Comet Prospects for 2021

There is a prospect of a moderately bright comet at the end of the year. 67P/Churyumov-Gerasimenko could be the only one of the returning periodic comets that receives any attention from European visual observers.

These predictions focus on comets that are likely to be within range of visual observers, though comets often do not behave as expected and can spring surprises. Members are encouraged to make visual magnitude estimates, particularly of periodic comets, as long term monitoring over many returns helps understand their evolution. Please submit your magnitude estimates in ICQ format. Guidance on visual observation and how to submit estimates is given in the BAA Observing Guide to Comets. Drawings are also useful, as the human eye can sometimes discern features that initially elude electronic devices.

Theories on the structure of comets suggest that any comet could fragment at any time, so it is worth keeping an eye on some of the fainter comets, which are often ignored. They would make useful targets for those making electronic observations, especially those with time on instruments such as the Faulkes telescopes. Such observers are encouraged to report electronic visual equivalent magnitude estimates via COBS. When possible use a waveband approximating to Visual or V magnitudes. These estimates can be used to extend the visual light curves, and hence derive more accurate absolute magnitudes. Such observations of periodic comets are particularly valuable as observations over many returns allow investigation into the evolution of comets.

In addition to the information in the BAA Handbook and on the Section web pages, ephemerides for new and currently observable comets are on the JPL, CBAT and Seiichi Yoshida's web pages. The BAA Observing Guide to Comets is available on the Section web page.

7P/Pons-Winnecke was discovered by Jean Louis Pons with a 0.12-m refractor at Marseilles in 1819, but was then lost until rediscovered by Friedrich August Theodor Winnecke with a 0.11-m refractor in Bonn in 1858. He demonstrated the identity and recovered the comet in 1869. The perihelion distance has slowly been increasing since the early 1800s. It can make close approaches to the Earth and did so in 1927 (0.04 au), 1939 (0.11), 1892 (0.12), 1819 (0.13) and 1921 (0.14). The 2021 return produces a relatively close approach at 0.44 au, but this is not sufficient to make the comet a bright object. An outburst of the meteor shower associated with the comet, the June Bootids, occurred on 1998 June 27.6, with another lesser display in 2004. The comet should be in telescopic range by April, but it is a morning object and UK observers will loose it by the end of May. When brightest at 10th magnitude in early June it will best seen from the Southern Hemisphere.

8P/Tuttle has a rather poor apparition. Southern hemisphere observers stand the best chance of seeing it, but only after perihelion when it is fading at around 11th magnitude.

15P/Finlay might reach 9th magnitude, but it won't be observable from the UK until it is past its brightest, and then only in the morning sky. William Henry Finlay discovered the comet from the Cape Observatory on 1886 September 26, with an 18cm refractor. It was around 11th magnitude at this and the following return. In 1906 it passed 0.3 au from the Earth and reached 6th magnitude. Jupiter perturbations in 1910 gave an unfavourable return in 1913, but a good one in 1919, though they were unfavourable after that until 1953, when it was recovered. It has been observed at every return since 1953. It is an intrinsically faint object and there are usually few visual observations. A September perihelion would give favourable observing circumstances, under which the comet could reach 5th magnitude, but this won't occur until 2034.

29P/Schwassmann-Wachmann is an annual comet that has outbursts, which over the last few decades seem to have become more frequent, though this could just reflect more intense coverage. Richard Miles has developed a theory that suggests that these outbursts are in fact periodic, and arise from at least four independent active areas on the slowly rotating nucleus. The activity of the active areas evolves with time. The comet is an ideal target for electronic observations and it should be observed at every opportunity. It is in solar conjunction in March and at opposition in October. The comet has moved into the northern celestial sphere, and should be adequately placed for observation from the UK in the second half of the year.

67P/Churyumov-Gerasimenko is well known from the investigations of the Rosetta spacecraft, but it could still spring surprises. The comet could reach 8th magnitude during its closest observed perihelion passage, when it also comes relatively close to the Earth. Analysis of previous apparitions suggests that the absolute magnitude is brighter when the comet's perihelion distance is closer to the Sun, as it is this year. It will be best seen in the morning sky, but is relatively well placed in the latter part of the year. From the autumn onwards it may be visible in large binoculars in the late evening.

2021 A1 (Leonard) reaches perihelion in early January 2022, but is brightest three weeks earlier when it passes 0.23 au from the Earth. It is well placed for observation from the northern hemisphere prior to the close approach, however it is a morning object, so less likely to be widely observed. Although predicted to reach around 4th magnitude during the approach, the close distance means that the coma is likely to be large and diffuse, making it a more difficult target than might appear from the magnitude. Whilst still a brightening object it passes galaxy NGC 4631 around 2021 November 24; the galaxy may be a little fainter than the comet. Around December 3 it passes globular cluster M3 and could be a similar magnitude to it. Around December 13 it passes between globular clusters M10 and M14, but by then will be getting low in the dawn sky for UK observers. It emerges into the evening sky for southern observers, but by then will be fading due to its increasing distance from Earth, though it could remain a binocular object until the second half of January 2022.

The other periodic and parabolic comets that are at perihelion during 2021 are unlikely to become brighter than 11th magnitude or are poorly placed. Ephemerides for these can be found on the CBAT or other WWW pages.

Several D/ comets have predictions for a return, though searches at favourable returns in the intervening period have failed to reveal the comets and the orbits will have been perturbed by Jupiter. There is however always a chance that they will be rediscovered accidentally by one of the Sky Survey patrols.

Looking ahead to 2022, seven comets may reach 9th magnitude, though not all are that well placed for observation. 19P/Borrelly will be an evening object when brightest in January. 45P/Honda-Mrkos-Pajdusakova will be too close to the Sun for observation. 67P/Churyumov-Gerasimenko should still be visible after its 2021 return. 81P/Wild is an early morning object. 104P/Kowal is another evening object at the start of the year, but may be large and diffuse. 255P/Levy might be observed from more southerly latitudes prior to perihelion. 2021 A1 (Leonard) will be fading from 4th magnitude for southern hemisphere observers. We can hope that we will we get another surprise comet like 2020 F3 (NEOWISE)!

With more and more discoveries of periodic comets being made, the number of expected returns increases every year. A full list of returning comets is given as an appendix, but here only those comets expected to be brighter than 14th magnitude during the year are listed.

List of Comets brighter than 14 in 2021

Comet	T	q	P	N	H_1	K_1	Peak mag	Elong at peak
At perihelion in 2020								
58P/Jackson-Neujmin	May 27.5	1.38	8.25	5	7.4	8.1	12	163
88P/Howell	Sep 26.5	1.35	5.47	8	5.4	18.3	11	50
141P/Machholz	Dec 15.4	0.81	5.34	4	12.8	10.0	11	61
PanSTARRS (2017 T2)	May 4.9	1.62			6.2	6.9	13	27
ATLAS (2019 N1)	Dec 1.8	1.70			5.6	12.2	10	57
ATLAS (2020 M3)	Oct 25.6	1.27			9.8	12.9	12	150
Erasmus (2020 S3)	Dec 12.7	0.40			9.2	10.0	8	8
At perihelion in 2021								
4P/Faye	Sep 9.4	1.62	7.48	22	9.7	8.5	12	121
6P/d'Arrest	Sep 17.8	1.35	6.54	20	12.4	15.0	14	100
7P/Pons-Winnecke	May 27.1	1.23	6.31	24	10.7	10.0	10	109
8P/Tuttle	Aug 27.8	1.03	13.6	12	9.0	10.0	10	26
10P/Tempel	Mar 24.3	1.41	5.36	24	6.8	16.6	11	30
15P/Finlay	Jul 13.5	0.99	6.56	15	8.8	20.0	9	54
28P/Neujmin	Mar 11.9	1.58	18.4	7	8.5	15.0	13	11
52P/Harrington-Abell	Oct 5.2	1.78	7.60	10	6.6	20.3	13	59

67P/Churyumov-Gerasimenko	Nov 2.1	1.21	6.42	9	9.2	7.1	8	111
106P/Schuster	Aug 18.8	1.53	7.30	5	10.0	15.0	14	72
108P/Ciffreo	Sep 10.1	1.66	7.23	5	11.7	10.0	14	122
132P/Helin-Roman-Alu	Nov 13.1	1.69	7.66	4	10.1	10.0	12	160
246P/NEAT	Feb 22.8	2.86	8.05	2	2.5	15.0	11	162
252P/LINEAR	Jul 10.9	1.00	5.33	3	10.7	20.0	12	33
297P/Beshore	Jan 22.9	2.34	6.39	2	6.9	10.0	12	157
342P/SOHO	Oct 19.4	0.05	5.31	4	20.0	10.0	7	2
ATLAS-Africano (2019 F1)	Jun 22.9	3.60			5.5	10.0	13	114
PanSTARRS (2020 K5)	Jun 5.5	1.54			12.0	7.5	14	70
ATLAS (2020 R4)	Mar 1.9	1.03			14.0	8.0	13	123
At perihelion in 2022								
9P/Tempel	Mar 4.8	1.54	5.58	13	6.6	17.8	12	45
19P/Borrelly	Feb 1.8	1.31	6.84	16	7.1	11.7	9	77
22P/Kopff	Mar 18.1	1.55	6.38	18	7.0	15.0	13	26
97P/Metcalf-Brewington	Feb 14.3	2.57	10.4	4	5.5	15.0	13	153
104P/Kowal	Jan 11.1	1.07	5.74	6	9.6	9.9	9	80
116P/Wild	Jul 16.9	2.20	6.52	5	5.6	13.4	12	132
181P/Shoemaker-Levy	Jan 8.7	1.16	7.62	3	10.5	10.0	12	47
205P/Giacobini	Jan 13.4	1.53	6.67	3	10.0	10.0	14	29
PanSTARRS (2017 K2)	Dec 19.7	1.80			5.4	5.6	13	38
Leonard (2021 A1)	Jan 3.3	0.62			8.5	10.0	4	15

The date of perihelion (T), perihelion distance (q), period (P), the number of previously observed returns (N), the magnitude parameters H_1 and K_1, the brightest magnitude (which must be regarded as uncertain) and the approximate elongation at which this occurs are given for each comet. 342P/SOHO will be in solar conjunction when brightest and therefore only visible in satellite coronagraphs. In most cases the comet will be brightest at around the time of perihelion.

Note: $m_1 = H_1 + 5.0 * \log(d) + K_1 * \log(r)$

Comets reaching perihelion in 2021 – Supplementary List of all comets

Comet	T	q	P	N	H_1	K_1	Peak mag
D/Skiff-Kosai (1977 C1)	Jul 27.5	2.80	7.49	1			
P/SOHO (1999 J6)	Feb 16.8	0.04	5.34	3			
P/SOHO (1999 U2)	Apr 17.6	0.04	5.35	3			
P/LINEAR-NEAT (2004 R3)	Sep 29.8	3.54	10.47	1	14.5	10.0	22
P/McNaught (2005 L1)	Nov 2.5	3.14	7.93	1	9.5	10.0	16

P/Kowalski (2005 W3)	Sep 20.6	2.89	15.94	1	12.0	10.0	18
P/Garradd (2007 R4)	Dec 8.9	1.95	14.41	1	14.5	10.0	18
P/Lemmon (2008 CL_{94})	Sep 22.7	5.42	15.29	1	8.0	10.0	19
P/LINEAR (2008 WZ_{96})	Aug 26.5	1.85	6.53	1	13.5	10.0	17
P/McNaught (2009 U4)	Feb 1.1	1.65	11.45	1	14.0	10.0	18
P/LINEAR (2010 A5)	Oct 17.5	1.70	11.46	1	13.0	10.0	17
P/SOHO (2010 H3)	Feb 8.0	0.04	5.36	1			
P/Scotti (2011 A2)	Dec 1.7	1.55	5.47	1	16.5	10.0	19
P/La Sagra (2012 S2)	Oct 31.7	1.36	9.28	1	17.0	10.0	18
P/Tenagra (2012 TK_8)	Oct 26.2	3.00	8.39	1	9.0	10.0	15
P/Scotti (2013 A2)	Feb 15.7	2.19	8.04	1	15.5	10.0	19
P/Tenagra (2013 EW_{90})	Feb 15.6	3.31	8.35	1	12.0	10.0	19
Sheppard-Trujillo (2014 F3)	May 19.5	5.69	60.8	0	6.0	10.0	17
P/PanSTARRS (2014 U4)	Feb 13.5	1.88	6.57	1	18.0	10.0	23
P/Gibbs (2014 W12)	Jun 19.2	1.67	6.60	1	15.0	10.0	18
P/PanSTARRS (2015 F1)	Oct 27.7	2.54	6.61	1	12.5	10.0	18
P/NEOWISE (2015 J3)	Apr 22.2	1.49	6.13	1	16.5	10.0	17
P/PanSTARRS (2016 BA_{14})	Jun 17.3	1.01	5.26	1	21.0	10.0	22
P/PanSTARRS (2016 G1)	Mar 22.2	2.04	4.15	1	14.0	10.0	18
P/PanSTARRS (2016 P1)	Jun 10.3	2.27	5.71	1	15.0	10.0	19
PanSTARRS (2016 Q2)	May 11.9	7.08			6.0	10.0	19
A/ (2017 MB_1)	May 2.8	0.59	3.66	1			
P/Lemmon-PanSTARRS (2020 K9)	Feb 15.6	2.83	8.56	0	12.0	10.0	19
4P/Faye	Sep 9.4	1.62	7.48	22	9.7	8.5	12
6P/d'Arrest	Sep 17.8	1.35	6.54	20	12.4	15.0	14
7P/Pons-Winnecke	May 27.1	1.23	6.31	24	10.7	10.0	10
8P/Tuttle	Aug 27.8	1.03	13.62	12	9.0	10.0	10
10P/Tempel	Mar 24.3	1.41	5.36	24	6.8	16.6	11
15P/Finlay	Jul 13.5	0.99	6.56	15	8.8	20.0	9
16P/Brooks	Apr 18.2	1.88	6.99	18	11.9	8.2	16
17P/Holmes	Feb 19.8	2.08	6.93	12	10.0	10.0	15 ?
28P/Neujmin	Mar 11.9	1.58	18.4	7	8.5	15.0	13
52P/Harrington-Abell	Oct 5.2	1.78	7.60	10	6.6	20.3	13
57P/du Toit-Neujmin-Delporte	Oct 17.4	1.72	6.40	9	12.5	15.0	17
67P/Churyumov-Gerasimenko	Nov 2.1	1.21	6.42	9	9.2	7.1	8
70P/Kojima	Nov 3.1	2.01	7.05	8	11.0	15.0	17
75D/Kohoutek	Mar 4.9	1.78	6.65	2			
98P/Takamizawa	Jan 4.9	1.66	7.40	5	12.1	10.0	16
102P/Shoemaker	Jan 22.4	2.07	7.45	5	8.0	15.0	15
106P/Schuster	Aug 18.8	1.53	7.30	5	10.0	15.0	14
108P/Ciffreo	Sep 10.1	1.66	7.23	5	11.7	10.0	14
110P/Hartley	Oct 18.3	2.46	6.84	5	5.5	20.0	15
111P/Helin-Roman-Crockett	Jun 16.5	3.71	8.44	3	5.0	20.0	19
120P/Mueller	May 7.1	2.48	7.88	4	12.0	10.0	18
132P/Helin-Roman-Alu	Nov 13.1	1.69	7.66	4	10.1	10.0	12
142P/Ge-Wang	May 12.8	2.51	11.21	3	9.0	10.0	15
158P/Kowal-LINEAR	May 10.9	4.80	11.10	3	9.0	10.0	19
173P/Mueller	Dec 16.7	4.22	13.63	2	7.5	10.0	16
191P/McNaught	Mar 20.1	2.23	6.93	3	13.0	10.0	19
193P/LINEAR-NEAT	Aug 25.3	2.17	6.77	3	11.4	10.0	15
201P/LONEOS	May 26.7	1.22	6.14	3	12.7	10.0	15
206P/Barnard-Boattini	Mar 4.5	1.56	6.51	3	19.0	10.0	23
221P/LINEAR	Dec 18.1	1.75	6.42	3	14.0	10.0	19
241P/LINEAR	Jul 25.4	1.92	10.96	2	13.5	10.0	18
246P/NEAT	Feb 22.8	2.86	8.05	2	2.5	15.0	11
252P/LINEAR	Jul 10.9	1.00	5.33	3	10.7	20.0	12
265P/LINEAR	Feb 9.0	1.50	8.77	2	14.5	10.0	18
282P/LONEOS (323137)	Oct 24.1	3.44	8.74	2	13.5	5.0	18

283P/Spacewatch	Sep 8.0	2.13	8.42	3	16.0	10.0	22
284P/McNaught	Sep 12.7	2.30	7.06	2	13.0	10.0	17
297P/Beshore	Jan 22.9	2.34	6.39	2	6.9	10.0	12
320P/McNaught	Jan 17.1	0.97	5.44	2	20.5	10.0	22
323P/SOHO	Jan 17.7	0.04	4.15	5			
324P/La Sagra	May 6.0	2.62	5.45	2	13.0	10.0	19
332P/Ikeya-Murakami	Aug 18.4	1.58	5.43	2	18.0	10.0	21
342P/SOHO	Oct 19.4	0.05	5.31	4	20.0	10.0	7
395P/Catalina-NEAT	Dec 30.5	4.06	16.8	2	10.0	10.0	19
399P/PanSTARRS	May 22.6	2.10	7.38	1	14.0	10.0	20
400P/PanSTARRS	Feb 10.1	2.10	6.71	1	15.5	7.0	19
402P/LINEAR	Dec 14.5	3.94	18.6	1	6.0	10.0	16
409P/LONEOS-Hill (2020 V1)	Jan 28.2	1.75	14.9	1	14.0	10.0	16
4xxP/NEAT-LINEAR (2020 W2)	Jun 23.6	3.25	17.1	1	10.0	10.0	19
4xxP/Larson (2020 W4)	Jul 20.2	2.14	7.15	1	14.0	10.0	18
4xxP/STEREO (2021 A3)	Jan 25.4	0.53	4.67	1	13.3	10.0	9
Lemmon (2018 U1)	Nov 3.1	4.99			5.0	10.0	15
PANSTARRS (2019 B3)	Jan 20.0	6.82			5.5	10.0	18
ATLAS-Africano (2019 F1)	Jun 22.9	3.60			5.5	10.0	13
Palomar (2019 O3)	Mar 7.1	8.82			9.9	10.0	24
A/[PanSTARRS] (2019 T1)	Jan 14.1	4.28			13.6	5.0	20
A/[Lemmon] (2019 T2)	Apr 22.3	2.65			13.2	5.0	17
ATLAS (2019 T3)	Mar 2.7	5.95			5.0	12.0	18
MASTER (2020 F5)	Mar 24.2	4.33			5.0	12.0	15
A/[Lemmon] (2020 F7)	Nov 14.0	5.33			11.9	5.0	19
ATLAS (2020 H6)	Oct 1.0	4.70			8.0	8.0	16
SONEAR (2020 J1)	Apr 18.4	3.36			8.5	8.0	15
PanSTARRS (2020 K5)	Jun 5.6	1.54			12.0	7.5	14
Rankin (2020 K6)	Sep 15.3	5.87			10.0	7.5	19
ATLAS (2020 M5)	Aug 19.9	3.00			9.0	10.0	16
PanSTARRS (2020 N1)	Mar 12.2	1.32			13.0	8.0	15
Amaral (2020 O2)	Aug 28.4	4.86			8.0	8.0	17
P/PanSTARRS (2020 O3)	Jan 29.8	4.17	10.1	0	12.5	10.0	21
ATLAS (2020 P3)	Apr 20.9	6.81			8.0	8.0	19
ATLAS (2020 R4)	Mar 1.9	1.03			14.0	8.0	13
P/PanSTARRS (2020 S1)	Jan 16.9	2.95	14.6	0	14.0	10.0	21
Lemmon (2020 S8)	Apr 10.9	2.36			13.5	8.0	17
Palomar (2020 T2)	Jul 11.2	2.05			11.0	8.0	14
P/PanSTARRS (2020 T3)	Jan 20.5	1.44	6.60	0	18.0	8.0	19
PanSTARRS (2020 T4)	Jul 5.2	2.19			13.0	8.0	18
Rankin (2020 U3)	Feb 6.0	2.28			15.0	8.0	20
Rankin (2020 V4)	Jul 17.9	5.15	29		10.0	8.0	19
NEOWISE (2021 A2)	Jan 22.7	1.41			11.0	10.0	14

The date of perihelion (T), perihelion distance (q), period (P), the number of previously observed returns (N), the magnitude parameters H_1 and K_1 and the brightest magnitude (which must be regarded as uncertain) are given for each comet. The magnitudes, orbits, and in particular the time of perihelion of the D/ comets are uncertain. The SOHO comets are only likely to be observed by satellite and some of the linkages are uncertain. 17P underwent a massive outburst in 2007 making it a naked eye object. Whilst this is unlikely to repeat, smaller outbursts are possible. 332P/Ikeya-Murakami was discovered when in outburst in 2010 and multiple components were observed at the next return in 2016. 342P will be in solar conjunction when brightest and therefore only visible in satellite coronagraphs. 2017 MB_1 showed cometary features, but has not been named. Periodic comet numbers greater than 409 are provisional.

Note: $m_1 = H_1 + 5.0 * \log(d) + K_1 * \log(r)$

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