.70	-15 59.4	1.806	1.795	+2.54	-0.6	14.3	73.4
Nov. 13	20 02.51	-15 56.2	1.884	1.794	+2.62	+1.5	14.4	69.5
Nov. 23	20 28.93	-15 32.4	1.965	1.800	+2.66	+3.5	14.5	65.7
Dec. 3	20 55.64	-14 48.8	2.052	1.811	+2.67	+5.4	14.6	61.9
Dec. 13	21 22.32	-13 47.1	2.142	1.827	+2.66	+7.1	14.8	58.3
Dec. 23	21 48.72	-12 29.4	2.237	1.849	+2.62	+8.5	14.9	54.6
Jan. 2	22 14.67	-10 58.4	2.335	1.876	+2.57	+9.7	15.1	50.9
Jan. 12	22 40.05	-09 16.9	2.436	1.908	+2.50	+10.6	15.2	47.1
Jan. 22	23 04.78	-07 28.0	2.540	1.944	+2.44	+11.2	15.4	43.3
Feb. 1	23 28.85	-05 34.2	2.645	1.985	+2.37	+11.5	15.6	39.4
Feb. 11	23 52.25	-03 38.3	2.750	2.028	+2.30	+11.6	15.8	35.4
Feb. 21	00 15.01	-01 42.4	2.855	2.076	+2.24	+11.5	15.9	31.4
Mar. 2	00 37.17	+00 11.4	2.958	2.125	+2.18	+11.2	16.1	27.2
Mar. 12	00 58.75	+02 01.5	3.057	2.178	+2.13	+10.7	16.3	23.0
Mar. 22	01 19.79	+03 46.5	3.153	2.232	+2.08	+10.2	16.5	18.8



## Comet C/2018 N2 (ASASSN)

Epoch = 2019 July 16.0 TT  
 T = 2019 Nov. 10.95098 TT  
 Peri. = 24.39729  
 Node = 25.25981 2000.0  
 Incl. = 77.53491  
 q = 3.1245398 AU  
 e = 1.0002644

$$m1 = 2.9 + 5 \log(\Delta) + 12.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion	m1	Elong.
2019/20	h m	° ' .4			m		°
Jan. 7	01 02.78	-32 31.4	4.384	4.267	-0.12 +16.2	14.0	76.7
Jan. 17	01 02.33	-29 49.4	4.455	4.206	+0.05 +16.2	13.9	69.1
Jan. 27	01 03.48	-27 07.6	4.523	4.147	+0.19 +16.1	13.9	61.6
Feb. 6	01 05.98	-24 27.7	4.585	4.088	+0.32 +15.8	13.9	54.2
Feb. 16	01 09.61	-21 50.8	4.638	4.030	+0.42 +15.5	13.8	47.0
Feb. 26	01 14.17	-19 17.5	4.680	3.973	+0.50 +15.1	13.7	40.0
Mar. 8	01 19.48	-16 48.2	4.708	3.917	+0.57 +14.7	13.7	33.4
Mar. 18	01 25.40	-14 22.9	4.719	3.862	+0.62 +14.3	13.6	27.3
Mar. 28	01 31.77	-12 01.6	4.714	3.809	+0.66 +13.9	13.5	22.2
Apr. 7	01 38.50	-09 44.2	4.691	3.757	+0.69 +13.6	13.4	18.7
Apr. 17	01 45.46	-07 30.2	4.649	3.706	+0.70 +13.2	13.3	17.8
Apr. 27	01 52.54	-05 19.4	4.588	3.657	+0.71 +12.9	13.2	19.8
May 7	01 59.66	-03 11.1	4.508	3.609	+0.71 +12.7	13.1	23.9
May 17	02 06.69	-01 05.1	4.410	3.563	+0.70 +12.5	13.0	29.3
May 27	02 13.55	+00 59.6	4.295	3.518	+0.67 +12.4	12.9	35.4
June 6	02 20.11	+03 03.6	4.162	3.476	+0.63 +12.4	12.8	42.0
June 16	02 26.22	+05 07.7	4.015	3.435	+0.58 +12.5	12.6	49.0
June 26	02 31.75	+07 13.2	3.855	3.397	+0.51 +12.7	12.5	56.3
July 6	02 36.49	+09 21.3	3.683	3.361	+0.42 +13.0	12.3	63.8
July 16	02 40.21	+11 33.2	3.502	3.327	+0.31 +13.5	12.1	71.7
July 26	02 42.65	+13 50.8	3.317	3.295	+0.16 +14.1	12.0	80.0
Aug. 5	02 43.44	+16 15.4	3.129	3.266	-0.03 +14.9	11.8	88.6
Aug. 15	02 42.17	+18 48.6	2.944	3.239	-0.26 +15.8	11.6	97.7
Aug. 25	02 38.35	+21 31.1	2.766	3.215	-0.54 +16.8	11.4	107.3
Sept. 4	02 31.43	+24 22.2	2.603	3.194	-0.88 +17.5	11.3	117.3
Sept. 14	02 20.86	+27 18.9	2.459	3.175	-1.27 +17.8	11.1	127.6
Sept. 24	02 06.29	+30 14.7	2.344	3.159	-1.68 +17.2	11.0	137.7
Oct. 4	01 47.70	+32 59.1	2.261	3.146	-2.06 +15.3	10.9	146.7
Oct. 14	01 25.82	+35 19.9	2.218	3.136	-2.32 +12.4	10.8	152.4
Oct. 24	01 02.13	+37 07.0	2.216	3.129	-2.39 +8.6	10.8	152.0
Nov. 3	00 38.68	+38 16.4	2.253	3.126	-2.25 +5.0	10.9	146.0
Nov. 13	00 17.49	+38 53.0	2.327	3.125	-1.94 +2.2	10.9	137.0
Nov. 23	23 59.92	+39 07.1	2.430	3.127	-1.53 +0.6	11.0	127.2
Dec. 3	23 46.56	+39 10.6	2.555	3.132	-1.10 +0.2	11.1	117.3
Dec. 13	23 37.35	+39 14.1	2.694	3.140	-0.71 +0.6	11.3	107.9
Dec. 23	23 31.86	+39 24.5	2.842	3.151	-0.36 +1.6	11.4	99.1
Jan. 2	23 29.56	+39 46.5	2.993	3.165	-0.07 +2.9	11.5	90.9
Jan. 12	23 29.92	+40 22.3	3.141	3.182	+0.16 +4.4	11.7	83.4
Jan. 22	23 32.45	+41 13.0	3.284	3.202	+0.36 +5.9	11.8	76.5
Feb. 1	23 36.78	+42 18.7	3.419	3.224	+0.52 +7.4	11.9	70.4
Feb. 11	23 42.58	+43 39.2	3.543	3.250	+0.65 +8.8	12.0	64.9
Feb. 21	23 49.62	+45 13.8	3.655	3.277	+0.77 +10.2	12.2	60.1
Mar. 2	23 57.72	+47 02.0	3.755	3.308	+0.86 +11.5	12.3	56.2
Mar. 12	00 06.74	+49 03.1	3.842	3.340	+0.95 +12.8	12.4	53.0
Mar. 22	00 16.61	+51 16.3	3.917	3.375	+1.03 +14.0	12.5	50.7

## Comet P/2003 F2 (NEAT)

Epoch = 2019 July 16.0 TT  
 T = 2019 Nov. 11.93101 TT  
 Peri. = 191.81557 e = 0.5420477  
 Node = 359.09137 2000.0 a = 6.4854412 AU  
 Incl. = 11.60554 n = 0.05967532  
 q = 2.9700227 AU P = 16.52 years

$$m_1 = 13.7 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	09 28.57	+27 28.2	2.813	3.686	-0.86 +5.6	21.6	6.1/293	148.3
Jan. 17	09 23.59	+27 52.4	2.715	3.647	-0.89 +5.6	21.5	8.1/287	158.3
Jan. 27	09 17.21	+28 13.8	2.645	3.609	-0.92 +5.6	21.4	9.4/281	166.5
Feb. 6	09 10.00	+28 28.6	2.603	3.572	-0.93 +5.5	21.3	9.8/276	167.3
Feb. 16	09 02.70	+28 33.6	2.592	3.535	-0.93 +5.3	21.3	9.3/269	159.8
Feb. 26	08 56.07	+28 27.0	2.607	3.499	-0.91 +5.1	21.2	8.0/261	149.8
Mar. 8	08 50.80	+28 08.6	2.648	3.463	-0.89 +4.9	21.2	6.2/247	139.5
Mar. 18	08 47.37	+27 39.0	2.711	3.429	-0.85 +4.7	21.2	4.7/221	129.3
Mar. 28	08 46.05	+26 59.7	2.790	3.395	-0.82 +4.6	21.2	4.4/182	119.5
Apr. 7	08 46.91	+26 12.3	2.882	3.362	-0.78 +4.5	21.3	5.8/152	110.2
Apr. 17	08 49.87	+25 17.9	2.983	3.330	-0.75 +4.5	21.3	8.0/136	101.4
Apr. 27	08 54.77	+24 17.6	3.088	3.299	-0.72 +4.6	21.3	10.2/128	93.1
May 7	09 01.38	+23 11.9	3.195	3.269	-0.69 +4.6	21.4	12.4/124	85.2
May 17	09 09.49	+22 01.1	3.301	3.241	-0.67 +4.7	21.4	14.3/121	77.7
May 27	09 18.86	+20 45.4	3.404	3.213	-0.65 +4.8	21.4	16.1/119	70.6
June 6	09 29.29	+19 24.8	3.502	3.187	-0.63 +4.9	21.5	17.6/118	63.8
June 16	09 40.61	+17 59.5	3.594	3.162	-0.61 +5.0	21.5	18.9/118	57.2
June 26	09 52.66	+16 29.4	3.678	3.138	-0.60 +5.2	21.5	20.1/117	50.9
July 6	10 05.32	+14 54.7	3.754	3.115	-0.59 +5.3	21.5	21.1/117	44.8
July 16	10 18.46	+13 15.7	3.820	3.094	-0.58 +5.4	21.5	22.0/117	38.8
July 26	10 32.00	+11 32.6	3.877	3.075	-0.58 +5.6	21.5	22.8/118	33.0
Aug. 5	10 45.87	+09 45.6	3.924	3.057	-0.57 +5.7	21.5	23.4/118	27.2
Aug. 15	11 00.00	+07 55.3	3.960	3.041	-0.57 +5.8	21.5	24.0/118	21.5
Aug. 25	11 14.35	+06 02.0	3.985	3.026	-0.57 +5.9	21.5	24.4/118	15.9
Sept. 4	11 28.86	+04 06.2	4.000	3.013	-0.57 +6.0	21.5	24.8/118	10.3
Sept. 14	11 43.52	+02 08.6	4.003	3.001	-0.57 +6.0	21.5	25.0/118	4.7
Sept. 24	11 58.27	+00 09.6	3.995	2.992	-0.58 +6.1	21.5	25.2/118	0.9
Oct. 4	12 13.11	-01 50.1	3.976	2.984	-0.58 +6.1	21.4	25.3/118	6.5
Oct. 14	12 27.99	-03 49.9	3.945	2.978	-0.59 +6.1	21.4	25.3/118	12.2
Oct. 24	12 42.87	-05 49.1	3.904	2.973	-0.60 +6.2	21.4	25.2/118	17.9
Nov. 3	12 57.73	-07 47.2	3.852	2.971	-0.61 +6.1	21.4	24.9/118	23.7
Nov. 13	13 12.50	-09 43.3	3.789	2.970	-0.63 +6.1	21.3	24.6/118	29.7
Nov. 23	13 27.14	-11 36.9	3.716	2.971	-0.64 +6.1	21.3	24.1/118	35.7
Dec. 3	13 41.55	-13 27.6	3.634	2.974	-0.66 +6.0	21.2	23.5/118	41.9
Dec. 13	13 55.66	-15 14.7	3.543	2.979	-0.68 +5.9	21.2	22.7/118	48.2
Dec. 23	14 09.34	-16 57.8	3.443	2.985	-0.70 +5.9	21.1	21.7/118	54.7
Jan. 2	14 22.47	-18 36.7	3.337	2.994	-0.73 +5.8	21.1	20.5/118	61.4
Jan. 12	14 34.87	-20 11.0	3.224	3.004	-0.76 +5.7	21.0	19.1/119	68.3
Jan. 22	14 46.37	-21 40.7	3.108	3.015	-0.80 +5.6	21.0	17.5/120	75.5
Feb. 1	14 56.75	-23 05.6	2.989	3.029	-0.83 +5.5	20.9	15.7/122	82.9
Feb. 11	15 05.75	-24 25.6	2.869	3.044	-0.87 +5.4	20.8	13.6/125	90.6
Feb. 21	15 13.15	-25 40.7	2.751	3.061	-0.92 +5.4	20.8	11.3/130	98.7
Mar. 2	15 18.65	-26 50.4	2.638	3.079	-0.97 +5.4	20.7	8.9/139	107.1
Mar. 12	15 22.05	-27 54.1	2.532	3.099	-1.03 +5.4	20.6	6.7/155	115.9
Mar. 22	15 23.16	-28 50.8	2.438	3.120	-1.08 +5.5	20.6	5.2/183	125.1

## Comet 155P/Shoemaker

Epoch = 2019 July 16.0 TT  
 T = 2019 Nov. 15.20535 TT  
 Peri. = 14.67124 e = 0.7266074  
 Node = 97.19795 2000.0 a = 6.5905646 AU  
 Incl. = 6.39589 n = 0.05825325  
 q = 1.8018116 AU P = 16.92 years

$$m1 = 10.3 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	23 59.54	-06 38.0	3.713	3.522	+0.65	+5.9	21.4	71.2
Jan. 17	00 06.67	-05 35.5	3.783	3.452	+0.78	+6.6	21.3	63.1
Jan. 27	00 15.03	-04 26.3	3.842	3.382	+0.90	+7.2	21.2	55.4
Feb. 6	00 24.49	-03 11.4	3.890	3.311	+1.00	+7.8	21.0	47.9
Feb. 16	00 34.95	-01 51.5	3.923	3.240	+1.10	+8.2	20.9	40.8
Feb. 26	00 46.33	+00 27.5	3.942	3.170	+1.18	+8.6	20.8	34.0
Mar. 8	00 58.55	+00 59.9	3.946	3.099	+1.27	+8.9	20.6	27.4
Mar. 18	01 11.56	+02 30.0	3.935	3.028	+1.34	+9.1	20.5	21.1
Mar. 28	01 25.32	+04 02.0	3.909	2.957	+1.42	+9.3	20.3	15.2
Apr. 7	01 39.82	+05 35.2	3.868	2.887	+1.49	+9.4	20.1	9.6
Apr. 17	01 55.04	+07 08.9	3.814	2.816	+1.56	+9.4	20.0	5.2
Apr. 27	02 10.99	+08 42.1	3.747	2.746	+1.64	+9.3	19.7	5.0
May 7	02 27.68	+10 14.3	3.669	2.677	+1.71	+9.1	19.5	9.0
May 17	02 45.12	+11 44.4	3.580	2.608	+1.79	+8.9	19.3	13.7
May 27	03 03.34	+13 11.5	3.481	2.540	+1.87	+8.5	19.1	18.4
June 6	03 22.37	+14 34.7	3.375	2.473	+1.95	+8.1	18.8	23.1
June 16	03 42.22	+15 52.7	3.262	2.408	+2.03	+7.5	18.6	27.6
June 26	04 02.93	+17 04.6	3.143	2.344	+2.12	+6.8	18.3	32.0
July 6	04 24.50	+18 09.1	3.021	2.281	+2.20	+6.0	18.1	36.2
July 16	04 46.92	+19 04.9	2.897	2.221	+2.29	+5.1	17.8	40.3
July 26	05 10.19	+19 50.8	2.771	2.163	+2.37	+4.0	17.5	44.3
Aug. 5	05 34.24	+20 25.5	2.645	2.108	+2.45	+2.8	17.3	48.2
Aug. 15	05 59.00	+20 48.0	2.520	2.056	+2.51	+1.5	17.0	51.9
Aug. 25	06 24.37	+20 57.4	2.398	2.008	+2.57	+0.2	16.7	55.6
Sept. 4	06 50.22	+20 53.1	2.278	1.964	+2.60	-1.2	16.5	59.2
Sept. 14	07 16.35	+20 35.2	2.163	1.924	+2.62	-2.5	16.2	62.8
Sept. 24	07 42.59	+20 03.9	2.052	1.889	+2.62	-3.8	16.0	66.4
Oct. 4	08 08.71	+19 20.4	1.946	1.859	+2.60	-5.0	15.8	70.0
Oct. 14	08 34.47	+18 26.6	1.845	1.836	+2.55	-5.9	15.6	73.8
Oct. 24	08 59.62	+17 24.9	1.749	1.818	+2.47	-6.5	15.4	77.7
Nov. 3	09 23.89	+16 18.4	1.658	1.807	+2.37	-6.8	15.3	81.8
Nov. 13	09 46.99	+15 10.9	1.573	1.802	+2.24	-6.7	15.1	86.2
Nov. 23	10 08.66	+14 06.4	1.493	1.804	+2.07	-6.1	15.0	91.0
Dec. 3	10 28.54	+13 09.3	1.417	1.812	+1.88	-5.1	14.9	96.2
Dec. 13	10 46.30	+12 24.0	1.347	1.827	+1.64	-3.7	14.9	102.1
Dec. 23	11 01.55	+11 54.3	1.283	1.848	+1.37	-2.0	14.8	108.5
Jan. 2	11 13.88	+11 43.7	1.225	1.875	+1.06	+0.1	14.8	115.8
Jan. 12	11 22.93	+11 54.1	1.176	1.908	+0.71	+2.2	14.9	123.8
Jan. 22	11 28.43	+12 25.2	1.138	1.945	+0.35	+4.2	14.9	132.7
Feb. 1	11 30.28	+13 14.3	1.114	1.988	-0.01	+5.7	15.0	142.4
Feb. 11	11 28.81	+14 14.6	1.107	2.034	-0.31	+6.3	15.1	152.5
Feb. 21	11 24.71	+15 16.9	1.121	2.085	-0.52	+6.0	15.3	162.3
Mar. 2	11 19.09	+16 11.1	1.158	2.139	-0.59	+4.6	15.6	168.9
Mar. 12	11 13.27	+16 48.6	1.218	2.195	-0.55	+2.6	15.9	166.0
Mar. 22	11 08.41	+17 04.8	1.302	2.254	-0.40	+0.4	16.2	157.4

Comet 215P/NEAT

Epoch = 2019 July 16.0 TT  
 T = 2019 Nov. 17.66275 TT  
 Peri. = 261.96320 e = 0.1679164  
 Node = 56.70106 2000.0 a = 4.3322488 AU  
 Incl. = 10.58189 n = 0.10930348  
 q = 3.6047932 AU P = 9.02 years

$$m1 = 2.6 + 5 \log(\Delta) + 25.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .			m	'		°
Jan. 7	18 17.90	-28 09.1	4.732	3.780	+1.45	-0.6	20.4	13.1
Jan. 17	18 32.37	-28 13.4	4.681	3.770	+1.44	-0.2	20.4	19.8
Jan. 27	18 46.67	-28 14.3	4.614	3.760	+1.42	+0.1	20.3	26.7
Feb. 6	19 00.70	-28 12.3	4.531	3.750	+1.38	+0.3	20.2	33.6
Feb. 16	19 14.35	-28 08.1	4.434	3.741	+1.34	+0.5	20.2	40.7
Feb. 26	19 27.49	-28 02.4	4.324	3.732	+1.28	+0.6	20.1	47.8
Mar. 8	19 40.04	-27 56.2	4.202	3.723	+1.22	+0.6	20.0	55.0
Mar. 18	19 51.85	-27 50.4	4.069	3.714	+1.14	+0.5	19.9	62.4
Mar. 28	20 02.80	-27 46.2	3.929	3.706	+1.04	+0.3	19.8	69.8
Apr. 7	20 12.77	-27 44.7	3.783	3.698	+0.94	-0.1	19.7	77.5
Apr. 17	20 21.60	-27 47.4	3.634	3.690	+0.81	-0.5	19.6	85.3
Apr. 27	20 29.14	-27 55.2	3.483	3.682	+0.68	-1.1	19.5	93.4
May 7	20 35.22	-28 09.3	3.335	3.675	+0.52	-1.8	19.3	101.7
May 17	20 39.67	-28 30.4	3.192	3.668	+0.35	-2.5	19.2	110.4
May 27	20 42.34	-28 58.9	3.058	3.662	+0.16	-3.3	19.1	119.3
June 6	20 43.10	-29 34.5	2.936	3.656	-0.03	-3.9	19.0	128.6
June 16	20 41.88	-30 15.9	2.830	3.650	-0.23	-4.4	18.9	138.1
June 26	20 38.74	-31 00.8	2.744	3.644	-0.41	-4.6	18.8	147.7
July 6	20 33.87	-31 46.2	2.681	3.639	-0.57	-4.4	18.8	157.0
July 16	20 27.67	-32 28.1	2.644	3.634	-0.67	-3.9	18.7	164.6
July 26	20 20.70	-33 03.0	2.634	3.630	-0.71	-3.0	18.7	166.5
Aug. 5	20 13.64	-33 27.9	2.652	3.626	-0.68	-1.9	18.7	160.9
Aug. 15	20 07.23	-33 41.1	2.696	3.622	-0.58	-0.7	18.7	152.1
Aug. 25	20 02.09	-33 42.6	2.764	3.618	-0.43	+0.5	18.8	142.4
Sept. 4	19 58.68	-33 33.3	2.854	3.615	-0.23	+1.5	18.8	132.8
Sept. 14	19 57.30	-33 14.7	2.962	3.613	-0.02	+2.3	18.9	123.3
Sept. 24	19 58.00	-32 48.6	3.083	3.610	+0.18	+3.0	19.0	114.1
Oct. 4	20 00.76	-32 16.1	3.215	3.609	+0.38	+3.5	19.1	105.2
Oct. 14	20 05.43	-31 38.5	3.353	3.607	+0.56	+4.0	19.2	96.6
Oct. 24	20 11.80	-30 56.4	3.495	3.606	+0.72	+4.4	19.2	88.4
Nov. 3	20 19.67	-30 10.2	3.636	3.605	+0.86	+4.8	19.3	80.4
Nov. 13	20 28.82	-29 20.2	3.775	3.605	+0.98	+5.2	19.4	72.6
Nov. 23	20 39.02	-28 26.4	3.908	3.605	+1.07	+5.6	19.5	65.1
Dec. 3	20 50.10	-27 28.8	4.035	3.605	+1.15	+6.0	19.6	57.7
Dec. 13	21 01.87	-26 27.7	4.151	3.606	+1.21	+6.3	19.6	50.5
Dec. 23	21 14.18	-25 23.2	4.257	3.607	+1.26	+6.6	19.7	43.5
Jan. 2	21 26.89	-24 15.5	4.351	3.609	+1.29	+6.9	19.7	36.6
Jan. 12	21 39.88	-23 04.9	4.430	3.611	+1.31	+7.2	19.8	29.8
Jan. 22	21 53.05	-21 51.8	4.496	3.613	+1.32	+7.4	19.8	23.3
Feb. 1	22 06.30	-20 36.7	4.545	3.616	+1.33	+7.6	19.8	17.1
Feb. 11	22 19.56	-19 20.2	4.579	3.619	+1.32	+7.7	19.9	11.7
Feb. 21	22 32.75	-18 02.7	4.597	3.622	+1.31	+7.8	19.9	8.4
Mar. 2	22 45.82	-16 45.0	4.599	3.626	+1.30	+7.8	19.9	9.7
Mar. 12	22 58.70	-15 27.7	4.585	3.630	+1.28	+7.7	19.9	14.3
Mar. 22	23 11.35	-14 11.4	4.555	3.634	+1.25	+7.5	19.9	20.0

Comet 294P/LINEAR

Epoch = 2019 July 16.0 TT  
 T = 2019 Nov. 29.71782 TT  
 Peri. = 235.52725 e = 0.5942268  
 Node = 312.59875 2000.0 a = 3.2050483 AU  
 Incl. = 18.21450 n = 0.17177194  
 q = 1.3005227 AU P = 5.74 years

$$m_1 = 16.9 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .			m	'		°
Jan. 7	02 25.92	+36 51.4	2.629	3.211	-0.09	-7.6	.	118.0
Jan. 17	02 26.33	+35 39.7	2.700	3.153	+0.19	-6.6	.	108.5
Jan. 27	02 29.43	+34 39.4	2.779	3.095	+0.45	-5.3	.	99.3
Feb. 6	02 34.99	+33 51.7	2.862	3.035	+0.68	-4.1	.	90.5
Feb. 16	02 42.74	+33 16.4	2.944	2.975	+0.89	-2.9	.	82.2
Feb. 26	02 52.44	+32 52.3	3.022	2.913	+1.07	-1.9	.	74.2
Mar. 8	03 03.87	+32 37.7	3.093	2.850	+1.23	-1.0	.	66.7
Mar. 18	03 16.87	+32 30.6	3.155	2.787	+1.38	-0.4	.	59.6
Mar. 28	03 31.29	+32 28.9	3.206	2.722	+1.52	0.0	.	52.8
Apr. 7	03 47.02	+32 30.4	3.246	2.657	+1.64	+0.2	.	46.4
Apr. 17	04 03.98	+32 33.0	3.273	2.590	+1.76	+0.2	.	40.3
Apr. 27	04 22.07	+32 34.4	3.287	2.523	+1.87	0.0	.	34.5
May 7	04 41.23	+32 32.6	3.288	2.455	+1.97	-0.4	.	29.0
May 17	05 01.41	+32 25.5	3.276	2.386	+2.07	-1.1	.	23.9
May 27	05 22.51	+32 11.0	3.251	2.317	+2.16	-1.9	.	19.0
June 6	05 44.50	+31 47.2	3.214	2.246	+2.24	-3.0	.	14.5
June 16	06 07.29	+31 12.0	3.166	2.176	+2.32	-4.2	.	10.6
June 26	06 30.79	+30 23.6	3.108	2.105	+2.39	-5.6	.	7.7
July 6	06 54.93	+29 20.2	3.041	2.034	+2.45	-7.2	.	6.6
July 16	07 19.62	+27 59.9	2.965	1.963	+2.50	-9.0	.	7.9
July 26	07 44.78	+26 21.2	2.883	1.893	+2.54	-10.9	22.0	10.4
Aug. 5	08 10.35	+24 22.7	2.796	1.823	+2.58	-13.0	21.7	13.3
Aug. 15	08 36.26	+22 03.0	2.705	1.755	+2.61	-15.2	21.5	16.2
Aug. 25	09 02.49	+19 21.3	2.612	1.688	+2.64	-17.4	21.3	19.0
Sept. 4	09 29.06	+16 16.9	2.519	1.624	+2.67	-19.7	21.0	21.6
Sept. 14	09 55.97	+12 49.7	2.428	1.563	+2.71	-22.0	20.8	23.9
Sept. 24	10 23.32	+09 00.3	2.341	1.506	+2.76	-24.1	20.5	26.1
Oct. 4	10 51.21	+04 50.3	2.259	1.453	+2.82	-26.0	20.3	28.0
Oct. 14	11 19.79	+00 22.5	2.184	1.407	+2.90	-27.6	20.1	29.7
Oct. 24	11 49.25	-04 18.9	2.119	1.368	+3.00	-28.7	19.9	31.1
Nov. 3	12 19.81	-09 08.0	2.064	1.337	+3.12	-29.1	19.7	32.4
Nov. 13	12 51.63	-13 57.2	2.021	1.315	+3.26	-28.6	19.6	33.5
Nov. 23	13 24.92	-18 37.6	1.989	1.303	+3.41	-27.2	19.5	34.6
Dec. 3	13 59.75	-22 59.8	1.968	1.301	+3.57	-24.8	19.5	35.6
Dec. 13	14 36.04	-26 54.2	1.958	1.310	+3.70	-21.6	19.5	36.8
Dec. 23	15 13.54	-30 13.1	1.956	1.328	+3.80	-17.7	19.6	38.1
Jan. 2	15 51.76	-32 51.0	1.960	1.356	+3.83	-13.4	19.7	39.6
Jan. 12	16 29.97	-34 45.4	1.968	1.393	+3.79	-9.1	19.8	41.4
Jan. 22	17 07.41	-35 57.3	1.978	1.437	+3.67	-5.0	20.0	43.6
Feb. 1	17 43.28	-36 30.6	1.987	1.487	+3.47	-1.4	20.1	46.2
Feb. 11	18 16.93	-36 31.1	1.993	1.542	+3.22	+1.5	20.3	49.3
Feb. 21	18 47.94	-36 05.5	1.993	1.602	+2.94	+3.7	20.4	52.8
Mar. 2	19 16.03	-35 20.8	1.988	1.666	+2.64	+5.3	20.6	56.8
Mar. 12	19 41.10	-34 23.4	1.975	1.731	+2.34	+6.2	20.8	61.2
Mar. 22	20 03.15	-33 18.9	1.954	1.799	+2.04	+6.7	20.9	66.2

## Comet P/2013 T2 (Schwartz)

Epoch = 2019 July 16.0 TT  
 T = 2019 Nov. 30.50225 TT  
 Peri. = 345.43136 e = 0.5011844  
 Node = 0.82890 2000.0 a = 3.4889993 AU  
 Incl. = 9.45539 n = 0.15123515  
 q = 1.7403673 AU P = 6.52 years

$$m1 = 13.0 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	16 22.24	-28 02.6	3.826	3.113	-0.64 +1.9	.	21.2/104	38.1
Jan. 17	16 37.88	-28 50.8	3.682	3.062	-0.70 +1.7	.	21.1/103	44.7
Jan. 27	16 53.55	-29 35.5	3.526	3.011	-0.76 +1.5	.	20.9/102	51.3
Feb. 6	17 09.16	-30 17.0	3.361	2.959	-0.82 +1.2	.	20.5/101	58.0
Feb. 16	17 24.56	-30 55.4	3.189	2.907	-0.89 +0.9	.	20.0/101	64.7
Feb. 26	17 39.64	-31 31.2	3.012	2.855	-0.97 +0.6	.	19.3/100	71.4
Mar. 8	17 54.22	-32 05.1	2.830	2.802	-1.06 +0.2	22.0	18.4/101	78.2
Mar. 18	18 08.13	-32 38.1	2.648	2.749	-1.17 -0.2	21.7	17.3/101	85.2
Mar. 28	18 21.15	-33 11.2	2.466	2.696	-1.28 -0.7	21.4	16.0/102	92.2
Apr. 7	18 33.03	-33 45.9	2.286	2.643	-1.41 -1.3	21.1	14.4/105	99.5
Apr. 17	18 43.48	-34 23.3	2.112	2.589	-1.56 -1.9	20.8	12.4/109	107.0
Apr. 27	18 52.17	-35 05.0	1.945	2.536	-1.74 -2.4	20.5	10.3/116	114.7
May 7	18 58.68	-35 51.9	1.787	2.483	-1.93 -3.0	20.2	8.0/129	122.8
May 17	19 02.59	-36 44.1	1.642	2.430	-2.16 -3.4	19.9	6.2/153	131.1
May 27	19 03.50	-37 40.6	1.512	2.377	-2.40 -3.7	19.5	5.9/190	139.8
June 6	19 01.07	-38 38.2	1.399	2.325	-2.65 -3.6	19.2	7.6/222	148.5
June 16	18 55.26	-39 31.0	1.306	2.274	-2.89 -3.0	18.9	9.9/241	156.6
June 26	18 46.56	-40 11.3	1.234	2.223	-3.07 -2.0	18.7	11.8/255	162.1
July 6	18 36.02	-40 31.4	1.185	2.174	-3.17 -0.7	18.4	12.5/267	161.6
July 16	18 25.38	-40 25.9	1.159	2.126	-3.17 +0.7	18.2	11.6/280	155.4
July 26	18 16.48	-39 54.9	1.153	2.079	-3.07 +1.6	18.1	9.5/297	146.8
Aug. 5	18 10.86	-39 02.7	1.166	2.034	-2.91 +2.0	18.0	7.3/327	137.7
Aug. 15	18 09.49	-37 55.8	1.194	1.991	-2.72 +1.8	17.9	7.4/10	128.8
Aug. 25	18 12.63	-36 40.4	1.233	1.951	-2.54 +1.1	17.8	10.3/40	120.4
Sept. 4	18 20.08	-35 19.7	1.282	1.913	-2.39 0.0	17.8	14.5/55	112.7
Sept. 14	18 31.44	-33 55.3	1.337	1.878	-2.25 -1.4	17.7	18.7/62	105.7
Sept. 24	18 46.09	-32 26.3	1.396	1.846	-2.14 -2.8	17.7	22.6/66	99.3
Oct. 4	19 03.50	-30 51.2	1.459	1.818	-2.04 -4.3	17.7	26.1/68	93.5
Oct. 14	19 23.12	-29 08.0	1.524	1.794	-1.95 -5.7	17.7	29.1/68	88.1
Oct. 24	19 44.40	-27 14.9	1.592	1.774	-1.87 -7.2	17.7	31.7/68	83.2
Nov. 3	20 06.93	-25 10.5	1.662	1.759	-1.79 -8.5	17.8	33.9/67	78.6
Nov. 13	20 30.30	-22 54.3	1.734	1.748	-1.71 -9.6	17.8	35.7/67	74.3
Nov. 23	20 54.16	-20 26.5	1.808	1.742	-1.64 -10.6	17.9	37.2/66	70.2
Dec. 3	21 18.29	-17 47.7	1.885	1.741	-1.56 -11.4	18.0	38.3/65	66.3
Dec. 13	21 42.46	-14 59.4	1.965	1.744	-1.49 -12.0	18.1	39.0/64	62.5
Dec. 23	22 06.53	-12 03.5	2.047	1.753	-1.43 -12.4	18.2	39.5/63	58.8
Jan. 2	22 30.44	-09 02.0	2.132	1.766	-1.36 -12.5	18.3	39.8/63	55.2
Jan. 12	22 54.11	-05 57.1	2.219	1.784	-1.31 -12.5	18.5	39.7/62	51.6
Jan. 22	23 17.53	-02 51.2	2.309	1.806	-1.25 -12.3	18.7	39.5/62	48.0
Feb. 1	23 40.73	+00 13.6	2.401	1.832	-1.21 -11.9	18.8	39.2/62	44.4
Feb. 11	00 03.71	+03 15.3	2.494	1.862	-1.16 -11.4	19.0	38.6/62	40.8
Feb. 21	00 26.50	+06 11.9	2.587	1.895	-1.13 -10.8	19.2	38.0/63	37.1
Mar. 2	00 49.15	+09 02.1	2.681	1.932	-1.09 -10.2	19.4	37.3/64	33.4
Mar. 12	01 11.67	+11 44.2	2.773	1.971	-1.06 -9.4	19.6	36.5/64	29.6
Mar. 22	01 34.09	+14 17.2	2.863	2.013	-1.03 -8.7	19.8	35.7/66	25.8

Comet 160P/LINEAR

Epoch = 2019 July 16.0 TT  
 T = 2019 Dec. 2.31384 TT  
 Peri. = 12.63589 e = 0.5262453  
 Node = 333.37192 2000.0 a = 3.7728607 AU  
 Incl. = 15.61393 n = 0.13449245  
 q = 1.7874105 AU P = 7.33 years

$$m1 = 10.0 + 5 \log(\Delta) + 20.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	16 26.44	-34 31.2	3.920	3.197	+1.65	-4.9	.	37.6
Jan. 17	16 43.06	-35 18.7	3.779	3.145	+1.67	-4.6	.	43.9
Jan. 27	16 59.76	-36 03.2	3.627	3.091	+1.67	-4.3	.	50.3
Feb. 6	17 16.45	-36 44.6	3.465	3.038	+1.66	-4.0	.	56.7
Feb. 16	17 32.99	-37 23.3	3.296	2.984	+1.64	-3.7	.	63.2
Feb. 26	17 49.24	-37 59.4	3.122	2.930	+1.60	-3.5	21.8	69.7
Mar. 8	18 05.05	-38 33.7	2.943	2.875	+1.55	-3.4	21.5	76.3
Mar. 18	18 20.20	-39 06.9	2.762	2.820	+1.47	-3.3	21.2	83.0
Mar. 28	18 34.49	-39 39.9	2.582	2.766	+1.37	-3.3	20.9	89.9
Apr. 7	18 47.66	-40 13.8	2.403	2.711	+1.24	-3.5	20.6	96.8
Apr. 17	18 59.39	-40 49.8	2.229	2.656	+1.08	-3.7	20.2	103.9
Apr. 27	19 09.35	-41 28.6	2.061	2.601	+0.88	-4.1	19.9	111.3
May 7	19 17.09	-42 11.0	1.902	2.547	+0.63	-4.4	19.5	118.9
May 17	19 22.16	-42 56.4	1.753	2.493	+0.34	-4.7	19.2	126.7
May 27	19 24.08	-43 43.1	1.618	2.439	0.00	-4.6	18.8	134.6
June 6	19 22.42	-44 27.1	1.499	2.386	-0.37	-4.0	18.4	142.6
June 16	19 17.03	-45 01.7	1.398	2.334	-0.73	-2.6	18.1	150.0
June 26	19 08.26	-45 18.4	1.317	2.282	-1.03	-0.3	17.8	155.7
July 6	18 57.10	-45 08.0	1.258	2.232	-1.19	+2.8	17.5	157.6
July 16	18 45.29	-44 24.5	1.221	2.183	-1.14	+6.2	17.2	154.5
July 26	18 34.83	-43 07.9	1.206	2.136	-0.90	+9.3	17.0	147.9
Aug. 5	18 27.43	-41 23.6	1.210	2.090	-0.52	+11.6	16.8	139.7
Aug. 15	18 24.19	-39 20.8	1.232	2.046	-0.08	+12.9	16.7	131.2
Aug. 25	18 25.39	-37 08.4	1.268	2.005	+0.36	+13.5	16.6	122.8
Sept. 4	18 30.84	-34 52.5	1.315	1.967	+0.76	+13.6	16.5	115.0
Sept. 14	18 40.09	-32 36.5	1.371	1.931	+1.11	+13.6	16.4	107.7
Sept. 24	18 52.54	-30 21.2	1.433	1.899	+1.40	+13.5	16.4	100.9
Oct. 4	19 07.63	-28 05.7	1.500	1.870	+1.64	+13.6	16.3	94.7
Oct. 14	19 24.86	-25 48.4	1.570	1.845	+1.82	+13.9	16.3	89.0
Oct. 24	19 43.72	-23 27.5	1.643	1.824	+1.96	+14.3	16.3	83.7
Nov. 3	20 03.86	-21 01.6	1.718	1.808	+2.07	+14.9	16.3	78.7
Nov. 13	20 24.94	-18 29.5	1.795	1.796	+2.15	+15.6	16.4	74.1
Nov. 23	20 46.65	-15 51.0	1.874	1.790	+2.20	+16.2	16.4	69.7
Dec. 3	21 08.82	-13 05.8	1.955	1.787	+2.23	+16.9	16.5	65.5
Dec. 13	21 31.26	-10 14.7	2.037	1.790	+2.25	+17.4	16.6	61.5
Dec. 23	21 53.84	-07 18.5	2.120	1.798	+2.26	+17.8	16.7	57.7
Jan. 2	22 16.50	-04 18.5	2.206	1.810	+2.27	+18.2	16.9	53.9
Jan. 12	22 39.16	-01 16.3	2.292	1.827	+2.26	+18.3	17.0	50.2
Jan. 22	23 01.79	+01 46.6	2.380	1.848	+2.26	+18.3	17.2	46.6
Feb. 1	23 24.40	+04 48.5	2.469	1.874	+2.26	+18.1	17.4	43.0
Feb. 11	23 46.98	+07 47.6	2.558	1.903	+2.26	+17.7	17.6	39.5
Feb. 21	00 09.55	+10 42.3	2.648	1.936	+2.26	+17.2	17.9	35.9
Mar. 2	00 32.12	+13 31.3	2.736	1.972	+2.26	+16.5	18.1	32.3
Mar. 12	00 54.71	+16 12.9	2.824	2.011	+2.26	+15.7	18.3	28.8
Mar. 22	01 17.33	+18 46.1	2.909	2.052	+2.26	+14.8	18.6	25.3

## Comet C/2018 F4 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2019 Dec. 4.05149 TT  
 Peri. = 263.20270  
 Node = 26.50731 2000.0  
 Incl. = 78.09848  
 q = 3.4399080 AU  
 e = 1.0014518

$$m1 = 7.4 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	14 13.63	-36 25.7	4.894	4.557	+0.35	-12.9	17.4	64.5
Jan. 17	14 16.54	-38 37.7	4.694	4.501	+0.22	-13.6	17.3	72.8
Jan. 27	14 18.02	-40 56.2	4.491	4.446	+0.06	-14.2	17.1	81.1
Feb. 6	14 17.68	-43 20.9	4.290	4.391	-0.15	-14.8	17.0	89.4
Feb. 16	14 15.02	-45 50.1	4.094	4.338	-0.41	-15.1	16.8	97.7
Feb. 26	14 09.51	-48 21.4	3.910	4.285	-0.73	-15.1	16.7	105.7
Mar. 8	14 00.55	-50 50.5	3.741	4.233	-1.11	-14.5	16.5	113.3
Mar. 18	13 47.63	-53 10.8	3.593	4.183	-1.52	-13.2	16.4	120.2
Mar. 28	13 30.50	-55 14.2	3.469	4.133	-1.94	-11.1	16.3	125.8
Apr. 7	13 09.45	-56 51.5	3.373	4.085	-2.29	-8.0	16.2	129.7
Apr. 17	12 45.59	-57 54.7	3.305	4.037	-2.47	-4.3	16.1	131.2
Apr. 27	12 20.78	-58 20.4	3.265	3.991	-2.45	-0.5	16.0	130.4
May 7	11 57.18	-58 10.8	3.254	3.947	-2.22	+2.6	15.9	127.2
May 17	11 36.61	-57 33.8	3.266	3.904	-1.85	+4.8	15.9	122.5
May 27	11 20.05	-56 40.1	3.299	3.862	-1.42	+5.9	15.9	116.7
June 6	11 07.75	-55 40.7	3.348	3.822	-1.00	+5.9	15.8	110.4
June 16	10 59.45	-54 44.8	3.408	3.783	-0.63	+5.1	15.8	103.9
June 26	10 54.62	-53 59.2	3.475	3.746	-0.31	+3.8	15.8	97.6
July 6	10 52.75	-53 28.2	3.544	3.711	-0.05	+2.2	15.8	91.4
July 16	10 53.31	-53 14.9	3.612	3.678	+0.17	+0.3	15.8	85.7
July 26	10 55.88	-53 20.6	3.676	3.647	+0.35	-1.6	15.8	80.4
Aug. 5	11 00.14	-53 45.9	3.733	3.617	+0.51	-3.6	15.8	75.6
Aug. 15	11 05.81	-54 31.2	3.782	3.590	+0.64	-5.6	15.8	71.4
Aug. 25	11 12.71	-55 36.2	3.822	3.565	+0.75	-7.6	15.8	67.8
Sept. 4	11 20.72	-57 00.9	3.852	3.542	+0.86	-9.5	15.8	64.8
Sept. 14	11 29.76	-58 44.9	3.871	3.521	+0.96	-11.4	15.8	62.5
Sept. 24	11 39.83	-60 47.8	3.881	3.502	+1.07	-13.3	15.8	60.8
Oct. 4	11 51.02	-63 09.3	3.882	3.486	+1.19	-15.2	15.8	59.7
Oct. 14	12 03.53	-65 48.9	3.875	3.472	+1.34	-16.9	15.7	59.2
Oct. 24	12 17.77	-68 45.6	3.862	3.461	+1.55	-18.6	15.7	59.3
Nov. 3	12 34.60	-71 58.5	3.845	3.452	+1.88	-20.1	15.7	59.7
Nov. 13	12 55.79	-75 25.6	3.826	3.445	+2.49	-21.4	15.7	60.4
Nov. 23	13 25.80	-79 03.3	3.807	3.441	+3.85	-22.1	15.7	61.2
Dec. 3	14 18.31	-82 42.6	3.790	3.440	+7.83	-21.2	15.7	62.0
Dec. 13	16 27.68	-85 46.9	3.778	3.441	+22.09	-11.9	15.7	62.8
Dec. 23	20 43.60	-85 44.8	3.771	3.444	+20.21	+14.5	15.7	63.4
Jan. 2	22 54.46	-82 27.7	3.773	3.450	+7.26	+23.4	15.7	63.6
Jan. 12	23 47.71	-78 23.0	3.782	3.459	+3.72	+25.3	15.7	63.6
Jan. 22	00 18.44	-74 08.6	3.801	3.470	+2.49	+25.5	15.7	63.2
Feb. 1	00 40.53	-69 55.1	3.827	3.483	+1.94	+25.1	15.7	62.5
Feb. 11	00 58.43	-65 48.0	3.860	3.499	+1.64	+24.2	15.8	61.5
Feb. 21	01 13.98	-61 50.7	3.900	3.517	+1.46	+23.1	15.8	60.3
Mar. 2	01 28.06	-58 06.1	3.943	3.537	+1.34	+21.7	15.9	59.1
Mar. 12	01 41.08	-54 36.1	3.988	3.560	+1.26	+20.1	15.9	57.8
Mar. 22	01 53.30	-51 22.1	4.033	3.584	+1.18	+18.5	16.0	56.7



## Comet P/2006 H1 (McNaught)

Epoch = 2019 July 16.0 TT  
 T = 2019 Dec. 7.46971 TT  
 Peri. = 309.26167 e = 0.5809066  
 Node = 359.92065 2000.0 a = 5.7804267 AU  
 Incl. = 12.80270 n = 0.07091926  
 q = 2.4225387 AU P = 13.90 years

$$m_1 = 9.6 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	15 34.14	-27 25.9	4.136	3.566	-0.60 +2.9	21.0	18.3/111	48.8
Jan. 17	15 46.87	-28 31.7	3.971	3.516	-0.65 +2.8	20.8	17.8/111	55.9
Jan. 27	15 59.32	-29 36.0	3.798	3.465	-0.71 +2.8	20.6	17.2/112	63.1
Feb. 6	16 11.34	-30 39.2	3.618	3.415	-0.77 +2.7	20.4	16.4/113	70.4
Feb. 16	16 22.76	-31 41.3	3.433	3.365	-0.84 +2.6	20.2	15.3/114	77.8
Feb. 26	16 33.36	-32 42.9	3.246	3.316	-0.91 +2.5	20.0	14.1/116	85.3
Mar. 8	16 42.93	-33 44.3	3.060	3.267	-1.00 +2.5	19.7	12.7/119	93.1
Mar. 18	16 51.19	-34 45.9	2.877	3.218	-1.09 +2.4	19.5	11.1/124	101.0
Mar. 28	16 57.87	-35 48.1	2.700	3.170	-1.19 +2.4	19.3	9.3/132	109.1
Apr. 7	17 02.63	-36 50.7	2.532	3.123	-1.30 +2.4	19.0	7.6/145	117.5
Apr. 17	17 05.18	-37 52.8	2.376	3.076	-1.42 +2.5	18.8	6.3/167	126.1
Apr. 27	17 05.28	-38 52.9	2.235	3.030	-1.54 +2.8	18.6	6.0/195	134.9
May 7	17 02.79	-39 48.2	2.112	2.985	-1.66 +3.2	18.3	6.8/221	143.7
May 17	16 57.80	-40 34.9	2.010	2.941	-1.76 +3.7	18.1	8.1/240	151.9
May 27	16 50.76	-41 08.7	1.932	2.898	-1.83 +4.4	18.0	9.3/254	158.5
June 6	16 42.42	-41 26.2	1.878	2.856	-1.86 +5.2	17.8	9.8/266	161.0
June 16	16 33.89	-41 25.6	1.849	2.816	-1.86 +5.8	17.7	9.3/276	157.8
June 26	16 26.33	-41 08.2	1.844	2.776	-1.81 +6.3	17.6	7.9/289	150.9
July 6	16 20.78	-40 37.6	1.861	2.738	-1.74 +6.5	17.5	5.9/307	142.5
July 16	16 17.99	-39 58.9	1.898	2.702	-1.67 +6.5	17.5	4.3/343	133.7
July 26	16 18.31	-39 17.0	1.951	2.667	-1.59 +6.1	17.4	4.8/30	125.1
Aug. 5	16 21.82	-38 35.7	2.016	2.634	-1.52 +5.6	17.4	7.3/57	116.8
Aug. 15	16 28.39	-37 57.1	2.092	2.604	-1.46 +5.0	17.4	10.3/69	109.0
Aug. 25	16 37.77	-37 21.8	2.175	2.575	-1.41 +4.2	17.4	13.3/75	101.5
Sept. 4	16 49.66	-36 49.3	2.262	2.548	-1.38 +3.4	17.5	16.1/79	94.5
Sept. 14	17 03.77	-36 18.3	2.353	2.524	-1.35 +2.6	17.5	18.6/81	87.8
Sept. 24	17 19.79	-35 46.8	2.445	2.502	-1.32 +1.7	17.5	20.9/81	81.5
Oct. 4	17 37.43	-35 12.9	2.538	2.482	-1.30 +0.8	17.5	22.9/81	75.4
Oct. 14	17 56.40	-34 34.7	2.629	2.465	-1.27 -0.1	17.6	24.6/80	69.6
Oct. 24	18 16.44	-33 50.3	2.720	2.451	-1.25 -1.0	17.6	26.0/79	63.9
Nov. 3	18 37.31	-32 58.4	2.808	2.440	-1.22 -1.8	17.7	27.3/78	58.5
Nov. 13	18 58.73	-31 57.7	2.893	2.431	-1.18 -2.6	17.7	28.3/77	53.1
Nov. 23	19 20.49	-30 47.7	2.975	2.426	-1.15 -3.4	17.7	29.2/75	47.9
Dec. 3	19 42.40	-29 27.8	3.053	2.423	-1.11 -4.1	17.8	29.9/74	42.7
Dec. 13	20 04.26	-27 58.4	3.127	2.423	-1.06 -4.8	17.8	30.4/72	37.6
Dec. 23	20 25.92	-26 19.6	3.197	2.426	-1.02 -5.3	17.9	30.7/70	32.6
Jan. 2	20 47.29	-24 32.3	3.261	2.432	-0.97 -5.8	18.0	31.0/69	27.6
Jan. 12	21 08.24	-22 37.4	3.319	2.441	-0.93 -6.2	18.0	31.0/68	22.6
Jan. 22	21 28.73	-20 36.0	3.372	2.453	-0.89 -6.6	18.1	31.0/66	17.7
Feb. 1	21 48.71	-18 29.2	3.418	2.467	-0.84 -6.8	18.2	30.9/65	12.8
Feb. 11	22 08.15	-16 18.3	3.457	2.484	-0.80 -7.0	18.2	30.6/64	8.2
Feb. 21	22 27.04	-14 04.5	3.489	2.504	-0.77 -7.2	18.3	30.2/64	4.4
Mar. 2	22 45.38	-11 49.0	3.512	2.526	-0.73 -7.2	18.4	29.8/63	4.9
Mar. 12	23 03.15	-09 33.0	3.528	2.551	-0.70 -7.3	18.4	29.2/62	9.0
Mar. 22	23 20.38	-07 17.4	3.534	2.578	-0.68 -7.2	18.5	28.6/62	13.8

Comet 289P/Blanpain

Epoch = 2019 July 16.0 TT  
 T = 2019 Dec. 20.99362 TT  
 Peri. = 9.84499 e = 0.6851211  
 Node = 68.92575 2000.0 a = 3.0453365 AU  
 Incl. = 5.89766 n = 0.18546038  
 q = 0.9589122 AU P = 5.31 years

$$m1 = 16.0 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .			m	'		°
Jan. 7	19 47.77	-24 36.8	4.476	3.508	+1.29	+3.1	.	8.9
Jan. 17	20 00.85	-24 04.1	4.432	3.450	+1.32	+3.5	.	3.6
Jan. 27	20 14.19	-23 27.6	4.367	3.391	+1.35	+3.9	.	6.9
Feb. 6	20 27.71	-22 47.3	4.282	3.331	+1.36	+4.2	.	13.4
Feb. 16	20 41.34	-22 03.6	4.179	3.269	+1.37	+4.6	.	20.1
Feb. 26	20 55.02	-21 16.7	4.058	3.206	+1.37	+4.9	.	26.8
Mar. 8	21 08.69	-20 27.0	3.920	3.141	+1.36	+5.1	.	33.5
Mar. 18	21 22.29	-19 35.1	3.768	3.075	+1.35	+5.3	.	40.2
Mar. 28	21 35.79	-18 41.4	3.602	3.007	+1.34	+5.4	.	46.7
Apr. 7	21 49.13	-17 46.7	3.425	2.938	+1.32	+5.5	.	53.3
Apr. 17	22 02.27	-16 51.6	3.238	2.867	+1.30	+5.5	.	59.8
Apr. 27	22 15.16	-15 57.1	3.043	2.795	+1.28	+5.4	.	66.3
May 7	22 27.77	-15 03.9	2.842	2.721	+1.24	+5.2	.	72.9
May 17	22 40.02	-14 13.4	2.638	2.646	+1.20	+4.9	.	79.4
May 27	22 51.85	-13 26.8	2.431	2.569	+1.16	+4.4	.	86.0
June 6	23 03.17	-12 45.4	2.225	2.490	+1.10	+3.8	.	92.8
June 16	23 13.85	-12 11.2	2.021	2.409	+1.03	+3.0	.	99.6
June 26	23 23.74	-11 46.2	1.822	2.327	+0.94	+1.9	.	106.7
July 6	23 32.62	-11 33.0	1.628	2.243	+0.82	+0.6	.	114.0
July 16	23 40.21	-11 34.6	1.443	2.158	+0.68	-1.1	21.8	121.7
July 26	23 46.17	-11 54.3	1.268	2.071	+0.49	-3.1	21.3	129.8
Aug. 5	23 49.98	-12 36.0	1.106	1.982	+0.24	-5.5	20.7	138.3
Aug. 15	23 51.09	-13 43.0	0.959	1.892	-0.06	-8.2	20.1	147.3
Aug. 25	23 48.84	-15 17.3	0.829	1.801	-0.44	-10.9	19.4	156.3
Sept. 4	23 42.58	-17 17.3	0.717	1.709	-0.86	-13.1	18.8	163.8
Sept. 14	23 32.07	-19 34.2	0.625	1.617	-1.28	-14.0	18.1	164.1
Sept. 24	23 17.75	-21 50.7	0.553	1.524	-1.59	-12.8	17.5	155.6
Oct. 4	23 01.18	-23 43.2	0.498	1.432	-1.68	-9.0	16.8	143.6
Oct. 14	22 45.04	-24 49.3	0.456	1.342	-1.48	-3.5	16.2	131.2
Oct. 24	22 32.00	-24 57.1	0.421	1.256	-1.05	+2.6	15.6	119.2
Nov. 3	22 24.02	-24 03.9	0.389	1.175	-0.48	+8.6	15.0	108.4
Nov. 13	22 21.79	-22 10.9	0.354	1.102	+0.08	+14.6	14.4	98.9
Nov. 23	22 24.81	-19 15.0	0.313	1.040	+0.56	+21.6	13.7	90.8
Dec. 3	22 32.33	-14 58.2	0.265	0.994	+0.97	+31.5	13.1	84.0
Dec. 13	22 43.76	-08 32.9	0.212	0.966	+1.36	+49.2	12.4	78.8
Dec. 23	23 00.04	+02 05.0	0.158	0.959	+2.08	+87.4	11.7	76.6
Jan. 2	23 29.33	+22 17.8	0.111	0.975	+4.63	173.5	11.1	82.3
Jan. 12	01 02.92	+57 22.1	0.091	1.010	+21.30	207.7	10.9	104.6
Jan. 22	06 49.89	+68 41.9	0.118	1.063	+24.22	-83.5	11.8	129.5
Feb. 1	08 51.20	+54 37.0	0.175	1.130	+4.58	-69.6	13.0	142.8
Feb. 11	09 20.15	+45 07.7	0.248	1.206	+1.62	-44.4	14.2	149.1
Feb. 21	09 32.23	+38 49.1	0.334	1.290	+0.88	-31.5	15.3	150.6
Mar. 2	09 40.06	+34 09.2	0.432	1.378	+0.72	-24.4	16.3	148.3
Mar. 12	09 47.28	+30 25.6	0.545	1.469	+0.74	-20.2	17.2	143.8
Mar. 22	09 54.99	+27 17.5	0.671	1.561	+0.82	-17.4	18.0	138.0

Comet P/2006 R1 (Siding Spring)

Epoch = 2019 July 16.0 TT  
 T = 2019 Dec. 22.43717 TT  
 Peri. = 249.28901 e = 0.7042101  
 Node = 218.83571 2000.0 a = 5.6232968 AU  
 Incl. = 160.06915 n = 0.07391244  
 q = 1.6633144 AU P = 13.33 years

$$m_1 = 12.5 + 5 \log(\Delta) + 25.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Variation	m1	Mot./PA	Elong.
2019/20	h m	° '			for T=+1 day			°
Jan. 7	04 10.76	+37 40.8	2.917	3.714	+0.78 +4.2	.	26.7/246	138.8
Jan. 17	03 52.02	+35 47.7	2.983	3.646	+0.77 +4.8	.	23.2/240	125.7
Jan. 27	03 37.29	+33 52.7	3.079	3.578	+0.74 +5.2	.	19.3/234	112.8
Feb. 6	03 26.42	+32 04.4	3.194	3.509	+0.71 +5.4	.	15.3/228	100.4
Feb. 16	03 19.00	+30 27.9	3.319	3.439	+0.68 +5.5	.	11.6/220	88.6
Feb. 26	03 14.49	+29 05.4	3.444	3.369	+0.65 +5.5	.	8.5/209	77.4
Mar. 8	03 12.37	+27 56.6	3.563	3.299	+0.63 +5.4	.	6.3/192	66.7
Mar. 18	03 12.20	+27 00.6	3.668	3.229	+0.61 +5.4	.	5.1/169	56.5
Mar. 28	03 13.55	+26 15.5	3.756	3.157	+0.60 +5.3	.	4.9/145	46.8
Apr. 7	03 16.13	+25 39.5	3.821	3.086	+0.59 +5.3	.	5.3/127	37.4
Apr. 17	03 19.64	+25 10.7	3.860	3.015	+0.58 +5.2	.	5.9/116	28.3
Apr. 27	03 23.85	+24 47.3	3.871	2.943	+0.58 +5.2	.	6.5/109	19.6
May 7	03 28.58	+24 27.8	3.853	2.871	+0.57 +5.2	.	7.0/105	11.3
May 17	03 33.63	+24 10.7	3.805	2.799	+0.57 +5.2	.	7.2/103	5.0
May 27	03 38.83	+23 54.5	3.725	2.727	+0.58 +5.3	.	7.3/103	8.4
June 6	03 44.03	+23 38.0	3.615	2.655	+0.59 +5.4	.	7.2/104	16.1
June 16	03 49.03	+23 19.7	3.475	2.584	+0.59 +5.6	.	6.9/107	24.4
June 26	03 53.64	+22 58.0	3.306	2.513	+0.61 +5.9	.	6.4/112	32.8
July 6	03 57.63	+22 31.1	3.109	2.442	+0.63 +6.3	.	5.8/122	41.5
July 16	04 00.67	+21 56.5	2.887	2.373	+0.65 +6.8	.	5.2/140	50.4
July 26	04 02.36	+21 11.0	2.642	2.304	+0.68 +7.5	.	5.4/169	59.7
Aug. 5	04 02.12	+20 09.5	2.379	2.237	+0.73 +8.6	.	7.6/197	69.6
Aug. 15	03 59.05	+18 44.1	2.102	2.171	+0.80 +10.1	.	12.6/215	80.1
Aug. 25	03 51.85	+16 41.7	1.817	2.107	+0.92 +12.5	21.9	21.0/224	91.9
Sept. 4	03 38.36	+13 39.6	1.533	2.046	+1.10 +16.2	21.2	34.9/229	105.3
Sept. 14	03 15.17	+08 58.7	1.268	1.987	+1.43 +22.3	20.5	57.4/232	121.4
Sept. 24	02 37.33	+01 42.6	1.045	1.931	+1.97 +31.4	19.7	90.1/233	141.0
Oct. 4	01 40.16	-08 34.9	0.908	1.880	+2.73 +40.7	19.1	121.4/236	159.9
Oct. 14	00 27.23	-19 31.0	0.898	1.832	+3.38 +40.7	18.8	120.7/242	150.3
Oct. 24	23 15.98	-26 58.9	1.012	1.789	+3.43 +31.0	18.8	89.3/250	126.1
Nov. 3	22 21.91	-30 24.4	1.208	1.752	+3.04 +21.5	19.0	57.0/258	105.1
Nov. 13	21 46.31	-31 34.4	1.440	1.720	+2.62 +15.5	19.2	35.1/265	88.1
Nov. 23	21 24.06	-31 47.3	1.680	1.696	+2.29 +12.1	19.4	21.5/271	73.9
Dec. 3	21 10.49	-31 38.6	1.909	1.677	+2.06 +10.1	19.5	13.0/276	61.4
Dec. 13	21 02.44	-31 22.9	2.119	1.667	+1.90 +8.8	19.7	7.7/283	50.0
Dec. 23	20 57.93	-31 06.4	2.301	1.663	+1.79 +7.9	19.8	4.2/292	39.5
Jan. 2	20 55.74	-30 51.9	2.449	1.667	+1.71 +7.4	20.0	2.1/308	29.7
Jan. 12	20 55.01	-30 40.8	2.561	1.679	+1.66 +6.9	20.2	0.9/346	20.9
Jan. 22	20 55.15	-30 34.5	2.635	1.698	+1.63 +6.6	20.4	0.7/60	14.2
Feb. 1	20 55.72	-30 33.9	2.668	1.724	+1.61 +6.4	20.5	0.9/112	13.2
Feb. 11	20 56.27	-30 40.7	2.662	1.756	+1.61 +6.3	20.7	1.3/156	18.6
Feb. 21	20 56.43	-30 56.5	2.618	1.794	+1.63 +6.2	20.9	2.2/188	26.9
Mar. 2	20 55.73	-31 23.8	2.539	1.837	+1.67 +6.1	21.1	3.9/207	36.4
Mar. 12	20 53.59	-32 05.5	2.427	1.885	+1.73 +6.1	21.3	6.5/218	46.4
Mar. 22	20 49.27	-33 05.4	2.288	1.937	+1.83 +6.0	21.5	10.3/226	57.1

Minor Planet (6478) Gault

Epoch = 2019 July 16.0 TT  
 T = 2020 Jan. 2.86673 TT  
 Peri. = 83.26564 e = 0.1936186  
 Node = 183.55755 2000.0 a = 2.3052012 AU  
 Incl. = 22.81120 n = 0.28160529  
 q = 1.8588714 AU P = 3.50 years

H = 14.2 , G = 0.15

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		V	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	10 48.17	-12 32.8	1.876	2.472	+0.12	-2.1	18.6	116.1
Jan. 17	10 48.20	-12 43.1	1.747	2.453	-0.14	+0.4	18.3	125.5
Jan. 27	10 45.58	-12 25.1	1.632	2.433	-0.41	+3.6	18.1	135.3
Feb. 6	10 40.40	-11 33.5	1.534	2.413	-0.65	+7.2	17.8	145.6
Feb. 16	10 33.09	-10 05.3	1.458	2.392	-0.82	+10.8	17.6	155.5
Feb. 26	10 24.49	-08 02.2	1.408	2.371	-0.89	+14.0	17.3	162.8
Mar. 8	10 15.70	-05 31.4	1.385	2.350	-0.84	+16.1	17.3	162.4
Mar. 18	10 08.00	-02 45.8	1.390	2.328	-0.67	+16.8	17.4	154.6
Mar. 28	10 02.41	+00 00.1	1.422	2.307	-0.41	+16.1	17.6	144.3
Apr. 7	09 59.59	+02 33.2	1.475	2.285	-0.11	+14.3	17.8	133.7
Apr. 17	09 59.84	+04 45.4	1.547	2.262	+0.19	+11.9	18.0	123.6
Apr. 27	10 03.10	+06 32.3	1.631	2.240	+0.48	+9.2	18.1	114.2
May 7	10 09.12	+07 53.1	1.724	2.218	+0.74	+6.7	18.3	105.5
May 17	10 17.59	+08 48.8	1.821	2.195	+0.97	+4.3	18.4	97.5
May 27	10 28.13	+09 21.5	1.921	2.173	+1.16	+2.1	18.5	90.1
June 6	10 40.43	+09 33.6	2.019	2.151	+1.32	+0.2	18.6	83.3
June 16	10 54.20	+09 27.3	2.115	2.129	+1.45	-1.5	18.7	76.9
June 26	11 09.20	+09 05.1	2.208	2.107	+1.56	-3.0	18.8	70.9
July 6	11 25.25	+08 29.0	2.294	2.086	+1.66	-4.3	18.8	65.3
July 16	11 42.20	+07 40.8	2.375	2.065	+1.74	-5.4	18.8	60.1
July 26	11 59.94	+06 42.6	2.450	2.045	+1.81	-6.3	18.8	55.1
Aug. 5	12 18.39	+05 35.9	2.517	2.025	+1.88	-7.1	18.8	50.3
Aug. 15	12 37.50	+04 22.4	2.577	2.006	+1.95	-7.6	18.8	45.8
Aug. 25	12 57.24	+03 04.0	2.630	1.988	+2.01	-8.1	18.8	41.4
Sept. 4	13 17.59	+01 42.1	2.675	1.970	+2.07	-8.3	18.7	37.3
Sept. 14	13 38.56	+00 18.6	2.714	1.954	+2.13	-8.4	18.7	33.4
Sept. 24	14 00.13	-01 04.8	2.745	1.938	+2.19	-8.3	18.7	29.7
Oct. 4	14 22.33	-02 26.3	2.770	1.924	+2.25	-8.0	18.6	26.2
Oct. 14	14 45.13	-03 44.2	2.789	1.911	+2.31	-7.5	18.5	23.0
Oct. 24	15 08.54	-04 56.5	2.803	1.899	+2.37	-6.9	18.5	20.1
Nov. 3	15 32.53	-06 01.4	2.811	1.889	+2.43	-6.0	18.4	17.6
Nov. 13	15 57.06	-06 57.2	2.814	1.880	+2.48	-5.0	18.4	15.7
Nov. 23	16 22.07	-07 42.1	2.813	1.873	+2.52	-3.8	18.4	14.5
Dec. 3	16 47.48	-08 14.8	2.807	1.867	+2.56	-2.5	18.3	14.1
Dec. 13	17 13.18	-08 33.9	2.799	1.862	+2.58	-1.1	18.3	14.6
Dec. 23	17 39.05	-08 38.8	2.787	1.860	+2.59	+0.3	18.3	15.8
Jan. 2	18 04.97	-08 28.9	2.772	1.859	+2.59	+1.8	18.4	17.6
Jan. 12	18 30.79	-08 04.2	2.754	1.860	+2.57	+3.3	18.4	19.9
Jan. 22	18 56.38	-07 25.3	2.733	1.862	+2.54	+4.7	18.4	22.5
Feb. 1	19 21.62	-06 32.9	2.709	1.866	+2.50	+5.9	18.5	25.2
Feb. 11	19 46.39	-05 28.3	2.682	1.871	+2.45	+7.1	18.5	28.2
Feb. 21	20 10.62	-04 13.0	2.651	1.879	+2.39	+8.1	18.6	31.3
Mar. 2	20 34.21	-02 48.7	2.617	1.887	+2.32	+8.8	18.6	34.6
Mar. 12	20 57.12	-01 17.3	2.579	1.897	+2.25	+9.4	18.6	38.0
Mar. 22	21 19.32	+00 19.1	2.536	1.909	+2.18	+9.8	18.6	41.6

## Comet 101P/Chernykh

Epoch = 2019 July 16.0 TT  
 T = 2020 Jan. 16.52485 TT  
 Peri. = 277.87563 e = 0.5953674  
 Node = 116.05787 2000.0 a = 5.7977857 AU  
 Incl. = 5.05300 n = 0.07060100  
 q = 2.3459731 AU P = 13.96 years

$$m_1 = 8.5 + 5 \log(\Delta) + 15.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	20 07.76	-20 42.6	4.721	3.772	+1.30	+3.4	20.5	13.6
Jan. 17	20 20.91	-20 06.4	4.695	3.719	+1.33	+3.9	20.4	6.5
Jan. 27	20 34.33	-19 25.6	4.651	3.666	+1.35	+4.3	20.3	0.8
Feb. 6	20 47.94	-18 40.3	4.589	3.613	+1.37	+4.8	20.2	7.3
Feb. 16	21 01.65	-17 50.9	4.510	3.560	+1.37	+5.1	20.0	14.1
Feb. 26	21 15.39	-16 57.8	4.416	3.508	+1.37	+5.5	19.9	20.8
Mar. 8	21 29.11	-16 01.6	4.306	3.455	+1.37	+5.8	19.7	27.4
Mar. 18	21 42.73	-15 02.7	4.183	3.403	+1.35	+6.0	19.6	33.9
Mar. 28	21 56.20	-14 01.9	4.047	3.351	+1.34	+6.2	19.4	40.5
Apr. 7	22 09.48	-12 59.9	3.900	3.299	+1.31	+6.2	19.2	46.9
Apr. 17	22 22.49	-11 57.6	3.744	3.248	+1.28	+6.2	19.0	53.4
Apr. 27	22 35.18	-10 55.7	3.581	3.197	+1.25	+6.1	18.8	59.9
May 7	22 47.48	-09 55.4	3.411	3.146	+1.21	+5.9	18.6	66.4
May 17	22 59.30	-08 57.8	3.237	3.096	+1.15	+5.6	18.4	73.0
May 27	23 10.56	-08 03.9	3.061	3.047	+1.09	+5.1	18.2	79.7
June 6	23 21.15	-07 15.1	2.883	2.999	+1.02	+4.5	18.0	86.5
June 16	23 30.91	-06 32.9	2.708	2.951	+0.93	+3.8	17.7	93.6
June 26	23 39.70	-05 58.8	2.535	2.904	+0.82	+2.9	17.5	100.9
July 6	23 47.32	-05 34.3	2.368	2.858	+0.69	+1.9	17.2	108.5
July 16	23 53.55	-05 21.1	2.209	2.814	+0.54	+0.6	17.0	116.5
July 26	23 58.18	-05 20.5	2.061	2.770	+0.37	-0.7	16.7	124.9
Aug. 5	00 00.99	-05 33.5	1.926	2.728	+0.17	-2.1	16.5	133.8
Aug. 15	00 01.82	-06 00.1	1.807	2.688	-0.03	-3.4	16.2	143.2
Aug. 25	00 00.65	-06 39.1	1.707	2.649	-0.22	-4.5	16.0	153.1
Sept. 4	23 57.62	-07 27.5	1.630	2.611	-0.39	-5.2	15.8	163.1
Sept. 14	23 53.17	-08 20.1	1.576	2.576	-0.50	-5.2	15.7	171.7
Sept. 24	23 47.97	-09 10.3	1.548	2.543	-0.53	-4.6	15.5	170.1
Oct. 4	23 42.88	-09 51.4	1.546	2.512	-0.47	-3.4	15.4	160.5
Oct. 14	23 38.82	-10 17.5	1.567	2.483	-0.32	-1.6	15.4	150.1
Oct. 24	23 36.51	-10 24.9	1.610	2.456	-0.11	+0.4	15.4	139.9
Nov. 3	23 36.46	-10 12.1	1.671	2.432	+0.13	+2.4	15.4	130.2
Nov. 13	23 38.89	-09 39.7	1.747	2.411	+0.38	+4.3	15.4	121.0
Nov. 23	23 43.79	-08 49.1	1.834	2.393	+0.62	+6.0	15.5	112.5
Dec. 3	23 50.99	-07 42.5	1.930	2.377	+0.84	+7.5	15.6	104.5
Dec. 13	00 00.26	-06 22.1	2.032	2.365	+1.03	+8.7	15.6	97.1
Dec. 23	00 11.33	-04 50.4	2.139	2.356	+1.20	+9.7	15.7	90.1
Jan. 2	00 23.94	-03 09.4	2.248	2.349	+1.34	+10.5	15.8	83.5
Jan. 12	00 37.86	-01 21.3	2.358	2.346	+1.46	+11.1	15.9	77.3
Jan. 22	00 52.89	+00 31.8	2.469	2.346	+1.56	+11.5	16.0	71.3
Feb. 1	01 08.86	+02 28.1	2.579	2.350	+1.64	+11.7	16.1	65.6
Feb. 11	01 25.64	+04 25.5	2.687	2.356	+1.72	+11.7	16.2	60.1
Feb. 21	01 43.09	+06 22.4	2.794	2.366	+1.78	+11.6	16.3	54.8
Mar. 2	02 01.15	+08 17.2	2.898	2.379	+1.83	+11.3	16.5	49.6
Mar. 12	02 19.71	+10 08.1	2.999	2.394	+1.88	+10.8	16.6	44.5
Mar. 22	02 38.70	+11 53.8	3.096	2.413	+1.92	+10.2	16.7	39.6

## Comet C/2017 T2 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2020 May 4.95462 TT  
 Peri. = 92.99484  
 Node = 64.37869 2000.0  
 Incl. = 57.23459  
 q = 1.6150381 AU  
 e = 0.9997546

$$m1 = 4.4 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	03 04.27	-03 45.7	5.126	5.607	-0.37	+5.0	15.4	114.6
Jan. 17	03 01.15	-02 52.6	5.188	5.520	-0.24	+5.7	15.4	104.7
Jan. 27	02 59.29	-01 53.5	5.258	5.433	-0.12	+6.2	15.4	95.0
Feb. 6	02 58.71	+00 49.7	5.331	5.346	+0.01	+6.6	15.3	85.5
Feb. 16	02 59.37	+00 17.7	5.403	5.257	+0.13	+6.9	15.3	76.3
Feb. 26	03 01.20	+01 27.4	5.470	5.169	+0.24	+7.1	15.2	67.3
Mar. 8	03 04.13	+02 38.8	5.526	5.080	+0.35	+7.2	15.2	58.6
Mar. 18	03 08.05	+03 50.9	5.570	4.991	+0.44	+7.2	15.1	50.1
Mar. 28	03 12.85	+05 03.1	5.597	4.901	+0.53	+7.2	15.0	42.0
Apr. 7	03 18.45	+06 15.1	5.607	4.811	+0.60	+7.2	15.0	34.1
Apr. 17	03 24.75	+07 26.4	5.597	4.720	+0.67	+7.1	14.9	26.5
Apr. 27	03 31.67	+08 36.8	5.567	4.629	+0.72	+7.0	14.8	19.3
May 7	03 39.12	+09 46.0	5.515	4.538	+0.77	+6.9	14.7	13.0
May 17	03 47.02	+10 53.9	5.442	4.446	+0.81	+6.7	14.6	8.9
May 27	03 55.30	+12 00.5	5.348	4.354	+0.85	+6.6	14.4	10.1
June 6	04 03.90	+13 05.8	5.232	4.261	+0.87	+6.5	14.3	15.2
June 16	04 12.74	+14 10.0	5.096	4.168	+0.89	+6.4	14.1	21.5
June 26	04 21.75	+15 13.3	4.941	4.075	+0.91	+6.3	14.0	28.3
July 6	04 30.85	+16 16.1	4.768	3.981	+0.91	+6.3	13.8	35.2
July 16	04 39.97	+17 18.8	4.578	3.887	+0.91	+6.3	13.6	42.3
July 26	04 49.00	+18 22.3	4.373	3.792	+0.90	+6.4	13.4	49.5
Aug. 5	04 57.86	+19 27.4	4.155	3.697	+0.87	+6.6	13.2	56.8
Aug. 15	05 06.40	+20 35.2	3.926	3.602	+0.83	+7.0	12.9	64.2
Aug. 25	05 14.50	+21 47.5	3.688	3.507	+0.78	+7.5	12.7	71.8
Sept. 4	05 21.96	+23 06.1	3.445	3.411	+0.70	+8.3	12.4	79.7
Sept. 14	05 28.54	+24 33.4	3.199	3.316	+0.60	+9.3	12.1	87.8
Sept. 24	05 33.98	+26 12.6	2.953	3.220	+0.47	+10.7	11.8	96.2
Oct. 4	05 37.88	+28 07.1	2.711	3.124	+0.29	+12.4	11.5	105.1
Oct. 14	05 39.77	+30 20.9	2.479	3.029	+0.06	+14.6	11.2	114.3
Oct. 24	05 39.02	+32 57.8	2.260	2.933	-0.25	+17.1	10.8	123.9
Nov. 3	05 34.82	+36 00.4	2.060	2.838	-0.65	+19.7	10.5	133.8
Nov. 13	05 26.20	+39 28.1	1.885	2.744	-1.15	+22.0	10.2	143.5
Nov. 23	05 12.10	+43 14.4	1.740	2.650	-1.75	+23.1	9.8	151.5
Dec. 3	04 51.70	+47 04.1	1.631	2.557	-2.39	+22.3	9.5	154.7
Dec. 13	04 25.13	+50 34.8	1.560	2.466	-2.95	+19.1	9.3	150.6
Dec. 23	03 54.15	+53 24.3	1.525	2.375	-3.22	+14.1	9.1	141.5
Jan. 2	03 22.34	+55 21.6	1.523	2.287	-3.06	+9.0	8.9	130.5
Jan. 12	02 53.83	+56 33.5	1.544	2.201	-2.55	+5.4	8.8	119.5
Jan. 22	02 31.43	+57 19.0	1.582	2.118	-1.85	+3.9	8.7	109.0
Feb. 1	02 16.20	+57 58.4	1.627	2.038	-1.13	+4.3	8.5	99.7
Feb. 11	02 07.90	+58 48.0	1.672	1.963	-0.47	+5.9	8.4	91.5
Feb. 21	02 05.89	+59 57.0	1.713	1.893	+0.13	+8.2	8.3	84.4
Mar. 2	02 09.76	+61 30.8	1.744	1.828	+0.70	+10.8	8.2	78.6
Mar. 12	02 19.51	+63 31.4	1.764	1.770	+1.32	+13.5	8.1	74.0
Mar. 22	02 36.04	+65 58.0	1.772	1.720	+2.10	+16.0	8.0	70.6

Comet 246P/NEAT

Epoch = 2019 July 16.0 TT  
 T = 2021 Feb. 22.33259 TT  
 Peri. = 176.17228 e = 0.2868048  
 Node = 78.75124 2000.0 a = 4.0174949 AU  
 Incl. = 15.98714 n = 0.12239708  
 q = 2.8652581 AU P = 8.05 years

$$m1 = 6.4 + 5 \log(\Delta) + 12.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	09 29.19	+31 04.3	3.558	4.422	-0.48	+5.6	17.2	147.9
Jan. 17	09 23.77	+32 00.0	3.478	4.401	-0.61	+5.4	17.2	157.0
Jan. 27	09 17.17	+32 51.9	3.428	4.379	-0.71	+4.8	17.1	163.0
Feb. 6	09 09.90	+33 36.3	3.409	4.358	-0.74	+3.9	17.1	162.2
Feb. 16	09 02.56	+34 09.9	3.419	4.336	-0.71	+2.7	17.0	155.3
Feb. 26	08 55.80	+34 31.1	3.458	4.314	-0.62	+1.4	17.0	145.9
Mar. 8	08 50.15	+34 39.5	3.522	4.292	-0.48	+0.2	17.0	136.0
Mar. 18	08 46.06	+34 35.9	3.607	4.269	-0.31	-1.0	17.1	126.0
Mar. 28	08 43.76	+34 21.8	3.709	4.246	-0.13	-1.9	17.1	116.3
Apr. 7	08 43.33	+33 58.9	3.822	4.223	+0.06	-2.7	17.1	106.9
Apr. 17	08 44.76	+33 28.9	3.943	4.200	+0.24	-3.3	17.2	97.9
Apr. 27	08 47.91	+32 53.2	4.067	4.177	+0.40	-3.9	17.2	89.3
May 7	08 52.62	+32 12.6	4.190	4.153	+0.55	-4.3	17.2	81.0
May 17	08 58.71	+31 28.0	4.309	4.130	+0.68	-4.7	17.3	73.1
May 27	09 05.98	+30 39.9	4.422	4.106	+0.79	-5.0	17.3	65.5
June 6	09 14.27	+29 48.7	4.526	4.082	+0.88	-5.3	17.3	58.1
June 16	09 23.41	+28 54.6	4.619	4.057	+0.95	-5.6	17.3	51.0
June 26	09 33.25	+27 57.9	4.699	4.033	+1.02	-5.8	17.3	44.2
July 6	09 43.68	+26 58.7	4.766	4.008	+1.07	-6.0	17.3	37.6
July 16	09 54.57	+25 57.5	4.818	3.984	+1.11	-6.2	17.3	31.2
July 26	10 05.84	+24 54.4	4.854	3.959	+1.14	-6.4	17.3	25.2
Aug. 5	10 17.40	+23 49.8	4.874	3.934	+1.17	-6.5	17.3	19.7
Aug. 15	10 29.18	+22 44.1	4.877	3.909	+1.19	-6.6	17.2	15.1
Aug. 25	10 41.11	+21 37.6	4.864	3.883	+1.20	-6.7	17.2	12.5
Sept. 4	10 53.14	+20 31.0	4.834	3.858	+1.21	-6.6	17.2	13.1
Sept. 14	11 05.21	+19 24.9	4.787	3.833	+1.21	-6.6	17.1	16.5
Sept. 24	11 17.27	+18 19.7	4.723	3.807	+1.20	-6.4	17.0	21.4
Oct. 4	11 29.26	+17 16.3	4.644	3.782	+1.19	-6.2	17.0	27.2
Oct. 14	11 41.13	+16 15.5	4.549	3.756	+1.18	-5.9	16.9	33.3
Oct. 24	11 52.80	+15 18.1	4.440	3.730	+1.15	-5.5	16.8	39.8
Nov. 3	12 04.22	+14 25.0	4.317	3.705	+1.12	-5.0	16.7	46.5
Nov. 13	12 15.29	+13 37.3	4.183	3.679	+1.08	-4.4	16.6	53.4
Nov. 23	12 25.92	+12 55.9	4.037	3.653	+1.03	-3.7	16.5	60.5
Dec. 3	12 35.99	+12 22.0	3.883	3.628	+0.97	-2.9	16.3	67.8
Dec. 13	12 45.37	+11 56.8	3.723	3.602	+0.89	-2.0	16.2	75.3
Dec. 23	12 53.92	+11 41.1	3.558	3.576	+0.80	-1.0	16.1	83.1
Jan. 2	13 01.44	+11 36.1	3.391	3.551	+0.69	+0.1	15.9	91.2
Jan. 12	13 07.74	+11 42.5	3.226	3.525	+0.56	+1.3	15.8	99.5
Jan. 22	13 12.62	+12 00.7	3.066	3.500	+0.40	+2.5	15.6	108.2
Feb. 1	13 15.85	+12 30.5	2.914	3.475	+0.23	+3.6	15.5	117.1
Feb. 11	13 17.26	+13 10.9	2.774	3.450	+0.04	+4.5	15.3	126.2
Feb. 21	13 16.72	+13 59.7	2.650	3.425	-0.16	+5.2	15.2	135.4
Mar. 2	13 14.18	+14 53.7	2.546	3.400	-0.36	+5.5	15.1	144.4
Mar. 12	13 09.81	+15 47.8	2.465	3.376	-0.53	+5.2	15.0	152.3
Mar. 22	13 03.92	+16 36.8	2.409	3.352	-0.65	+4.4	14.9	157.6

Comet C/2018 U1 (Lemmon)

Epoch = 2019 July 16.0 TT  
 T = 2021 Nov. 3.41665 TT  
 Peri. = 180.43782  
 Node = 75.44990 2000.0  
 Incl. = 108.30395  
 q = 4.9933377 AU  
 e = 0.9987514

$$m1 = 4.5 + 5 \log(\Delta) + 10.0 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' .3			m	'		°
Jan. 7	19 38.93	+45 56.3	9.252	8.942	+0.48	-2.2	18.8	68.7
Jan. 17	19 43.71	+45 38.2	9.233	8.888	+0.48	-1.3	18.8	66.6
Jan. 27	19 48.44	+45 29.7	9.204	8.834	+0.46	-0.3	18.8	65.0
Feb. 6	19 52.98	+45 30.6	9.164	8.780	+0.44	+0.6	18.7	64.2
Feb. 16	19 57.20	+45 40.3	9.112	8.726	+0.40	+1.4	18.7	64.1
Feb. 26	20 00.99	+45 58.4	9.048	8.672	+0.35	+2.2	18.7	64.8
Mar. 8	20 04.20	+46 24.0	8.972	8.619	+0.28	+2.9	18.6	66.2
Mar. 18	20 06.71	+46 56.2	8.885	8.565	+0.21	+3.5	18.6	68.2
Mar. 28	20 08.38	+47 33.9	8.787	8.511	+0.12	+4.0	18.5	70.8
Apr. 7	20 09.08	+48 15.9	8.681	8.458	+0.01	+4.4	18.5	73.9
Apr. 17	20 08.68	+49 00.7	8.567	8.404	-0.11	+4.6	18.4	77.3
Apr. 27	20 07.05	+49 46.3	8.449	8.351	-0.23	+4.5	18.4	81.0
May 7	20 04.10	+50 31.0	8.327	8.298	-0.37	+4.3	18.3	84.9
May 17	19 59.76	+51 12.5	8.204	8.244	-0.51	+3.9	18.2	88.8
May 27	19 54.02	+51 48.2	8.083	8.191	-0.65	+3.2	18.2	92.6
June 6	19 46.93	+52 15.8	7.966	8.138	-0.78	+2.2	18.1	96.2
June 16	19 38.65	+52 32.6	7.855	8.085	-0.89	+1.0	18.1	99.5
June 26	19 29.41	+52 36.5	7.753	8.033	-0.96	-0.4	18.0	102.4
July 6	19 19.57	+52 25.6	7.662	7.980	-1.00	-2.0	17.9	104.7
July 16	19 09.52	+51 58.8	7.583	7.927	-1.00	-3.6	17.9	106.2
July 26	18 59.71	+51 16.0	7.517	7.875	-0.95	-5.2	17.8	107.0
Aug. 5	18 50.55	+50 17.7	7.467	7.823	-0.87	-6.6	17.8	106.9
Aug. 15	18 42.37	+49 05.5	7.431	7.770	-0.75	-7.9	17.8	105.9
Aug. 25	18 35.43	+47 41.7	7.410	7.718	-0.62	-8.9	17.7	104.1
Sept. 4	18 29.87	+46 08.9	7.403	7.666	-0.48	-9.7	17.7	101.4
Sept. 14	18 25.76	+44 30.0	7.409	7.615	-0.33	-10.1	17.7	98.0
Sept. 24	18 23.06	+42 48.0	7.425	7.563	-0.19	-10.3	17.6	94.1
Oct. 4	18 21.71	+41 05.5	7.450	7.512	-0.06	-10.2	17.6	89.7
Oct. 14	18 21.60	+39 25.1	7.481	7.460	+0.05	-9.8	17.6	85.0
Oct. 24	18 22.59	+37 49.0	7.515	7.409	+0.16	-9.3	17.6	80.1
Nov. 3	18 24.56	+36 18.8	7.549	7.358	+0.24	-8.6	17.6	75.2
Nov. 13	18 27.35	+34 56.1	7.580	7.308	+0.32	-7.8	17.5	70.4
Nov. 23	18 30.81	+33 41.9	7.605	7.257	+0.38	-6.9	17.5	65.9
Dec. 3	18 34.81	+32 37.0	7.622	7.207	+0.42	-5.9	17.5	61.7
Dec. 13	18 39.20	+31 42.1	7.628	7.157	+0.46	-4.9	17.5	58.1
Dec. 23	18 43.86	+30 57.3	7.621	7.107	+0.48	-3.9	17.4	55.3
Jan. 2	18 48.65	+30 22.8	7.599	7.057	+0.48	-2.9	17.4	53.4
Jan. 12	18 53.43	+29 58.5	7.562	7.008	+0.47	-1.9	17.3	52.5
Jan. 22	18 58.08	+29 44.1	7.509	6.959	+0.45	-0.9	17.3	52.9
Feb. 1	19 02.46	+29 39.2	7.438	6.910	+0.42	0.0	17.3	54.3
Feb. 11	19 06.45	+29 43.3	7.351	6.861	+0.37	+0.9	17.2	56.8
Feb. 21	19 09.90	+29 55.7	7.249	6.813	+0.31	+1.7	17.1	60.3
Mar. 2	19 12.70	+30 15.5	7.132	6.765	+0.24	+2.4	17.1	64.5
Mar. 12	19 14.68	+30 41.7	7.002	6.717	+0.15	+2.9	17.0	69.4
Mar. 22	19 15.73	+31 12.9	6.862	6.670	+0.05	+3.4	16.9	74.8



## Comet C/2017 K2 (PANSTARRS)

Epoch = 2019 July 16.0 TT  
 T = 2022 Dec. 20.32656 TT  
 Peri. = 236.11526  
 Node = 88.27095 2000.0  
 Incl. = 87.54131  
 q = 1.8027466 AU  
 e = 1.0003773

$$m1 = -2.7 + 5 \log(\Delta) + 12.5 \log(r)$$

Oh TT	R. A. (2000)	Decl.	Delta	r	Daily motion		m1	Elong.
2019/20	h m	° ' "			m	' "		°
Jan. 7	17 50.57	+51 38.4	12.703	12.504	+0.49	+0.6	16.5	76.1
Jan. 17	17 55.34	+51 47.6	12.622	12.440	+0.46	+1.3	16.5	77.1
Jan. 27	17 59.80	+52 03.5	12.536	12.376	+0.42	+1.9	16.4	78.4
Feb. 6	18 03.84	+52 25.5	12.446	12.312	+0.38	+2.5	16.4	79.9
Feb. 16	18 07.35	+52 53.2	12.353	12.248	+0.32	+3.0	16.4	81.6
Feb. 26	18 10.21	+53 25.6	12.256	12.183	+0.25	+3.5	16.3	83.5
Mar. 8	18 12.34	+54 01.9	12.158	12.119	+0.17	+3.8	16.3	85.4
Mar. 18	18 13.62	+54 40.9	12.059	12.054	+0.08	+4.0	16.2	87.4
Mar. 28	18 13.96	+55 21.4	11.960	11.990	-0.02	+4.1	16.2	89.3
Apr. 7	18 13.30	+56 02.1	11.862	11.925	-0.12	+4.0	16.1	91.2
Apr. 17	18 11.59	+56 41.3	11.766	11.860	-0.23	+3.8	16.1	92.9
Apr. 27	18 08.82	+57 17.5	11.673	11.795	-0.33	+3.4	16.0	94.5
May 7	18 05.02	+57 49.3	11.584	11.729	-0.43	+2.9	16.0	95.8
May 17	18 00.28	+58 14.8	11.500	11.664	-0.52	+2.2	15.9	96.8
May 27	17 54.75	+58 32.9	11.421	11.598	-0.59	+1.4	15.9	97.6
June 6	17 48.62	+58 42.3	11.348	11.532	-0.64	+0.4	15.8	97.9
June 16	17 42.15	+58 42.3	11.281	11.466	-0.66	-0.5	15.8	98.0
June 26	17 35.60	+58 32.3	11.221	11.400	-0.65	-1.5	15.8	97.6
July 6	17 29.25	+58 12.4	11.166	11.334	-0.61	-2.5	15.7	96.9
July 16	17 23.38	+57 43.0	11.118	11.268	-0.55	-3.4	15.7	95.9
July 26	17 18.21	+57 05.0	11.075	11.201	-0.47	-4.2	15.6	94.5
Aug. 5	17 13.91	+56 19.4	11.037	11.134	-0.38	-4.9	15.6	92.9
Aug. 15	17 10.59	+55 27.6	11.004	11.068	-0.27	-5.5	15.6	91.0
Aug. 25	17 08.32	+54 31.2	10.974	11.001	-0.17	-5.8	15.5	88.9
Sept. 4	17 07.12	+53 31.6	10.947	10.933	-0.06	-6.1	15.5	86.6
Sept. 14	17 06.95	+52 30.5	10.921	10.866	+0.04	-6.1	15.4	84.2
Sept. 24	17 07.77	+51 29.3	10.896	10.798	+0.13	-6.1	15.4	81.8
Oct. 4	17 09.50	+50 29.4	10.869	10.731	+0.22	-5.9	15.4	79.4
Oct. 14	17 12.06	+49 32.2	10.841	10.663	+0.30	-5.5	15.3	77.1
Oct. 24	17 15.35	+48 38.8	10.809	10.595	+0.37	-5.1	15.3	75.0
Nov. 3	17 19.27	+47 50.3	10.772	10.527	+0.42	-4.5	15.2	73.1
Nov. 13	17 23.71	+47 07.7	10.731	10.458	+0.47	-3.9	15.2	71.5
Nov. 23	17 28.57	+46 31.6	10.683	10.390	+0.51	-3.2	15.2	70.2
Dec. 3	17 33.74	+46 02.8	10.627	10.321	+0.53	-2.5	15.1	69.3
Dec. 13	17 39.12	+45 41.6	10.564	10.252	+0.54	-1.7	15.1	68.9
Dec. 23	17 44.59	+45 28.5	10.493	10.183	+0.55	-0.9	15.0	69.0
Jan. 2	17 50.04	+45 23.6	10.414	10.114	+0.54	0.0	14.9	69.6
Jan. 12	17 55.36	+45 26.8	10.327	10.044	+0.52	+0.8	14.9	70.7
Jan. 22	18 00.43	+45 38.1	10.232	9.974	+0.49	+1.6	14.8	72.2
Feb. 1	18 05.13	+45 57.2	10.130	9.905	+0.45	+2.3	14.8	74.1
Feb. 11	18 09.35	+46 23.3	10.021	9.834	+0.39	+3.0	14.7	76.3
Feb. 21	18 12.97	+46 56.0	9.907	9.764	+0.32	+3.6	14.7	78.8
Mar. 2	18 15.86	+47 34.2	9.789	9.694	+0.24	+4.1	14.6	81.6
Mar. 12	18 17.91	+48 16.8	9.669	9.623	+0.15	+4.5	14.5	84.4
Mar. 22	18 19.01	+49 02.6	9.546	9.552	+0.05	+4.7	14.5	87.4

## Orbital elements:

Comet 95P/(2060) Chiron

Epoch 1996 Feb. 7.0 TT = JDT 2450120.5

T 1996 Feb. 14.74505 TT

		(2000.0)	P	Sato	Q
q	8.4539294				
n	0.01942785	Peri.	339.55382	-0.98660438	+0.15200978
a	13.7041742	Node	209.38435	-0.12782244	-0.94583865
e	0.3831128	Incl.	6.92994	-0.10135690	-0.28684886
P	50.73				

From 2142 observations 1941 Jan. 23–2018 Dec. 31, mean residual 0".42.

Comet 174P/(60558) Echeclus

Epoch 2015 Apr. 8.0 TT = JDT 2457120.5

T 2015 Apr. 22.53266 TT

		(2000.0)	P	Sato	Q
q	5.8170650				
n	0.02822877	Peri.	162.93185	+0.91553944	+0.40213219
a	10.6825463	Node	173.33667	-0.37731576	+0.86619942
e	0.4554608	Incl.	4.34369	-0.13935692	+0.29662817
P	34.92				

From 3556 observations 1979 Sept. 23–2019 Jan. 10, mean residual 0".41.

Comet C/2011 KP36 (Spacewatch)

Epoch 2016 May 12.0 TT = JDT 2457520.5

T 2016 May 26.89712 TT

		(2000.0)	P	Sato	Q
q	4.8833088				
n	0.00414023	Peri.	180.59783	+0.99445338	+0.09830698
a	38.4107651	Node	173.40038	-0.09509860	+0.99227937
e	0.8728661	Incl.	18.98677	-0.04493027	+0.07561345
P	238.06				

From 3386 observations 2011 May 21–2019 Jan. 5, mean residual 0".41.

Comet C/2014 R3 (PANSTARRS)

Epoch 2016 July 31.0 TT = JDT 2457600.5

T 2016 Aug. 7.89626 TT

		(2000.0)	P	Sato	Q
q	7.2754000				
z	+0.0000140	Peri.	113.40108	-0.36316642	-0.82311742
	+/-0.0000006	Node	334.11219	-0.21699429	+0.53039089
e	0.9998985	Incl.	90.83745	+0.90610354	-0.20288721

From 749 observations 2014 Sept. 6–2019 Jan. 6, mean residual 0".47.

Comet C/2014 OE4 (PANSTARRS)

Epoch 2016 Nov. 28.0 TT = JDT 2457720.5

T 2016 Dec. 10.75072 TT

		(2000.0)	P	Sato	Q
q	6.2443075				
z	+0.0000860	Peri.	65.74346	-0.08368151	+0.50406431
	+/-0.0000003	Node	240.40003	-0.74841439	+0.53775617
e	0.9994628	Incl.	81.34886	+0.65793108	+0.67582355

From 1611 observations 2014 May 8–2019 Jan. 3, mean residual 0".46.

Comet C/2014 B1 (Schwartz)

Epoch 2017 Sept. 4.0 TT = JDT 2458000.5

T 2017 Sept. 10.53487 TT

		(2000.0)	P	Sato	Q
q	9.5565886				
z	-0.0003923	Peri.	345.84167	-0.85029303	-0.50400221
	+/-0.0000007	Node	161.39565	+0.51719189	-0.85353226
e	1.0037488	Incl.	28.37228	+0.09754136	+0.13215314

From 848 observations 2014 Jan. 28–2019 Jan. 19, mean residual 0".48.

Comet C/2016 N4 (MASTER)

Epoch 2017 Sept. 4.0 TT = JDT 2458000.5

T 2017 Sept. 16.59690 TT

		(2000.0)	P	Sato	Q
q	3.1991146				
z	+0.0001915	Peri.	55.95522	+0.58263274	-0.80665855
	+/-0.0000004	Node	354.03139	-0.14120881	+0.01973051
e	0.9993873	Incl.	72.55727	+0.80037439	+0.59068832

From 1816 observations 2015 Sept. 11–2019 Jan. 24, mean residual 0".57.

Comet 65P/Gunn

Epoch 2017 Oct. 14.0 TT = JDT 2458040.5

T 2017 Oct. 16.79085 TT

	(2000.0)		P	Sato	Q
q	2.9100507				
n	0.12895509	Peri.	213.53844	+0.09056692	+0.98586295
a	3.8801072	Node	62.01783	-0.87503975	+0.14636034
e	0.2500076	Incl.	9.18538	-0.47550296	-0.08156531
P	7.64				

From 1440 observations 2015 Dec. 11–2018 Nov. 30, mean residual 0".57.

Comet C/2016 A1 (PANSTARRS)

Epoch 2017 Nov. 23.0 TT = JDT 2458080.5

T 2017 Nov. 23.37261 TT

	(2000.0)		P	Sato	Q
q	5.3277658				
z	-0.0003731	Peri.	10.32034	-0.53513252	+0.51121071
+/-	-0.0000004	Node	128.17453	+0.70123275	-0.17512484
e	1.0019878	Incl.	121.18576	+0.47106880	+0.84142433

From 1746 observations 2016 Jan. 1–2019 Jan. 20, mean residual 0".47.

Comet C/2015 V1 (PANSTARRS)

Epoch 2018 Jan. 2.0 TT = JDT 2458120.5

T 2017 Dec. 17.73693 TT

	(2000.0)		P	Sato	Q
q	4.2667869				
z	-0.0001229	Peri.	179.63925	+0.95387998	+0.22988445
+/-	-0.0000003	Node	197.19417	+0.27375598	-0.40230263
e	1.0005244	Incl.	139.22913	+0.12316919	-0.88617478

From 2045 observations 2015 Nov. 2–2018 Nov. 27, mean residual 0".48.

Comet C/2017 K6 (Jacques)

Epoch 2018 Jan. 2.0 TT = JDT 2458120.5

T 2018 Jan. 3.13764 TT

	(2000.0)		P	Sato	Q
q	2.0027571				
z	+0.0008939	Peri.	303.83883	+0.49565860	-0.22851059
+/-	-0.0000012	Node	85.05444	+0.75134575	+0.59675970
e	0.9982097	Incl.	57.25101	-0.43566284	+0.76919488

From 393 observations 2017 May 29–2019 Jan. 3, mean residual 0".60.

Comet C/2017 K4 (ATLAS)

Epoch 2018 Jan. 2.0 TT = JDT 2458120.5

T 2018 Jan. 8.03428 TT

	(2000.0)		P	Sato	Q
q	2.6480773				
n	0.00661376	Peri.	15.10920	+0.68514384	+0.68369590
a	28.1084542	Node	298.89770	-0.69452538	+0.50918788
e	0.9057907	Incl.	16.67902	-0.21957326	+0.52276919
P	149.02				

From 430 observations 2017 May 26–2019 Jan. 3, mean residual 0".50.

Comet 130P/McNaught–Hughes

Epoch 2018 Jan. 2.0 TT = JDT 2458120.5

T 2018 Jan. 21.75962 TT

	(2000.0)		P	Sato	Q
q	1.8236379				
n	0.15847034	Peri.	245.90892	+0.71652770	+0.69043289
a	3.3819776	Node	70.25611	-0.59547984	+0.67967879
e	0.4607777	Incl.	6.06534	-0.36330678	+0.24766746
P	6.22				

From 963 observations 1991 Sept. 14–2019 Jan. 2, mean residual 0".63.

Comet 74P/Smirnova–Chernykh

Epoch 2018 Feb. 11.0 TT = JDT 2458160.5

T 2018 Jan. 26.70246 TT

	(2000.0)		P	Sato	Q
q	3.5364752				
n	0.11627430	Peri.	87.13463	-0.95561539	-0.27211516
a	4.1573209	Node	77.05566	+0.20254571	-0.88514866
e	0.1493380	Incl.	6.65391	+0.21394969	-0.37744560
P	8.48				

From 4924 observations 1985 Mar. 22–2019 Jan. 12, mean residual 0".65.

Nongravitational parameters  $Y1 = -0.05$ ,  $Y2 = -0.0265$ .

Comet C/2015 O1 (PANSTARRS)

Epoch 2018 Feb. 11.0 TT = JDT 2458160.5

T 2018 Feb. 19.02505 TT

	(2000.0)	P	Sato	Q
q	3.7296366			
z	+0.0000024	Peri. 89.59295	-0.52094156	-0.50153013
+/-	0.0000014	Node 299.85565	-0.59864645	+0.79148302
e	0.9999912	Incl. 127.21105	+0.60847541	+0.34931669

From 3290 observations 2015 June 15–2019 Jan. 18, mean residual 0".52.  
Nongravitational parameters Y1 = +6.66, Y2 = -2.1734.

Comet C/2018 E1 (ATLAS)

Epoch 2018 May 2.0 TT = JDT 2458240.5

T 2018 Apr. 17.32286 TT

	(2000.0)	P	Sato	Q
q	2.7054435			
n	0.00245058	Peri. 299.47202	-0.26852392	-0.80983521
a	54.4866686	Node 146.84066	+0.77844243	+0.13650648
e	0.9503467	Incl. 72.47969	-0.56738195	+0.57055491

P 402.19  
From 182 observations 2015 Aug. 11–2019 Jan. 4, mean residual 0".36.

Comet C/2015 XY1 (Lemmon)

Epoch 2018 May 2.0 TT = JDT 2458240.5

T 2018 Apr. 29.90734 TT

	(2000.0)	P	Sato	Q
q	7.9280039			
z	-0.0005250	Peri. 196.35131	+0.04277749	+0.86105021
+/-	0.0000010	Node 281.61655	+0.96478220	+0.09615732
e	1.0041620	Incl. 148.84778	+0.25954844	-0.49934588

From 434 observations 2015 Dec. 4–2019 Jan. 1, mean residual 0".48.

Comet 37P/Forbes

Epoch 2018 May 2.0 TT = JDT 2458240.5

T 2018 May 4.12365 TT

	(2000.0)	P	Sato	Q
q	1.6102842			
n	0.15337123	Peri. 329.98054	+0.25590541	+0.96032277
a	3.4565283	Node 314.58937	-0.85306588	+0.17038215
e	0.5341325	Incl. 8.95652	-0.45474280	+0.22079424

P 6.43  
From 1434 observations 1999 June 14–2018 Nov. 29, mean residual 0".74.  
Nongravitational parameters A1 = +0.54, A2 = -0.0758.

Comet C/2016 R2 (PANSTARRS)

Epoch 2018 May 2.0 TT = JDT 2458240.5

T 2018 May 9.58390 TT

	(2000.0)	P	Sato	Q
q	2.6023696			
z	+0.0014002	Peri. 33.19224	-0.14726448	-0.52443170
+/-	0.0000003	Node 80.56878	+0.61562505	-0.71221448
e	0.9963563	Incl. 58.22381	+0.77415694	+0.46660682

From 3122 observations 2016 Aug. 30–2019 Jan. 9, mean residual 0".49.

Comet 240P/NEAT

Epoch 2018 May 2.0 TT = JDT 2458240.5

T 2018 May 15.88121 TT

	(2000.0)	P	Sato	Q
q	2.1338417			
n	0.12931400	Peri. 352.09959	+0.37931668	-0.84132278
a	3.8729245	Node 74.92547	+0.86922986	+0.18137615
e	0.4490361	Incl. 23.50409	+0.31710930	+0.50919414

P 7.62  
From 461 observations 2017 July 6–2019 Jan. 10, mean residual 0".59.  
Nongravitational parameters A1 = -5.46, A2 = -2.1469.

## Comet 159P/LONEOS

Epoch 2018 June 11.0 TT = JDT 2458280.5

T 2018 May 22.79952 TT

		(2000.0)	P	Sato	Q
q	3.6252078				
n	0.06943706	Peri.	4.76216	+0.50884990	-0.79664082
a	5.8623962	Node	55.02421	+0.77608847	+0.26053694
e	0.3816167	Incl.	23.46274	+0.37250297	+0.54542085
P	14.19				

From 368 observations 1989 Dec. 17–2019 Jan. 20, mean residual 0".57.

## Comet 164P/Christensen

Epoch 2018 June 11.0 TT = JDT 2458280.5

T 2018 May 31.40839 TT

		(2000.0)	P	Sato	Q
q	1.6852524				
n	0.14067527	Peri.	325.93079	+0.56206060	-0.77834838
a	3.6614874	Node	88.30589	+0.80745250	+0.44309383
e	0.5397356	Incl.	16.25276	+0.17918801	+0.44479395
P	7.01				

From 959 observations 1998 Jan. 24–2019 Jan. 6, mean residual 0".66.

Nongravitational parameters A1 = -0.07, A2 = +0.0268.

## Comet C/2017 M5 (TOTAS)

Epoch 2018 June 11.0 TT = JDT 2458280.5

T 2018 June 2.97679 TT

		(2000.0)	P	Sato	Q
q	5.9895363				
z	-0.0006384	Peri.	92.66137	+0.60572524	+0.77903000
	+/-0.0000015	Node	216.26252	-0.79432097	+0.58018613
e	1.0038239	Incl.	15.88485	-0.04638032	+0.23768953

From 361 observations 2016 May 30–2019 Jan. 2, mean residual 0".58.

## Comet 370P/NEAT

Epoch 2018 June 11.0 TT = JDT 2458280.5

T 2018 June 9.52539 TT

		(2000.0)	P	Sato	Q
q	2.4853480				
n	0.06024040	Peri.	356.78737	+0.61373408	-0.74095758
a	6.4448204	Node	55.16290	+0.73156630	+0.40387643
e	0.6143650	Incl.	19.39792	+0.29688588	+0.53653117
P	16.36				

From 178 observations 2001 Aug. 20–2019 Jan. 3, mean residual 0".63.

Nongravitational parameters A1 = -4.06, A2 = -11.0926.

## Comet P/2017 TW13 (Lemmon)

Epoch 2018 June 11.0 TT = JDT 2458280.5

T 2018 June 20.98511 TT

		(2000.0)	P	Sato	Q
q	2.0788051				
n	0.05142261	Peri.	120.10947	-0.02146035	-0.90190024
a	7.1619835	Node	322.27636	+0.48415843	+0.36816117
e	0.7097445	Incl.	44.83672	+0.87471714	-0.22590552
P	19.17				

From 150 observations 2017 Aug. 31–2019 Jan. 6, mean residual 0".40.

## Comet 361P/Spacewatch

Epoch 2018 July 21.0 TT = JDT 2458320.5

T 2018 July 2.50531 TT

		(2000.0)	P	Sato	Q
q	2.7802764				
n	0.08960823	Peri.	219.21357	+0.46918990	-0.87799250
a	4.9458101	Node	203.27716	+0.85852170	+0.47864927
e	0.4378522	Incl.	13.88245	+0.20688481	+0.00490337
P	11.00				

From 249 observations 2006 Oct. 11–2019 Jan. 5, mean residual 0".58.

## Comet 49P/Arend-Rigaux

Epoch 2018 July 21.0 TT = JDT 2458320.5

T 2018 July 15.49710 TT

		(2000.0)	P	Sato	Q
q	1.4296064				
n	0.14618299	Peri.	332.88790	-0.05172816	-0.95687556
a	3.5689310	Node	118.82420	+0.96518831	-0.12138957
e	0.5994301	Incl.	19.04318	+0.25638980	+0.26391995
P	6.74				

From 2956 observations 1951 Feb. 8–2019 Jan. 12, mean residual 0".62.

Nongravitational parameters A1 = +0.01, A2 = -0.0013.

## Comet C/2016 N6 (PANSTARRS)

Epoch 2018 July 21.0 TT = JDT 2458320.5

T 2018 July 18.21047 TT

		(2000.0)	P	Sato	Q
q	2.6690713				
z	0.0004661	Peri.	162.80585	-0.53335097	+0.08479555
+/-0.0000003		Node	298.97633	+0.61778807	+0.71869335
e	0.9987561	Incl.	105.83226	+0.57781887	-0.69013736

From 2474 observations 2016 June 27–2019 Jan. 11, mean residual 0".41.

## Comet C/2016 M1 (PANSTARRS)

Epoch 2018 Aug. 30.0 TT = JDT 2458360.5

T 2018 Aug. 10.17131 TT

		(2000.0)	P	Sato	Q
q	2.2104779				
z	+0.0004318	Peri.	209.82519	+0.02468543	-0.03424835
+/-0.0000034		Node	92.20353	-0.59786969	+0.80048112
e	0.9990455	Incl.	90.99972	-0.80121312	-0.59837867

From 2859 observations 2016 June 22–2019 Jan. 9, mean residual 0".45.

Nongravitational parameters A1 = +5.14, A2 = -1.7890.

## Comet 48P/Johnson

Epoch 2018 Aug. 30.0 TT = JDT 2458360.5

T 2018 Aug. 12.19763 TT

		(2000.0)	P	Sato	Q
q	2.0045258				
n	0.15064112	Peri.	216.56111	+0.82311095	+0.53204952
a	3.4981656	Node	110.13356	-0.45794201	+0.82861330
e	0.4269780	Incl.	12.20702	-0.33582358	+0.17413589
P	6.54				

From 1845 observations 1949 Sept. 24–2019 Jan. 3, mean residual 0".65.

Nongravitational parameters A1 = +0.56, A2 = -0.0231.

## Comet 243P/NEAT

Epoch 2018 Aug. 30.0 TT = JDT 2458360.5

T 2018 Aug. 26.00638 TT

		(2000.0)	P	Sato	Q
q	2.4544424				
n	0.13144875	Peri.	283.55461	+0.97228358	-0.19238566
a	3.8308788	Node	87.65888	+0.23016241	+0.88749197
e	0.3593004	Incl.	7.64144	-0.04110843	+0.41874307
P	7.50				

From 452 observations 2003 Aug. 1–2019 Jan. 1, mean residual 0".70.

## Comet 21P/Giacobini-Zinner

Epoch 2018 Aug. 30.0 TT = JDT 2458360.5

T 2018 Sept. 10.27629 TT

		(2000.0)	P	Sato	Q
q	1.0128234				
n	0.15069665	Peri.	172.85921	+0.98463786	-0.10348840
a	3.4973062	Node	195.39118	+0.12216323	+0.98377570
e	0.7103990	Incl.	31.99776	+0.12475749	-0.14654528
P	6.54				

From 759 observations 2018 Sept. 10–2019 Jan. 27, mean residual 0".84.

## Comet 368P/NEAT

Epoch 2018 Aug. 30.0 TT = JDT 2458360.5

T 2018 Sept. 14.24998 TT

		(2000.0)	P	Sato	Q
q	2.0678166				
n	0.07588015	Peri.	118.80465	+0.92629935	-0.27163013
a	5.5256573	Node	257.97765	+0.17792971	+0.92623241
e	0.6257791	Incl.	15.48473	+0.33213030	+0.26136295
P	12.99				

From 184 observations 2018 June 6–2019 Jan. 3, mean residual 0".48.

## Comet 59P/Kearns-Kwee

Epoch 2018 Aug. 30.0 TT = JDT 2458360.5

T 2018 Sept. 16.77812 TT

		(2000.0)	P	Sato	Q
q	2.3587723				
n	0.10341994	Peri.	127.70374	+0.15680983	-0.98043131
a	4.4950362	Node	312.82799	+0.84736937	+0.19546204
e	0.4752495	Incl.	9.33938	+0.50732222	-0.02343140
P	9.53				

From 1078 observations 1990 Oct. 15–2019 Jan. 13, mean residual 0".76.

Nongravitational parameters A1 = +0.31, A2 = -0.1148.

## Comet 371P/LINEAR-Skiff

Epoch 2018 Oct. 9.0 TT = JDT 2458400.5

T 2018 Oct. 4.58827 TT

		(2000.0)	P	Sato	Q
q	2.1910576				
n	0.11528545	Peri.	308.47923	+0.92917166	-0.24630517
a	4.1810600	Node	67.33495	+0.35567954	+0.79878150
e	0.4759564	Incl.	17.37961	-0.10065824	+0.54889149
P	8.55				

From 145 observations 2001 Aug. 19–2018 Dec. 28, mean residual 0".73.

## Comet P/2018 P3 (PANSTARRS)

Epoch 2018 Oct. 9.0 TT = JDT 2458400.5

T 2018 Oct. 9.45766 TT

		(2000.0)	P	Sato	Q
q	1.7564480				
n	0.18902317	Peri.	305.88282	+0.98765462	-0.08269867
a	3.0069488	Node	59.21022	+0.13595028	+0.87443153
e	0.4158703	Incl.	8.90908	-0.07781949	+0.47804856
P	5.21				

From 238 observations 2018 Aug. 8–2019 Jan. 11, mean residual 0".55.

## Comet 369P/Hill

Epoch 2018 Oct. 9.0 TT = JDT 2458400.5

T 2018 Oct. 15.14846 TT

		(2000.0)	P	Sato	Q
q	1.9571539				
n	0.10712727	Peri.	13.27982	+0.49362625	-0.85966671
a	4.3907228	Node	47.32039	+0.78066797	+0.37134442
e	0.5542525	Incl.	10.30838	+0.38326316	+0.35082256
P	9.20				

From 246 observations 2010 Jan. 6–2019 Jan. 1, mean residual 0".68.

## Comet 300P/Catalina

Epoch 2018 Nov. 18.0 TT = JDT 2458440.5

T 2018 Nov. 2.05846 TT

		(2000.0)	P	Sato	Q
q	0.8328156				
n	0.22223438	Peri.	222.85365	+0.74595347	+0.65868580
a	2.6993667	Node	95.67369	-0.58115903	+0.71595868
e	0.6914774	Incl.	5.67607	-0.32528083	+0.23137888
P	4.43				

From 590 observations 2005 May 6–2019 Jan. 1, mean residual 0".68.

Nongravitational parameters A1 = -0.05, A2 = -0.0162.

## Comet 64P/Swift-Gehrels

Epoch 2018 Nov. 18.0 TT = JDT 2458440.5

T 2018 Nov. 3.89418 TT

		(2000.0)	P	Sato	Q
q	1.3931882				
n	0.10470737	Peri.	97.15128	+0.78661516	-0.60256859
a	4.4581146	Node	299.99707	+0.48711758	+0.73969933
e	0.6874938	Incl.	8.94864	+0.37941146	+0.29959307
P	9.41				

From 1664 observations 1991 Jan. 7–2019 Jan. 21, mean residual 0".48.

Nongravitational parameters A1 = +0.02, A2 = +0.0672.

## Comet 38P/Stephan-Oterma

Epoch 2018 Nov. 18.0 TT = JDT 2458440.5

T 2018 Nov. 10.97724 TT

		(2000.0)	P	Sato	Q
q	1.5885942				
n	0.02596716	Peri.	359.58213	+0.21468596	-0.92685010
a	11.2941374	Node	77.99948	+0.89700024	+0.06235437
e	0.8593435	Incl.	18.35314	+0.38639424	+0.37021726
P	37.96				

From 1150 observations 1942 Nov. 6–2019 Jan. 21, mean residual 0".52.

Nongravitational parameters A1 = +0.02, A2 = -0.0032.

## Comet P/2019 A2 (ATLAS)

Epoch 2018 Nov. 18.0 TT = JDT 2458440.5

T 2018 Nov. 23.15782 TT

		(2000.0)	P	Sato	Q
q	3.5448504				
n	0.07184551	Peri.	324.54951	-0.25441545	-0.95259649
a	5.7306376	Node	139.44273	+0.93592025	-0.28597028
e	0.3814213	Incl.	14.86732	+0.24356941	+0.10383124
P	13.72				

From 96 observations 2018 Dec. 13–2019 Jan. 25, mean residual 0".48.

## Comet 247P/LINEAR

Epoch 2018 Nov. 18.0 TT = JDT 2458440.5

T 2018 Dec. 2.10363 TT

		(2000.0)	P	Sato	Q
q	1.4890619				
n	0.12454433	Peri.	47.44854	-0.18180949	-0.96458503
a	3.9711847	Node	54.01085	+0.81874625	-0.25612788
e	0.6250333	Incl.	13.66154	+0.54460985	+0.06304152
P	7.91				

From 1034 observations 2002 Nov. 5–2019 Jan. 5, mean residual 0".55.

## Comet C/2018 L2 (ATLAS)

Epoch 2018 Nov. 18.0 TT = JDT 2458440.5

T 2018 Dec. 2.57570 TT

		(2000.0)	P	Sato	Q
q	1.7117115				
z	+0.0040787	Peri.	56.22774	+0.03218454	+0.56732849
	+/-0.0000025	Node	243.01850	-0.89266579	+0.38663297
e	0.9930184	Incl.	67.42356	+0.44956862	+0.72708550

From 403 observations 2018 June 4–2019 Jan. 20, mean residual 0".57.

## Comet C/2018 V1 (Machholz-Fujikawa-Iwamoto)

Epoch 2018 Nov. 18.0 TT = JDT 2458440.5

T 2018 Dec. 3.50823 TT

		(2000.0)	P	Sato	Q
q	0.3869599				
z	-0.0009199	Peri.	88.77453	+0.61758347	+0.63888507
	+/-0.0000548	Node	128.72115	+0.24562700	-0.71072842
e	1.0003560	Incl.	143.98892	+0.74716667	-0.29443333

From 365 observations 2018 Nov. 7–Dec. 15, mean residual 0".64.



## Comet 60P/Tsuchinshan

Epoch 2018 Dec. 28.0 TT = JDT 2458480.5

T 2018 Dec. 11.23218 TT

		(2000.0)	P	Sato	Q
q	1.6226518				
n	0.14986368	Peri.	216.55318	-0.55998417	-0.82611615
a	3.5102532	Node	267.58306	+0.77426152	-0.49481814
e	0.5377394	Incl.	3.60650	+0.29485051	-0.26960550
P	6.58				

From 570 observations 1978 Dec. 1–2019 Jan. 19, mean residual 0".68.

## Comet 46P/Wirtanen

Epoch 2018 Dec. 28.0 TT = JDT 2458480.5

T 2018 Dec. 12.94125 TT

		(2000.0)	P	Sato	Q
q	1.0553672				
n	0.18119171	Peri.	356.35367	+0.19786751	-0.95925749
a	3.0929804	Node	82.15692	+0.90441399	+0.09931779
e	0.6587863	Incl.	11.74645	+0.37799972	+0.26450150
P	5.44				

From 2702 observations 2014 Feb. 11–2019 Jan. 21, mean residual 0".58.

Nongravitational parameters A1 = +0.44, A2 = -0.4358.

## Comet 137P/Shoemaker–Levy

Epoch 2018 Dec. 28.0 TT = JDT 2458480.5

T 2018 Dec. 13.39061 TT

		(2000.0)	P	Sato	Q
q	1.9302195				
n	0.10259452	Peri.	141.01606	+0.96808220	-0.24133095
a	4.5191137	Node	233.08067	+0.20353085	+0.91447948
e	0.5728765	Incl.	4.85386	+0.14626018	+0.32478710
P	9.61				

From 834 observations 1990 Sept. 16–2019 Jan. 4, mean residual 0".43.

## Comet 375P/Hill

Epoch 2018 Nov. 18.0 TT = JDT 2458440.5

T 2018 Dec. 21.43409 TT

		(2000.0)	P	Sato	Q
q	1.8951643				
n	0.07511179	Peri.	119.42501	-0.49076797	-0.87129029
a	5.5632765	Node	359.96444	+0.65957596	-0.37137760
e	0.6593439	Incl.	17.36533	+0.56930338	-0.32083004
P	13.12				

From 93 observations 2005 Dec. 5–2019 Jan. 3, mean residual 0".59.

## Comet C/2018 X3 (PANSTARRS)

Epoch 2018 Dec. 28.0 TT = JDT 2458480.5

T 2018 Dec. 30.79413 TT

		(2000.0)	P	Sato	Q
q	2.6988791				
n	0.02252383	Peri.	359.83275	+0.19417773	-0.71284656
a	12.4177025	Node	78.92486	+0.90081449	-0.14240041
e	0.7826587	Incl.	43.36878	+0.38836615	+0.68671093
P	43.76				

From 28 observations 2018 Oct. 4–Dec. 16, mean residual 0".28.

## Comet P/2018 Y2 (Africano)

Epoch 2018 Dec. 28.0 TT = JDT 2458480.5

T 2019 Jan. 2.76423 TT

		(2000.0)	P	Sato	Q
q	3.8938734				
n	0.04820314	Peri.	162.53098	-0.17555355	-0.96786659
a	7.4774322	Node	297.25818	+0.87732512	-0.07083869
e	0.4792499	Incl.	11.68513	+0.44663362	-0.24128020
P	20.45				

From 45 observations 2018 Dec. 10–2019 Jan. 4, mean residual 0".38.

Comet 239P/LINEAR

Epoch 2018 Dec. 28.0 TT = JDT 2458480.5

T 2019 Jan. 10.15953 TT

		(2000.0)	P	Sato	Q
q	1.6494753				
n	0.10426230	Peri.	220.37824	-0.43066707	-0.88225369
a	4.4707925	Node	255.90825	+0.87031656	-0.35021303
e	0.6310553	Incl.	11.30562	+0.23890367	-0.31460969
P	9.45				

From 111 observations 1999 Nov. 14–2019 Jan. 18, mean residual 0".51.

Comet 374P/Larson

Epoch 2018 Dec. 28.0 TT = JDT 2458480.5

T 2019 Jan. 10.88219 TT

		(2000.0)	P	Sato	Q
q	2.6766247				
n	0.08874581	Peri.	51.59554	+0.50897448	-0.86039578
a	4.9778005	Node	7.93539	+0.72008032	+0.40918510
e	0.4622877	Incl.	10.75793	+0.47162412	+0.30378717
P	11.11				

From 227 observations 2007 Sept. 10–2019 Jan. 3, mean residual 0".72.

Comet C/2018 A3 (ATLAS)

Epoch 2018 Dec. 28.0 TT = JDT 2458480.5

T 2019 Jan. 12.85955 TT

		(2000.0)	P	Sato	Q
q	3.2767387				
z	+0.0020012	Peri.	86.42570	-0.24778131	+0.95551505
	+/-0.0000006	Node	194.27957	+0.40379685	+0.25196402
e	0.9934425	Incl.	139.56196	+0.88065460	+0.15331380

From 781 observations 2018 Jan. 10–2019 Jan. 19, mean residual 0".44.

Comet 171P/Spahr

Epoch 2018 Dec. 28.0 TT = JDT 2458480.5

T 2019 Jan. 13.70416 TT

		(2000.0)	P	Sato	Q
q	1.7723816				
n	0.14681276	Peri.	347.14411	+0.00447290	-0.93069574
a	3.5587176	Node	101.69598	+0.94735751	-0.11315747
e	0.5019606	Incl.	21.93301	+0.32014643	+0.34785173
P	6.71				

From 458 observations 1998 Nov. 13–2019 Jan. 20, mean residual 0".73.

Nongravitational parameters Y1 = +0.38, Y2 = -0.0969.

Comet C/2017 M4 (ATLAS)

Epoch 2019 Feb. 6.0 TT = JDT 2458520.5

T 2019 Jan. 18.19065 TT

		(2000.0)	P	Sato	Q
q	3.2517540				
z	-0.0007065	Peri.	167.62211	-0.34655508	-0.32821763
	+/-0.0000004	Node	65.86703	-0.92163493	+0.29351921
e	1.0022972	Incl.	105.65771	-0.17460993	-0.89784167

From 2764 observations 2017 June 16–2018 Nov. 13, mean residual 0".48.

Comet 131P/Mueller

Epoch 2019 Feb. 6.0 TT = JDT 2458520.5

T 2019 Jan. 24.23134 TT

		(2000.0)	P	Sato	Q
q	2.4175099				
n	0.13953762	Peri.	179.07793	+0.83602047	-0.54396318
a	3.6813619	Node	214.19206	+0.50259794	+0.81176772
e	0.3433110	Incl.	7.35377	+0.22014789	+0.21245524
P	7.06				

From 591 observations 1990 Sept. 15–2018 Dec. 31, mean residual 0".74.

Nongravitational parameters A1 = +0.90, A2 = -0.0463.

Comet 223P/Skiff

Epoch 2019 Feb. 6.0 TT = JDT 2458520.5

T 2019 Jan. 27.27122 TT

		(2000.0)	P	Sato	Q
q	2.4308739				
n	0.11624487	Peri.	37.82471	+0.89382212	-0.43624857
a	4.1580227	Node	346.79279	+0.21162325	+0.61440004
e	0.4153774	Incl.	27.01409	+0.39534493	+0.65741903
P	8.48				

From 568 observations 2001 July 27–2018 Dec. 31, mean residual 0".62.

Comet C/2017 B3 (LINEAR)

Epoch 2019 Feb. 6.0 TT = JDT 2458520.5

T 2019 Feb. 2.50429 TT

		(2000.0)	P	Sato	Q
q	3.9211449				
z	-0.0005367	Peri.	284.74988	+0.27591738	+0.96068762
+/-	-0.0000011	Node	2.17719	-0.19811347	+0.08820136
e	1.0021046	Incl.	54.17870	-0.94054274	+0.26324857

From 322 observations 2016 Apr. 1–2018 Oct. 11, mean residual 0".48.

Comet 123P/West–Hartley

Epoch 2019 Feb. 6.0 TT = JDT 2458520.5

T 2019 Feb. 5.11669 TT

		(2000.0)	P	Sato	Q
q	2.1268821				
n	0.13008756	Peri.	103.01037	-0.83647260	-0.51322375
a	3.8575557	Node	46.49942	+0.34088642	-0.76181068
e	0.4486451	Incl.	15.35960	+0.42908045	-0.39527947
P	7.58				

From 2373 observations 1989 Mar. 14–2019 Jan. 20, mean residual 0".71.

Nongravitational parameters A1 = +0.08, A2 = +0.0079.

Comet C/2018 Y1 (Iwamoto)

Epoch 2019 Feb. 6.0 TT = JDT 2458520.5

T 2019 Feb. 7.01460 TT

		(2000.0)	P	Sato	Q
q	1.2867946				
z	+0.0089550	Peri.	358.04602	-0.85996770	+0.47741625
+/-	-0.0007273	Node	147.47845	+0.47266801	+0.61180531
e	0.9884768	Incl.	160.39837	+0.19245911	+0.63068851

From 323 observations 2018 Dec. 18–2019 Jan. 21, mean residual 0".57.

Comet P/1996 R2 (Lagerkvist)

Epoch 2019 Feb. 6.0 TT = JDT 2458520.5

T 2019 Feb. 11.45421 TT

		(2000.0)	P	Sato	Q
q	2.5902806				
n	0.13448732	Peri.	333.29032	+0.97273029	-0.23009391
a	3.7729567	Node	40.04714	+0.22008913	+0.87596428
e	0.3134613	Incl.	2.60102	+0.07318847	+0.42396151
P	7.33				

From 126 observations 1996 Aug. 12–1997 Jan. 12, mean residual 0".70.

Comet 149P/Mueller

Epoch 2019 Feb. 6.0 TT = JDT 2458520.5

T 2019 Feb. 16.98708 TT

		(2000.0)	P	Sato	Q
q	2.6335379				
n	0.10990748	Peri.	43.79496	-0.93552304	+0.21125946
a	4.3163623	Node	145.23409	-0.21183287	-0.97687670
e	0.3898710	Incl.	29.77097	+0.28270740	-0.03288384
P	8.97				

From 250 observations 1992 Apr. 12–2019 Jan. 12, mean residual 0".72.

Comet C/2010 U3 (Boattini)

Epoch 2019 Mar. 18.0 TT = JDT 2458560.5

T 2019 Feb. 26.61770 TT

	(2000.0)		P	Sato	Q
q	8.4455601				
z	+0.0001941	Peri.	88.08606	-0.36204382	-0.74305942
	+/-0.0000004	Node	43.06721	+0.07256289	-0.62443280
e	0.9983607	Incl.	55.51170	+0.92933250	-0.24072054

From 1602 observations 2009 Sept. 16–2019 Jan. 13, mean residual 0".63.

Comet C/2018 P5 (PANSTARRS)

Epoch 2019 Mar. 18.0 TT = JDT 2458560.5

T 2019 Feb. 26.15676 TT

	(2000.0)		P	Sato	Q
q	4.5760836				
n	0.02166707	Peri.	131.62276	+0.97412007	+0.21333753
a	12.7429271	Node	216.24363	-0.22597707	+0.92642307
e	0.6408923	Incl.	7.25676	+0.00494509	+0.31020541

P 45.49

From 50 observations 2018 June 16–Oct. 8, mean residual 0".40.

Comet C/2018 V4 (Africano)

Epoch 2019 Mar. 18.0 TT = JDT 2458560.5

T 2019 Mar. 1.59463 TT

	(2000.0)		P	Sato	Q
q	3.1992448				
z	+0.0047971	Peri.	359.98113	+0.20146648	-0.35095221
	+/-0.0000772	Node	78.38403	+0.89879173	-0.30486092
e	0.9846530	Incl.	69.00061	+0.38933878	+0.88537696

From 127 observations 2018 Oct. 23–2019 Jan. 1, mean residual 0".61.

Comet P/2012 O1 (McNaught)

Epoch 2019 Mar. 18.0 TT = JDT 2458560.5

T 2019 Mar. 2.47374 TT

	(2000.0)		P	Sato	Q
q	1.4352596				
n	0.14811219	Peri.	238.17919	+0.86035058	+0.49303634
a	3.5378726	Node	91.98849	-0.41292081	+0.82289054
e	0.5943156	Incl.	7.43220	-0.29881981	+0.28242933

P 6.65

From 94 observations 2012 July 18–Nov. 18, mean residual 0".59.

From CHB 2018.

Comet 29P/Schwassmann–Wachmann

Epoch 2019 Mar. 18.0 TT = JDT 2458560.5

T 2019 Mar. 7.75450 TT

	(2000.0)		P	Sato	Q
q	5.7668176				
n	0.06662630	Peri.	47.77432	+0.99270161	-0.00956770
a	6.0261361	Node	312.39458	-0.05135277	+0.86841764
e	0.0430323	Incl.	9.36831	+0.10911647	+0.49574113

P 14.79

From 26735 observations 1902 Mar. 5–2019 Jan. 14, mean residual 0".66.

Comet C/2019 B1 (Africano)

T 2019 Mar. 19.39372 TT

	(2000.0)		P	Sato	Q
q	1.6032220				
		Peri.	174.31573	-0.39574586	+0.48103510
		Node	290.25232	+0.80631231	+0.58975642
e	1.0	Incl.	123.50383	+0.43959716	-0.64868529

From 17 observations 2019 Jan. 19–23, mean residual 0".51.

Comet 78P/Gehrels

Epoch 2019 Mar. 18.0 TT = JDT 2458560.5

T 2019 Apr. 2.69634 TT

	(2000.0)		P	Sato	Q
q	2.0138250				
n	0.13626083	Peri.	192.68369	+0.72925201	-0.68200513
a	3.7401472	Node	210.54808	+0.63690616	+0.70612709
e	0.4615653	Incl.	6.24877	+0.25008410	+0.19040360

P 7.23

From 6163 observations 1996 June 18–2019 Jan. 12, mean residual 0".62.

Nongravitational parameters A1 = +0.84, A2 = -0.1284.

## Comet 232P/Hill

Epoch 2019 Mar. 18.0 TT = JDT 2458560.5

T 2019 Apr. 6.59089 TT

		(2000.0)	P	Sato	Q
q	2.9845296				
n	0.10372370	Peri.	53.54966	-0.31349149	-0.92619765
a	4.4862559	Node	56.03032	+0.77023978	-0.37703832
e	0.3347393	Incl.	14.63058	+0.55538615	+0.00009872
P	9.50				

From 240 observations 1999 Dec. 12–2019 Jan. 20, mean residual 0".71.

## Comet 373P/Rinner

Epoch 2019 Apr. 7.0 TT = JDT 2458580.5

T 2019 Apr. 9.16379 TT

		(2000.0)	P	Sato	Q
q	2.3134752				
n	0.13262447	Peri.	221.21673	-0.04050838	-0.98146714
a	3.8082045	Node	231.95892	+0.96771742	+0.00813214
e	0.3925024	Incl.	13.75794	+0.24876106	-0.19145786
P	7.43				

From 714 observations 2011 Nov. 28–2019 Jan. 4, mean residual 0".67.

Nongravitational parameters Y1 = -2.31 Y2 = +0.0661.

## Comet P/2014 C1 (TOTAS)

Epoch 2019 Apr. 27.0 TT = JDT 2458600.5

T 2019 Apr. 13.74689 TT

		(2000.0)	P	Sato	Q
q	1.6845398				
n	0.18563077	Peri.	24.15186	-0.97804386	+0.20816653
a	3.0434727	Node	167.85075	-0.19800706	-0.91350512
e	0.4465073	Incl.	2.68089	-0.06498777	-0.34953553
P	5.31				

From 49 observations 2014 Feb. 1–May 8, mean residual 0".54.

## Comet P/2017 U3 (PANSTARRS)

Epoch 2019 Apr. 27.0 TT = JDT 2458600.5

T 2019 Apr. 20.96710 TT

		(2000.0)	P	Sato	Q
q	4.4447464				
n	0.08992874	Peri.	297.35959	-0.22488839	-0.97184006
a	4.9340518	Node	165.12374	+0.96246491	-0.23281919
e	0.0991691	Incl.	15.90859	+0.15194247	+0.03636087
P	10.96				

From 59 observations 2016 Oct. 30–2017 Nov. 22, mean residual 0".53.

## Comet C/2016 X1 (Lemmon)

Epoch 2019 Apr. 27.0 TT = JDT 2458600.5

T 2019 Apr. 29.73713 TT

		(2000.0)	P	Sato	Q
q	7.5642714				
z	+0.0005813	Peri.	224.55735	-0.44337594	-0.78477496
	+/-0.0000028	Node	256.42670	+0.89508296	-0.36211359
e	0.9956030	Incl.	26.45589	+0.04737368	-0.50299305

From 124 observations 2016 Nov. 26–2019 Jan. 6, mean residual 0".54.

## Comet 186P/Garradd

Epoch 2019 Apr. 27.0 TT = JDT 2458600.5

T 2019 May 4.96057 TT

		(2000.0)	P	Sato	Q
q	4.3894636				
n	0.08790509	Peri.	283.79930	-0.26416171	+0.92915121
a	5.0094884	Node	327.06892	-0.59295487	-0.36795846
e	0.1237701	Incl.	28.40962	-0.76067280	-0.03584118
P	11.21				

From 280 observations 1975 May 31–2018 Sept. 7, mean residual 0".64.

## Comet P/2012 O2 (McNaught)

Epoch 2019 Apr. 27.0 TT = JDT 2458600.5

T 2019 May 6.03131 TT

		(2000.0)	P	Sato	Q
q	1.6917077				
n	0.14301634	Peri.	183.34564	+0.55508837	+0.75154916
a	3.6214203	Node	120.68264	-0.75320958	+0.63597498
e	0.5328607	Incl.	24.48556	-0.35291958	-0.17524177
P	6.89				

From 81 observations 2012 May 20–Sept. 21, mean residual 0".38.

From CHB 2018.

## Comet C/2018 W1 (Catalina)

Epoch 2019 Apr. 27.0 TT = JDT 2458600.5

T 2019 May 11.85522 TT

		(2000.0)	P	Sato	Q
q	1.3601527				
n	0.00968971	Peri.	251.24997	+0.10158415	-0.59234566
a	21.7902548	Node	233.58974	+0.67178865	-0.55171808
e	0.9375798	Incl.	83.27740	-0.73374428	-0.58714034
P	101.72				

From 158 observations 2018 Nov. 16–2019 Jan. 27, mean residual 0".35.

## Comet 222P/LINEAR

Epoch 2019 June 6.0 TT = JDT 2458640.5

T 2019 June 5.05081 TT

		(2000.0)	P	Sato	Q
q	0.8283602				
n	0.19968845	Peri.	346.21742	+0.99249744	+0.12181093
a	2.8989057	Node	6.81222	-0.10207004	+0.87290330
e	0.7142507	Incl.	5.09418	-0.06730928	+0.47244251
P	4.94				

From 218 observations 2004 Dec. 7–2015 Jan. 27, mean residual 0".68.

## Comet C/2018 R3 (Lemmon)

Epoch 2019 June 6.0 TT = JDT 2458640.5

T 2019 June 7.25711 TT

		(2000.0)	P	Sato	Q
q	1.2909604				
z	+0.0005843	Peri.	112.87172	-0.13211005	-0.82923959
	+/-0.0000300	Node	324.62591	+0.10145519	+0.53366769
e	0.9992457	Incl.	69.72834	+0.98602930	-0.16601357

From 95 observations 2018 Aug. 8–Nov. 11, mean residual 0".53.

## Comet 209P/LINEAR

Epoch 2019 June 6.0 TT = JDT 2458640.5

T 2019 June 12.80658 TT

		(2000.0)	P	Sato	Q
q	0.9675041				
n	0.19341564	Peri.	152.50046	-0.78848298	+0.52378722
a	2.9612494	Node	62.77142	-0.60959071	-0.59578451
e	0.6732784	Incl.	21.25857	-0.08181542	-0.60884133
P	5.10				

From 2520 observations 2003 Dec. 3–2018 Dec. 28, mean residual 0".46.

## Comet 231P/LINEAR-NEAT

Epoch 2019 June 6.0 TT = JDT 2458640.5

T 2019 June 14.25350 TT

		(2000.0)	P	Sato	Q
q	3.0224813				
n	0.12241825	Peri.	42.75102	-0.98583634	-0.06118611
a	4.0170318	Node	133.02958	+0.01963492	-0.96677845
e	0.2475834	Incl.	12.33409	+0.16655681	-0.24818481
P	8.05				

From 304 observations 1950 Apr. 20–2019 Jan. 9, mean residual 0".70.

Nongravitational parameters A1 = +11.06, A2 = -0.6038.

## Comet P/2000 R2 (LINEAR)

Epoch 2019 June 6.0 TT = JDT 2458640.5

T 2019 June 15.58176 TT

		(2000.0)	P	Sato	Q
q	1.6250650				
n	0.15282088	Peri.	176.57127	+0.91973658	+0.38651439
a	3.4648218	Node	160.25516	-0.36479621	+0.90605687
e	0.5309816	Incl.	11.69735	-0.14494260	+0.17224277
P	6.45				

From 54 observations 2000 Sept. 3–Nov. 29, mean residual 0".64.

From CHB 2018.

## Comet 261P/Larson

Epoch 2019 June 6.0 TT = JDT 2458640.5

T 2019 June 18.65011 TT

		(2000.0)	P	Sato	Q
q	2.0134038				
n	0.15131039	Peri.	67.10740	+0.99472049	+0.02807399
a	3.4878427	Node	291.16706	-0.06812923	+0.89996340
e	0.4227366	Incl.	6.07603	+0.07674343	+0.43506060
P	6.51				

From 496 observations 2005 July 3–2013 Jan. 6, mean residual 0".68.

## Comet P/1999 R028 (LONEOS)

Epoch 2019 July 16.0 TT = JDT 2458680.5

T 2019 June 30.87941 TT

		(2000.0)	P	Sato	Q
q	1.1233564				
n	0.15535464	Peri.	232.07608	+0.98266715	-0.16252256
a	3.4270457	Node	137.06810	+0.18232428	+0.93427568
e	0.6722085	Incl.	7.52266	-0.03351295	+0.31735686
P	6.34				

From 109 observations 1999 Sept. 7–Nov. 13, mean residual 0".73.

From CHB 2018.

## Comet 31P/Schwassmann–Wachmann

Epoch 2019 July 16.0 TT = JDT 2458680.5

T 2019 July 6.12942 TT

		(2000.0)	P	Sato	Q
q	3.4253862				
n	0.11272796	Peri.	18.35269	-0.67422988	-0.73496794
a	4.2440611	Node	114.11191	+0.66726375	-0.64823529
e	0.1928989	Incl.	4.54711	+0.31650143	-0.19903050
P	8.74				

From 731 observations 1994 Mar. 30–2018 Dec. 12, mean residual 0".76.

Nongravitational parameters Y1 = +0.14, Y2 = -0.0157.

## Comet C/2018 X2 (Fitzsimmons)

Epoch 2019 July 16.0 TT = JDT 2458680.5

T 2019 July 8.50269 TT

		(2000.0)	P	Sato	Q
q	2.1267767				
z	+0.0070879	Peri.	162.00407	-0.80511041	-0.57901971
	+/-0.0008275	Node	340.84091	+0.48458093	-0.51712047
e	0.9849256	Incl.	23.06590	+0.34202126	-0.63033531

From 88 observations 2018 Dec. 8–24, mean residual 0".50.

## Comet C/2018 A6 (Gibbs)

Epoch 2019 July 16.0 TT = JDT 2458680.5

T 2019 July 14.26417 TT

		(2000.0)	P	Sato	Q
q	3.0177815				
n	0.01637514	Peri.	264.52695	-0.16526773	+0.93045469
a	15.3583996	Node	340.38605	+0.22093121	-0.28822338
e	0.8035094	Incl.	76.95479	-0.96118467	-0.22623298
P	60.19				

From 208 observations 2018 Jan. 15–2019 Jan. 20, mean residual 0".47.

## Comet P/2007 T4 (Gibbs)

Epoch 2019 July 16.0 TT = JDT 2458680.5

T 2019 July 23.65264 TT

		(2000.0)	P	Sato	Q
q	2.0050243				
n	0.08193580	Peri.	42.42394	+0.21727170	-0.94518569
a	5.2499310	Node	37.05887	+0.75131903	+0.00251523
e	0.6180856	Incl.	23.85877	+0.62314743	+0.32652363
P	12.03				

From 64 observations 2007 Oct. 12–2008 Apr. 25, mean residual 0".70.

## Comet 200P/Larsen

Epoch 2019 July 16.0 TT = JDT 2458680.5

T 2019 July 28.49002 TT

		(2000.0)	P	Sato	Q
q	3.2972244				
n	0.08993064	Peri.	133.97692	+0.97520736	-0.14000808
a	4.9339823	Node	234.80221	+0.08846377	+0.95649115
e	0.3317316	Incl.	12.10563	+0.20284171	+0.25597348
P	10.96				

From 540 observations 1997 Nov. 3–2018 Aug. 12, mean residual 0".62.

## Comet P/2006 F4 (Spacewatch)

Epoch 2019 July 16.0 TT = JDT 2458680.5

T 2019 Aug. 3.06623 TT

		(2000.0)	P	Sato	Q
q	2.3338882				
n	0.14885388	Peri.	31.16914	-0.81797061	+0.57506206
a	3.5261107	Node	184.03305	-0.56203511	-0.80448322
e	0.3381126	Incl.	12.38922	-0.12264014	-0.14869559
P	6.62				

From 46 observations 2006 Mar. 26–May 31, mean residual 0".68.

From CHB 2018.

## Comet 264P/Larsen

Epoch 2019 July 16.0 TT = JDT 2458680.5

T 2019 Aug. 4.96895 TT

		(2000.0)	P	Sato	Q
q	2.4384566				
n	0.12827456	Peri.	346.63329	-0.87236840	+0.40191243
a	3.8938183	Node	220.90284	-0.40027529	-0.91406192
e	0.3737621	Incl.	25.15059	-0.28062975	+0.05438018
P	7.68				

From 99 observations 2004 Apr. 22–2012 July 18, mean residual 0".64.

## Comet 163P/NEAT

Epoch 2019 Aug. 25.0 TT = JDT 2458720.5

T 2019 Aug. 5.23510 TT

		(2000.0)	P	Sato	Q
q	2.0666232				
n	0.13458078	Peri.	349.69926	-0.03553740	-0.97594586
a	3.7712097	Node	102.09178	+0.93183870	-0.11013534
e	0.4519999	Incl.	12.70772	+0.36112842	+0.18814856
P	7.32				

From 329 observations 1990 Oct. 24–2012 Jan. 20, mean residual 0".67.

## Comet 168P/Hergenrother

Epoch 2019 Aug. 25.0 TT = JDT 2458720.5

T 2019 Aug. 5.57650 TT

		(2000.0)	P	Sato	Q
q	1.3588544				
n	0.14545200	Peri.	14.99444	+0.98193453	-0.18697073
a	3.5808785	Node	355.46893	+0.11208524	+0.69861590
e	0.6205249	Incl.	21.61035	+0.15245153	+0.69063577
P	6.78				

From 3072 observations 2005 July 4–2013 Feb. 8, mean residual 0".77.

Nongravitational parameters A1 = +3.66, A2 = +1.1336.



Comet P/2012 K3 (Gibbs)

Epoch 2019 Aug. 25.0 TT = JDT 2458720.5

T 2019 Aug. 17.42496 TT

	(2000.0)	P	Sato	Q
q	2.0891020			
n	0.14280036	Peri. 172.11364	+0.47123048	+0.86236836
a	3.6250710	Node 125.80992	-0.82117568	+0.50554783
e	0.4237073	Incl. 13.19403	-0.32188871	-0.02724335
P	6.90			

From 136 observations 2012 May 21–Sept. 9, mean residual 0".56.

Comet 25D/Neujmin

Epoch 2019 Aug. 25.0 TT = JDT 2458720.5

T 2019 Aug. 18.21547 TT

	(2000.0)	P	Sato	Q
q	1.2909413			
n	0.18149772	Peri. 215.22784	-0.95318329	-0.29332575
a	3.0895028	Node 307.54779	+0.29433805	-0.84424803
e	0.5821524	Incl. 5.31888	+0.06933061	-0.44855910
P	5.43			

From 56 observations 1916 Mar. 4–1927 Feb. 10, mean residual 1".69.

Comet C/2018 W2 (Africano)

Epoch 2019 Aug. 25.0 TT = JDT 2458720.5

T 2019 Sept. 5.77426 TT

	(2000.0)	P	Sato	Q
q	1.4540716			
z	-0.0001894	Peri. 158.00613	+0.92132606	+0.38771875
+/-	-0.0001255	Node 181.84939	+0.04813344	-0.04010902
e	1.0002754	Incl. 116.61685	+0.38579976	-0.92090468

From 100 observations 2018 Nov. 27–2019 Jan. 14, mean residual 0".50.

Comet C/2018 KJ3 (Lemmon)

Epoch 2019 Aug. 25.0 TT = JDT 2458720.5

T 2019 Sept. 9.52139 TT

	(2000.0)	P	Sato	Q
q	3.6283385			
z	+0.0012289	Peri. 217.62988	-0.42218933	-0.59321567
+/-	-0.0000189	Node 91.59480	-0.57114672	+0.76126201
e	0.9955413	Incl. 136.70753	-0.70395141	-0.26186889

From 156 observations 2018 May 17–Oct. 8, mean residual 0".43.

Comet 260P/McNaught

Epoch 2019 Aug. 25.0 TT = JDT 2458720.5

T 2019 Sept. 9.95940 TT

	(2000.0)	P	Sato	Q
q	1.4167218			
n	0.14302584	Peri. 18.38922	+0.98887885	-0.14077463
a	3.6212600	Node 349.35555	+0.08129162	+0.78172769
e	0.6087766	Incl. 15.05224	+0.12454035	+0.60752311
P	6.89			

From 3333 observations 2005 May 20–2013 Mar. 4, mean residual 0".47.

Comet P/2008 Y1 (Boattini)

Epoch 2019 Aug. 25.0 TT = JDT 2458720.5

T 2019 Sept. 10.64727 TT

	(2000.0)	P	Sato	Q
q	1.2678134			
n	0.09354592	Peri. 162.80752	+0.46373943	-0.87277377
a	4.8060265	Node 259.33646	+0.79354713	+0.48564624
e	0.7362034	Incl. 8.91860	+0.39399073	+0.04912916
P	10.54			

From 160 observations 2008 Dec. 22–2009 Apr. 13, mean residual 0".63.

Comet P/2010 U2 (Hill)

Epoch 2019 Oct. 4.0 TT = JDT 2458760.5

T 2019 Sept. 15.24748 TT

	(2000.0)	P	Sato	Q
q	2.5676536			
n	0.11103801	Peri. 44.32861	+0.74847948	-0.66299406
a	4.2870144	Node 357.08073	+0.49897836	+0.57768053
e	0.4010625	Incl. 16.82668	+0.43680552	+0.47615553
P	8.88			

From 271 observations 2010 Oct. 1–2011 Mar. 7, mean residual 0".62.

Comet P/2000 S4 (LINEAR-Spacewatch)  
Epoch 2019 Oct. 4.0 TT = JDT 2458760.5

T 2019 Sept. 21.18299 TT		Sato	
	(2000.0)	P	Q
q	2.2653969		
n	0.05201524	Peri. 173.08328	+0.97548256
a	7.1074800	Node 173.80266	+0.21773558
e	0.6812658	Incl. 28.37769	-0.03201559

P 18.95  
From 35 observations 2000 Sept. 1–Nov. 21, mean residual 0".70.  
From CHB 2018.

Comet P/2005 GF8 = 2018 X1 (LONEOS)  
Epoch 2019 Oct. 4.0 TT = JDT 2458760.5

T 2019 Sept. 29.17223 TT		Sato	
	(2000.0)	P	Q
q	2.8309540		
n	0.06943164	Peri. 285.38996	-0.49565750
a	5.8627013	Node 314.88717	-0.78865696
e	0.5171246	Incl. 1.19230	-0.36379093

P 14.20  
From 219 observations 2005 Apr. 2–2018 Dec. 6, mean residual 0".61.

Comet 175P/Hergenrother  
Epoch 2019 Oct. 4.0 TT = JDT 2458760.5

T 2019 Sept. 30.78929 TT		Sato	
	(2000.0)	P	Q
q	1.9463076		
n	0.15534763	Peri. 56.19157	-0.99609598
a	3.4271488	Node 123.53348	-0.02822203
e	0.4320913	Incl. 6.07731	+0.08364402

P 6.34  
From 799 observations 2000 Jan. 4–2019 Jan. 11, mean residual 0".62.  
Nongravitational parameters A1 = +0.68, A2 = +0.0109.

Comet P/2014 U2 (Kowalski)  
Epoch 2019 Oct. 4.0 TT = JDT 2458760.5

T 2019 Oct. 11.52518 TT		Sato	
	(2000.0)	P	Q
q	1.1163376		
n	0.19935098	Peri. 37.64574	+0.84867231
a	2.9021763	Node 354.23306	+0.44925770
e	0.6153447	Incl. 7.28103	+0.27914662

P 4.94  
From 160 observations 2014 Oct. 18–2015 Jan. 18, mean residual 0".59.

Comet P/2009 SK280 (Spacewatch-Hill)  
Epoch 2019 Oct. 4.0 TT = JDT 2458760.5

T 2019 Oct. 23.96850 TT		Sato	
	(2000.0)	P	Q
q	4.2087510		
n	0.09426334	Peri. 327.96216	+0.98363892
a	4.7816102	Node 36.41850	+0.14777834
e	0.1198047	Incl. 16.79881	-0.10303414

P 10.46  
From 88 observations 2009 Sept. 17–2011 Dec. 23, mean residual 0".52.  
From CHB 2018.

Comet P/2006 S1 (Christensen)  
Epoch 2019 Nov. 13.0 TT = JDT 2458800.5

T 2019 Oct. 25.49862 TT		Sato	
	(2000.0)	P	Q
q	1.4191975		
n	0.14781888	Peri. 133.62467	+0.94058859
a	3.5425511	Node 207.88738	-0.33886844
e	0.5993855	Incl. 12.32367	+0.02147763

P 6.67  
From 304 observations 2006 Aug. 23–Dec. 16, mean residual 0".60.  
From CHB 2018.

## Comet 76P/West-Kohoutek-Ikemura

Epoch 2019 Nov. 13.0 TT = JDT 2458800.5

T 2019 Oct. 26.13976 TT

	(2000.0)	P	Sato	Q
q	1.6048040			
n	0.15213560	Peri. 0.02187	+0.10202885	-0.85752104
a	3.4752188	Node 84.12513	+0.91261714	-0.12102723
e	0.5382150	Incl. 30.45704	+0.39587885	+0.50001007
P	6.48			

From 611 observations 1993 July 20–2013 Mar. 1, mean residual 0".77.

Nongravitational parameters A1 = -0.37, A2 = -0.1763.

From CHB 2017.

## Comet 68P/Klemola

Epoch 2019 Nov. 13.0 TT = JDT 2458800.5

T 2019 Nov. 9.03916 TT

	(2000.0)	P	Sato	Q
q	1.7938519			
n	0.08952461	Peri. 153.05842	+0.85007539	+0.52640187
a	4.9488897	Node 175.08233	-0.51124634	+0.83232207
e	0.6375244	Incl. 11.11085	-0.12648720	+0.17361177
P	11.01			

From 515 observations 1976 Aug. 10–2010 Jan. 15, mean residual 0".72.

Nongravitational parameters A1 = -0.01, A2 = -0.0065.

## Comet C/2018 N2 (ASASSN)

Epoch 2019 Nov. 13.0 TT = JDT 2458800.5

T 2019 Nov. 10.94661 TT

	(2000.0)	P	Sato	Q
q	3.1245484			
z	-0.0000907	Peri. 24.39636	+0.78558152	-0.45745339
	+/-0.0000093	Node 25.25923	+0.27011321	-0.35227994
e	1.0002834	Incl. 77.53196	+0.55668710	+0.81647733

From 177 observations 2018 July 10–2019 Jan. 6, mean residual 0".54.

## Comet P/2003 F2 (NEAT)

Epoch 2019 Nov. 13.0 TT = JDT 2458800.5

T 2019 Nov. 11.96964 TT

	(2000.0)	P	Sato	Q
q	2.9699870			
n	0.05969567	Peri. 191.82456	-0.98184006	+0.18968374
a	6.4839676	Node 359.09124	-0.15349837	-0.80419639
e	0.5419491	Incl. 11.60601	-0.11148252	-0.56328345
P	16.51			

From 74 observations 2003 Mar. 27–May 28, mean residual 0".64.

From CHB 2018.

## Comet 155P/Shoemaker

Epoch 2019 Nov. 13.0 TT = JDT 2458800.5

T 2019 Nov. 15.19736 TT

	(2000.0)	P	Sato	Q
q	1.8018468			
n	0.05825667	Peri. 14.66660	-0.37084873	-0.92209354
a	6.5903066	Node 97.19787	+0.84044693	-0.38385711
e	0.7265914	Incl. 6.39592	+0.39512045	-0.04896151
P	16.92			

From 882 observations 1986 Jan. 10–2003 May 23, mean residual 0".69.

## Comet 215P/NEAT

Epoch 2019 Nov. 13.0 TT = JDT 2458800.5

T 2019 Nov. 18.00888 TT

	(2000.0)	P	Sato	Q
q	3.6047289			
n	0.10939016	Peri. 262.02381	+0.73737551	+0.65781861
a	4.3299598	Node 56.69229	-0.52452393	+0.70076600
e	0.1674914	Incl. 10.58134	-0.42561954	+0.27604654
P	9.01			

From 287 observations 1994 Oct. 10–2018 June 20, mean residual 0".65.

## Comet 294P/LINEAR

Epoch 2019 Nov. 13.0 TT = JDT 2458800.5

T 2019 Nov. 29.72334 TT

		(2000.0)	P	Sato	Q
q	1.3005085				
n	0.17180975	Peri.	235.53096	-0.95954059	+0.16228763
a	3.2045780	Node	312.59856	-0.00157883	-0.82027977
e	0.5941717	Incl.	18.21498	-0.28156593	-0.54845586
P	5.74				

From 211 observations 2008 Jan. 13–2014 July 3, mean residual 0".53.

## Comet P/2013 T2 (Schwartz)

Epoch 2019 Nov. 13.0 TT = JDT 2458800.5

T 2019 Nov. 30.52533 TT

		(2000.0)	P	Sato	Q
q	1.7403342				
n	0.15130456	Peri.	345.44678	+0.97137592	+0.23753577
a	3.4879322	Node	0.82322	-0.19820809	+0.81594645
e	0.5010413	Incl.	9.45589	-0.13092886	+0.52707508
P	6.51				

From 118 observations 2013 Sept. 14–Dec. 11, mean residual 0".53.

From CHB 2018.

## Comet 160P/LINEAR

Epoch 2019 Nov. 13.0 TT = JDT 2458800.5

T 2019 Dec. 2.33658 TT

		(2000.0)	P	Sato	Q
q	1.7873755				
n	0.13455760	Peri.	12.64846	+0.96674512	+0.22548954
a	3.7716429	Node	333.36862	-0.25176730	+0.75628509
e	0.5261016	Incl.	15.61526	-0.04491215	+0.61415579
P	7.32				

From 661 observations 1996 Sept. 8–2012 Dec. 12, mean residual 0".66.

## Comet C/2018 F4 (PANSTARRS)

Epoch 2019 Dec. 23.0 TT = JDT 2458840.5

T 2019 Dec. 4.09465 TT

		(2000.0)	P	Sato	Q
q	3.4398355				
z	-0.0004316	Peri.	263.21250	-0.01436350	+0.89948295
+/-	-0.0000063	Node	26.50745	+0.16996489	+0.43260492
e	1.0014845	Incl.	78.09832	-0.98534544	+0.06150932

From 184 observations 2018 Mar. 17–2019 Jan. 3, mean residual 0".52.

## Comet P/2006 H1 (McNaught)

Epoch 2019 Nov. 13.0 TT = JDT 2458800.5

T 2019 Dec. 7.45661 TT

		(2000.0)	P	Sato	Q
q	2.4226573				
n	0.07100440	Peri.	309.27580	+0.63170270	+0.77521065
a	5.7758053	Node	359.89751	-0.62536978	+0.50929823
e	0.5805507	Incl.	12.80357	-0.45810953	+0.37371616
P	13.88				

From 213 observations 2006 Apr. 29–Nov. 26, mean residual 0".58.

From CHB 2018.

## Comet 289P/Blanpain

Epoch 2019 Dec. 23.0 TT = JDT 2458840.5

T 2019 Dec. 20.98729 TT

		(2000.0)	P	Sato	Q
q	0.9588892				
n	0.18531825	Peri.	9.84352	+0.19563253	-0.97597925
a	3.0468934	Node	68.92413	+0.89262209	+0.13672400
e	0.6852895	Incl.	5.89758	+0.40614495	+0.16962029
P	5.32				

From 294 observations 2003 Oct. 25–2013 July 9, mean residual 0".74.

Nongravitational parameters A1 = +0.08, A2 = -0.0014.

## Comet P/2006 R1 (Siding Spring)

Epoch 2019 Dec. 23.0 TT = JDT 2458840.5

T 2019 Dec. 22.44954 TT

		(2000.0)	P	Sato	Q
q	1.6632699				
n	0.07392845	Peri.	249.29566	+0.82684704	-0.52021756
a	5.6224852	Node	218.83558	-0.29822133	-0.72777848
e	0.7041753	Incl.	160.06868	-0.47685220	-0.44689168
P	13.33				

From 52 observations 2006 Sept. 1–26, mean residual 0".47.

## Minor Planet (6478) Gault

Epoch 2019 Dec. 23.0 TT = JDT 2458840.5

T 2020 Jan. 2.79818 TT

		(2000.0)	P	Sato	Q
q	1.8589098				
n	0.28152833	Peri.	83.24431	-0.06070510	+0.99786683
a	2.3056213	Node	183.55150	-0.99806957	-0.06099841
e	0.1937489	Incl.	22.80945	-0.01311552	+0.02325920
P	3.50				

From 1278 observations 1988 May 12–2019 Jan. 18, mean residual 0".43.

## Comet 101P/Chernykh

Epoch 2020 Feb. 1.0 TT = JDT 2458880.5

T 2020 Jan. 16.51612 TT

		(2000.0)	P	Sato	Q
q	2.3459484				
n	0.0705531	Peri.	277.87402	+0.82624230	-0.55773022
a	5.8002883	Node	116.05797	+0.54529960	+0.75665043
e	0.5955462	Incl.	5.05301	+0.14132234	+0.34119955
P	13.97				

From 515 observations 2005 July 10–2007 Feb. 13, mean residual 0".64.

Nongravitational parameters A1 = +11.27, A2 = +5.1786.

## Comet C/2017 T2 (PANSTARRS)

Epoch 2020 Apr. 21.0 TT = JDT 2458960.5

T 2020 May 4.96594 TT

		(2000.0)	P	Sato	Q
q	1.6151615				
z	+0.0002299	Peri.	92.99384	-0.50994557	-0.40635984
+/-	-0.0000033	Node	64.37756	-0.16277456	-0.81987736
e	0.9996287	Incl.	57.23117	+0.84466559	-0.40332716

From 412 observations 2017 Sept. 15–2019 Jan. 10, mean residual 0".40.

## Comet 246P/NEAT

Epoch 2021 Mar. 7.0 TT = JDT 2459280.5

T 2021 Feb. 22.81669 TT

		(2000.0)	P	Sato	Q
q	2.8639227				
n	0.12245324	Peri.	176.29994	-0.25557269	+0.92828714
a	4.0162665	Node	78.74742	-0.89393233	-0.12049381
e	0.2869192	Incl.	15.98680	-0.36819503	-0.35180139
P	8.05				

From 2858 observations 2003 Jan. 24–2016 Mar. 6, mean residual 0".58.

## Comet C/2018 U1 (Lemmon)

Epoch 2021 Nov. 2.0 TT = JDT 2459520.5

T 2021 Nov. 3.79529 TT

		(2000.0)	P	Sato	Q
q	4.9896741				
z	+0.0000323	Peri.	180.52447	-0.25396211	-0.30163919
+/-	-0.0000780	Node	75.45204	-0.88390889	+0.45813616
e	0.9998386	Incl.	108.30163	-0.39269367	-0.83613699

From 163 observations 2018 Oct. 27–2019 Jan. 3, mean residual 0".37.

## Comet C/2017 K2 (PANSTARRS)

Epoch 2022 Dec. 7.0 TT = JDT 2459920.5

T 2022 Dec. 19.66511 TT

		(2000.0)	P	Sato	Q
q	1.7969644				
z	-0.0004774	Peri.	236.19641	+0.01818348	+0.04923201
+/-	-0.0000031	Node	88.23541	-0.18096130	+0.98245377
e	1.0008578	Incl.	87.56306	-0.98332211	-0.17989110

From 1043 observations 2013 May 12–2019 Jan. 6, mean residual 0".54

References:

Comet C/2018 R5 (Lemmon)

Epoch 2018 Dec. 28.0 TT = JDT 2458480.5

T 2019 Jan. 9.99398 TT

		(2000.0)	P	Sato	Q
q	3.6212242				
n	0.00901629	Peri.	178.01466	+0.98874818	-0.00236551
a	22.8621691	Node	171.14189	-0.14711344	+0.16579597
e	0.8416063	Incl.	103.75665	-0.02710492	-0.98615724
P	109.31				

From 159 observations 2018 July 5–Nov. 13, mean residual 0".49.

Comet P/2006 W1 (Gibbs)

Epoch 2020 Mar. 12.0 TT = JDT 2458920.5

T 2020 Mar. 31.77111 TT

		(2000.0)	P	Sato	Q
q	1.6993566				
n	0.07049605	Peri.	232.38153	+0.88976687	-0.43170762
a	5.8035385	Node	152.25973	+0.44936146	+0.88543339
e	0.7071861	Incl.	18.55703	-0.07993241	+0.17215181
P	13.98				

From 105 observations 2006 Nov. 16–2007 Feb. 17, mean residual 0".68.

Comet P/2004 WR9 (LINEAR)

Epoch 2020 Apr. 21.0 TT = JDT 2458960.5

T 2020 Apr. 1.65197 TT

		(2000.0)	P	Sato	Q
q	1.9502586				
n	0.06460962	Peri.	71.99918	-0.11841690	-0.99230531
a	6.1508896	Node	24.88699	+0.87542915	-0.12151745
e	0.6829306	Incl.	4.92935	+0.46861630	-0.02374182
P	15.25				

From 139 observations 2004 Dec. 15–2005 Mar. 30, mean residual 0".57.

Comet P/2005 T2 (Christensen)

Epoch 2020 Apr. 21.0 TT = JDT 2458960.5

T 2020 Apr. 8.53554 TT

		(2000.0)	P	Sato	Q
q	2.2442578				
n	0.13060767	Peri.	58.79992	+0.74542894	+0.65126025
a	3.8473077	Node	260.15921	-0.65008849	+0.66313147
e	0.4166680	Incl.	8.29293	-0.14737926	+0.36894002
P	7.55				

From 69 observations 2005 Oct. 7–Nov. 25, mean residual 0".62.

Comet 124P/Mrkos

Epoch 2020 Apr. 21.0 TT = JDT 2458960.5

T 2020 Apr. 26.88955 TT

		(2000.0)	P	Sato	Q
q	1.6475222				
n	0.16307524	Peri.	183.85533	-0.99734508	+0.07274162
a	3.3180075	Node	0.37085	-0.04453582	-0.57254594
e	0.5034604	Incl.	31.51280	-0.05761380	-0.81663933
P	6.04				

From 1927 observations 1991 Mar. 15–2014 July 13, mean residual 0".55.

Comet P/2012 SB6 (Lemmon)

Epoch 2020 May 31.0 TT = JDT 2459000.5

T 2020 June 19.41307 TT

		(2000.0)	P	Sato	Q
q	2.2768248				
n	0.13174176	Peri.	14.39214	+0.92384083	-0.38181827
a	3.8251964	Node	8.20981	+0.32977495	+0.75801799
e	0.4047822	Incl.	10.92868	+0.19433633	+0.52879441
P	7.48				

From 184 observations 2012 Sept. 14–2013 Feb. 6, mean residual 0".59.

## Comet P/2003 L1 (Scotti)

Epoch 2020 July 10.0 TT = JDT 2459040.5

T 2020 July 11.46753 TT

		(2000.0)	P	Sato	Q
q	5.0165608				
n	0.05666188	Peri.	355.00091	-0.75324017	+0.64798114
a	6.7133931	Node	226.05959	-0.59790405	-0.74608921
e	0.2527533	Incl.	9.02191	-0.27411674	-0.15320357
P	17.39				

From 69 observations 2002 Apr. 5–2003 June 20, mean residual 0".43.

## Comet P/2007 R2 (Gibbs)

Epoch 2020 Sept. 28.0 TT = JDT 2459120.5

T 2020 Sept. 15.61762 TT

		(2000.0)	P	Sato	Q
q	1.6371748				
n	0.14591963	Peri.	352.35024	+0.99775516	-0.06683465
a	3.5732240	Node	11.48450	+0.06250778	+0.90688343
e	0.5418214	Incl.	1.21287	+0.02402932	+0.41604757
P	6.75				

From 161 observations 2007 Sept. 10–Dec. 1, mean residual 0".71.

## Comet P/2007 VQ11 (Catalina)

Epoch 2020 Sept. 28.0 TT = JDT 2459120.5

T 2020 Sept. 18.07816 TT

		(2000.0)	P	Sato	Q
q	2.6953448				
n	0.07796326	Peri.	277.67753	+0.14156877	-0.98814025
a	5.4267863	Node	163.81547	+0.97139211	+0.12709510
e	0.5033258	Incl.	12.32007	+0.19067160	+0.08617235
P	12.64				

From 71 observations 2007 Nov. 3–2008 Mar. 27, mean residual 0".71.

## Comet P/2005 Y2 (McNaught)

Epoch 2020 Nov. 7.0 TT = JDT 2459160.5

T 2020 Oct. 20.83639 TT

		(2000.0)	P	Sato	Q
q	3.3808651				
n	0.06112710	Peri.	194.04843	+0.30500496	+0.89476247
a	6.3823438	Node	94.51305	-0.83913164	+0.41444584
e	0.4702784	Incl.	19.09660	-0.45036659	-0.16623710
P	16.12				

From 153 observations 2003 May 30–2009 Dec. 11, mean residual 0".69.

## Comet P/2009 WX51 (Catalina)

Epoch 2020 Nov. 7.0 TT = JDT 2459160.5

T 2020 Nov. 16.41099 TT

		(2000.0)	P	Sato	Q
q	0.7999980				
n	0.18235015	Peri.	118.06449	-0.85735516	-0.50722412
a	3.0798670	Node	31.68598	+0.39405074	-0.75622487
e	0.7402492	Incl.	9.59526	+0.33115879	-0.41333720
P	5.41				

From 113 observations 2009 Nov. 22–2010 Apr. 17, mean residual 0".45.

## Comet P/2007 Q2 (Gilmore)

Epoch 2020 Dec. 17.0 TT = JDT 2459200.5

T 2020 Nov. 27.39010 TT

		(2000.0)	P	Sato	Q
q	1.8646519				
n	0.07329010	Peri.	162.77510	+0.90646760	+0.42158355
a	5.6550857	Node	172.16005	-0.40529405	+0.88465268
e	0.6702699	Incl.	10.20270	-0.11854627	+0.19914053
P	13.45				

From 145 observations 2007 Aug. 22–Oct. 15, mean residual 0".51.

Comet P/2010 B2 (WISE)

Epoch 2020 Dec. 17.0 TT = JDT 2459200.5

T 2020 Dec. 4.56169 TT

	(2000.0)		P	Sato	Q
q	1.6175044				
n	0.17971596	Peri.	155.91882	-0.91883279	-0.39464038
a	3.1098895	Node	0.84785	+0.33219122	-0.77654998
e	0.4798836	Incl.	8.93065	+0.21306173	-0.49115078
P	5.48				

From 48 observations 2010 Jan. 22-Apr. 7, mean residual 0".48.

Comet P/2013 TL117 (Lemmon)

Epoch 2020 Dec. 17.0 TT = JDT 2459200.5

T 2020 Dec. 24.29944 TT

	(2000.0)		P	Sato	Q
q	1.1218996				
n	0.14367931	Peri.	112.24928	-0.43077628	-0.90240976
a	3.6102717	Node	3.31282	+0.75647441	-0.36675467
e	0.6892479	Incl.	9.36448	+0.49211610	-0.22615841
P	6.86				

From 327 observations 2013 Oct. 4-2014 Jan. 29, mean residual 0".42.

Comet P/2009 Q4 (Boattini)

Epoch 2020 Dec. 17.0 TT = JDT 2459200.5

T 2020 Dec. 26.96535 TT

	(2000.0)		P	Sato	Q
q	1.3056743				
n	0.17814219	Peri.	320.23609	+0.03078325	-0.98795280
a	3.1281784	Node	127.46360	+0.95878075	-0.01369508
e	0.5826087	Incl.	11.01546	+0.28247454	+0.15414832
P	5.53				

From 765 observations 2009 Aug. 26-2010 May 28, mean residual 0".60.

Remarks.

Non-gravitational parameters Y1 and Y2 indicate that the Yabushita-style non-gravitational effect based on CO sublimation is taken into account (MN 283, 347).



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