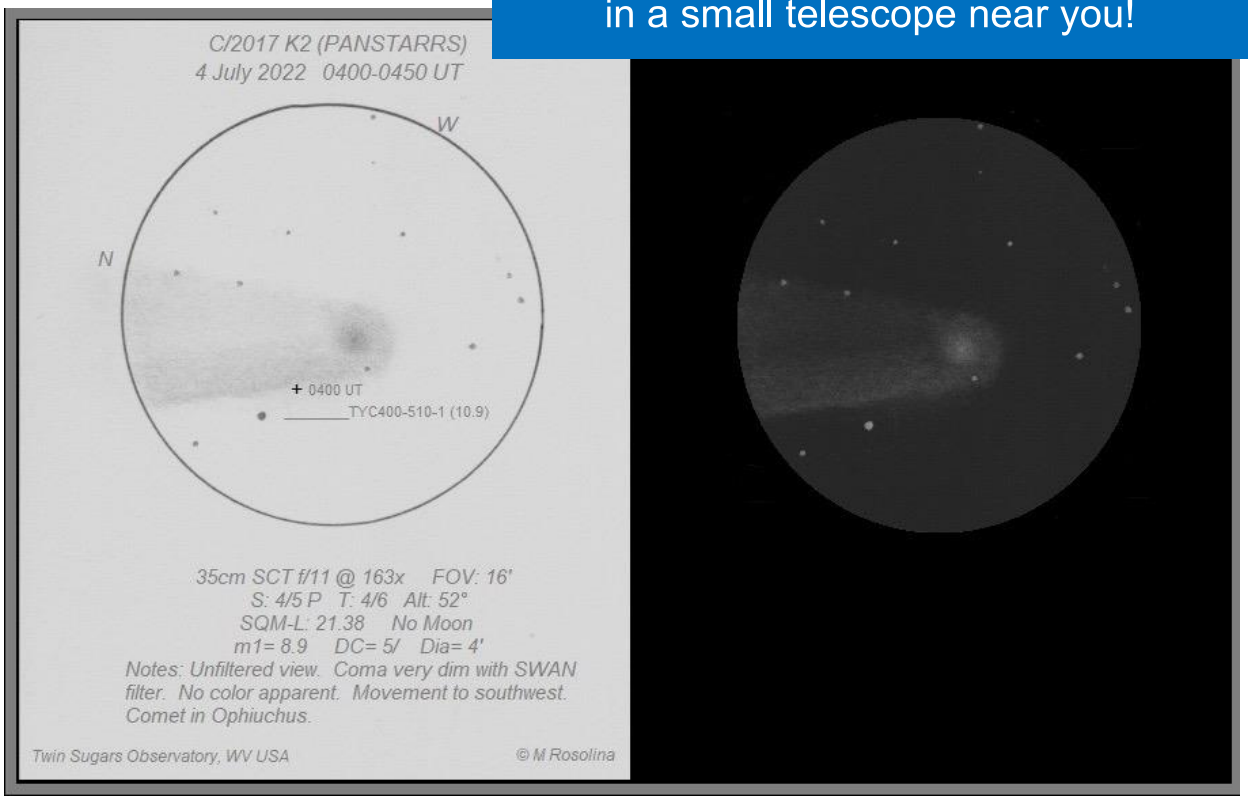
July 2022

ALPO Comet News

A Publication of the Comets Section of the Association of Lunar and Planetary Observers

C/2017 K2 (PANSTARRS) can be seen in a small telescope near you!



C/2017 K2 (PANSTARRS) was discovered over 5 years ago and may have already been active for 15 years or so. Though not as bright as originally hoped for, the comet is now around magnitude 8.0 to 8.5 and well placed for observers everywhere. Michael Rosolina sketched C/2017 K2 on 2022 July 4 between 04:00 and 04:50 UT with a 0.35-m SCT at f/11 and 163 power.

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The monthly ALPO Comet News PDF can be found on the ALPO Comets Section website (http://www.alpo-astronomy.org/cometblog/). A shorter version of this report is posted on a dedicated Cloudy Nights forum (https://www.cloudynights.com/topic/831014-alpo-comet-news-for-july-2022/). All are encouraged to join the discussion over at Cloudy Nights. The ALPO Comets Section welcomes all comet related articles, observations, images, drawings, magnitude estimates, or spectra. One does not have to be a member of ALPO to submit material, though membership is appreciated.

Please send your observations to the Comets Section at < comets@alpo-astronomy.org >, Coordinator Carl Hergenrother < carl.hergenrother@alpo-astronomy.org > and/or Acting Assistant Coordinator Michel Deconinck < michel.deconinck@alpo-astronomy.org >.

To learn more about the ALPO, please visit us @ http://www.alpo-astronomy.org.

Summary

The comet of the moment is C/2017 K2 (PANSTARRS). Currently around 8th magnitude, C/2017 K2 has become an interesting object for both visual and imaging observers. While K2 is visible from both hemispheres, the second brightest comet of the month, C/2021 E3 (ZTF) at 9-10th magnitude, is solely a southern hemisphere object. A number of fainter comets are in the 10th to 13th magnitude range, including 22P/Kopff, 73P/Schwassmann-Wachmann, 169P/NEAT, C/2019 L3 (ATLAS), C/2019 T4 (ATLAS), C/2020 V2 (ZTF), C/2021 P4 (PANSTARRS), and C/2022 E3 (ZTF). C/2022 E3 is still looking like it will become a nice borderline naked eye object in 2023.

In June the ALPO Comets Section received 52 magnitude estimates and 34 images/sketches of comets C/2022 L2 (ATLAS), C/2022 E3 (ZTF), C/2021 P4 (ATLAS), C/2021 F1 (Lemmon-PANSTARRS), C/2021 E3 (ZTF), C/2021 A1 (Leonard), C/2020 V2 (ZTF), C/2020 R7 (ATLAS), C/2020 K1 (PANSTARRS), C/2019 U5 (PANSTARRS), C/2019 T4 (ATLAS), C/2017 K2 (PANSTARRS), 337P/WISE, 327P/Van Ness, 325P/Yang-Gao, 287P/Christensen, 117P/Helin-Roman-Alu, 116P/Wild, 73P/Schwassmann-Wachmann, 45P/Honda-Mrkos-Pajdusakova, 22P/Kopff, and 12P/Pons-Brooks. A big thanks to our recent contributors: Dan Bartlett, John Chumack, J. J. Gonzalez, Christian Harder, Carl Hergenrother, Eliot Herman, Michael Jäger, John Maikner, Martin Mobberley, Michael Phillips, Uwe Pilz, Raymond Ramlow, Michael Rosolina, Gregg Ruppel, John D. Sabia, Chris Schur, Tenho Tuomi, and Chris Wyatt.

Request for Observations

As always, the Comet Section is happy to receive all comet observations, whether textual descriptions, images, drawings, magnitude estimates, or spectra. Please send your observations via email to the Comets Section < comets @ alpo-astronomy . org >, Comets Section Coordinator Carl Hergenrother < carl.hergenrother @ alpo-astronomy . org > and/or Comets Section Acting Assistant Coordinator Michel Deconinck < michel.deconinck @ alpo-astronomy . org >.

Upcoming Comet Meetings

July 22-23 – ALPO 2022 Conference

The 2022 ALPO Conference will be held online Friday and Saturday, July 22 and 23. The ALPO conference times will be Friday from 1 p.m. to 5 p.m. Eastern Time (10 a.m. to 2 p.m. Pacific Time) and Saturday from 1 p.m. to 6 p.m. Eastern Time (10 a.m. to 3 p.m. Pacific Time).

The ALPO Conference is free and open to all interested individuals via the free online conferencing software application Zoom and the ALPO YouTube channel. All are welcome to present planetary astronomy papers or presentations though in order to present one must be a member of the ALPO and use Zoom. Those who have not yet joined the ALPO may do so online go here. Digital ALPO memberships start at only $18 a year.

More information can be found at http://www.alpo-astronomy.org/alpo/wp-content/uploads/2022/03/ALPO_2022_Online_Conference_Details.pdf .

Aperture Corrections to Magnitude Measurements

We try to include up-to-date lightcurves for most of the objects discussed in this report as well as applying aperture corrections to the visual observations. All magnitude estimates are affected by many factors including instrumental (aperture, focal length, magnification, type of optics), environmental (sky brightness due to

moonlight, light pollution, twilight, aurora activity, zodiacal light, etc.), cometary (degree of condensation, coma color, strength and type of gas emission lines, coma-tail interface) and personal (sensitivity to different wavelengths, personal technique, observational biases). The correction used here only corrects for differences in aperture [C. S. Morris, On Aperture Corrections for Comet Magnitude Estimates. Publ Astron Soc Pac 85, 470, 1973]. Visual observations are corrected to a standard aperture of 6.78 cm by 0.019 magnitudes per centimeter for refractors and 0.066 magnitudes per centimeter for reflectors. If a sufficient number of visual observations are submitted for a particular comet, we determine personal corrections for each observer for each individual comet. If the magnitudes shown in the text don't match those plotted in the lightcurves, it is because of the application of aperture and personal bias corrections.

Acknowledgements

In addition to observations submitted directly to the ALPO, we occasionally use data from other sources to augment our analysis. We would like to acknowledge with thanks observations submitted directly to the ALPO as well as those originally submitted to the International Comet Quarterly, Minor Planet Center, and COBS Comet Observation Database. We would also like to thank the Jet Propulsion Laboratory for making available their Small-Body Browser and Orbit Visualizer and Seiichi Yoshida for his Comets for Windows programs that are used to produce the lightcurves and orbit diagrams in these pages. And last but not least, we'd like to thank Syuichi Nakano and the Minor Planet Center for their comet orbit elements, the asteroid surveys and dedicated comet hunters for their discoveries, and all of the observers who volunteer their time to adding to our knowledge of these amazing objects.

Thank you to everyone who contributed to the ALPO Comets Section!

Clear skies!
- Carl Hergenrother

Comets Calendar

July 01 - 337P/WISE at perihelion (q = 1.65 au, 6.0-yr period, V ~ 18, discovered in 2010, observed at 3 returns)
July 01 - P/2022 C3 (PANSTARRS) at perihelion (q = 4.37 au, 30.0-yr period, V ~ 19)
July 01 - 73P/Schwassmann-Wachmann within 10' of galaxy NGC 3489
July 03-04 - C/2022 E3 (ZTF) within 0.5 deg of Ring Nebula (M57)
July 05-06 - C/2021 P4 (ATLAS) passes over bright galaxy NGC 2683
July 06 - First Quarter Moon
July 07 - C/2021 E3 (ZTF) orbit plane crossing
July 07 - 117P/Helin-Roman-Alu at perihelion (q = 3.04 au, 8.3-yr period, V ~ 13, discovered in 1989, 2022 is the 5th observed return)
July 09 - 169P/NEAT at perihelion (q = 0.60 au, 4.2-yr period, V ~ 12, discovered in 2001, 2022 is the 8th observed return)
July 13 - Full Moon
July 15 - C/2020 F2 (ATLAS) at perihelion (q = 8.82 au, V ~ 17)
July 15 - 22P within ~0.5 deg of galaxies NGC 467, 470, and 474
July 15 - C/2017 K2 (PANSTARRS) within 0.5 deg of bright globular M10
July 16 - 116P/Wild at perihelion (q = 2.20 au, 6.5-yr period, V ~ 13, discovered in 1990, 2022 is the 6th observed return)
July 17 - 272P/NEAT at perihelion (q = 2.43 au, 9.4-yr period, V ~ 20, discovered in 2003, 2022 is the 3rd observed return)
July 19 - 22P within ~0.5 deg of galaxies NGC 520
July 20 - Last Quarter Moon
July 28 - New Moon
July 30 - C/2021 P4 (ATLAS) at perihelion (q = 1.08 au, V ~ 11, see more below)

Recent Magnitudes Contributed to the ALPO Comets Section

Comet Des	YYYY MM DD.DD (UT)	Mag	SC	APER	FL	POW T	COMA Dia	COMA DC	TAIL LENG	TAIL PA	ICQ CODE	Observer Name
C/2022 L2 (ATLAS)												
2022L2	2022 06 25.17	C 18.4	BG	30.5H	4	B700					ICQ XX	MAIab John Maikner
2022L2	2022 06 20.13	C 18.6	BG	30.5H	4	a990					ICQ XX	MAIab John Maikner
C/2022 E3 (ZTF)												
2022E3	2022 06 28.03	I 13.7	AQ	20.3T	10	133	0.4	7			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2022E3	2022 06 26.21	C 14.4	BG	30.5H	4	a900			6	m170	ICQ XX	MAIab John Maikner
2022E3	2022 06 24.49	xM 14.1	AQ	40.0L	4	261	0.3	5/			ICQ XX	WYA Christopher Wyatt
2022E3	2022 06 22.53	xM 14.1	AQ	40.0L	4	261	0.3	5/			ICQ XX	WYA Christopher Wyatt
2022E3	2022 06 06.24	C 14.7	BG	30.5H	4	a999				316	ICQ XX	MAIab John Maikner
C/2021 P4 (ATLAS)												
2021P4	2022 06 30.92	S 9.4	TK	20.3T	10	77	6	2/			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2021P4	2022 06 27.92	S 9.7	TK	20.3T	10	77	6	2			ICQ XX	GON05 Juan Jose Gonzalez Suarez
C/2021 F1 (Lemmon-PANSTARRS)												
2021F1	2022 06 04.17	Z 11.3	U4	20.0L	3	a360	6.1				ICQ xx	HER02 Carl Hergenrother
C/2021 E3 (ZTF)												
2021E3	2022 06 24.46	xM 10.7	AQ	40.0L	4	59	4	6	5.5	m160	ICQ XX	WYA Christopher Wyatt
2021E3	2022 06 22.48	xM 10.6	AQ	40.0L	4	59	4.1	5			ICQ xx	WYA Christopher Wyatt
2021E3	2022 06 05.46	xM 9.3	AQ	40.0L	4	59	5.5	6			ICQ xx	WYA Christopher Wyatt
2021E3	2022 06 05.45	xM 9.8	TK	7.0B		11	7.8	3/			ICQ xx	WYA Christopher Wyatt
C/2020 V2 (ZTF)												
2020V2	2022 06 27.94	S 12.9	AQ	20.3T	10	133	1.1	6			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2020V2	2022 06 04.98	S 13.3	TI	29.8L	4	132	0.8	3/			ICQ XX	HAR11 Christian Harder
C/2020 R7 (ATLAS)												
2020R7	2022 06 24.46	xM 13.9	AQ	40.0L	4	182	0.8	5			ICQ XX	WYA Christopher Wyatt
2020R7	2022 06 22.48	xM 13.8	AQ	40.0L	4	182	1.0	5/			ICQ XX	WYA Christopher Wyatt
C/2020 K1 (PANSTARRS)												
2020K1	2022 06 30.98	S 12.7	AQ	20.3T	10	167	1.6	4			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2020K1	2022 06 24.48	xM 13.2	AQ	40.0L	4	182	1.2	5			ICQ XX	WYA Christopher Wyatt
2020K1	2022 06 22.51	xM 13.9	AQ	40.0L	4	182	0.7	5/			ICQ XX	WYA Christopher Wyatt
C/2019 U5 (PANSTARRS)												
2019U5	2022 06 30.99	S 13.6	AQ	20.3T	10	167	1.3	5			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2019U5	2022 06 24.45	xM 14.0	AQ	40.0L	4	182	0.7	4			ICQ XX	WYA Christopher Wyatt
2019U5	2022 06 22.46	xM 14.1	AQ	40.0L	4	182	0.6	4/			ICQ XX	WYA Christopher Wyatt
2019U5	2022 06 05.44	xM 14.0	AQ	40.0L	4	182	0.8	5			ICQ XX	WYA Christopher Wyatt
C/2019 T4 (ATLAS)												
2019T4	2022 06 30.93	S 10.7	TK	20.3T	10	100	5	2/			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2019T4	2022 06 27.93	S 10.9	TK	20.3T	10	77	4	3			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2019T4	2022 06 24.45	xM 13.0	AQ	40.0L	4	108	1	6			ICQ XX	WYA Christopher Wyatt
2019T4	2022 06 22.47	xM 12.7	AQ	40.0L	4	108	1.6	6			ICQ XX	WYA Christopher Wyatt
2019T4	2022 06 05.44	xM 12.2	AQ	40.0L	4	59	1.9	5/			ICQ xx	WYA Christopher Wyatt
C/2017 K2 (PANSTARRS)												
2017K2	2022 07 02.00	S 8.9	TI	29.8L	4	79	3	s4			ICQ XX	HAR11 Christian Harder
2017K2	2022 07 01.02	S 8.7	TK	20.3T	10	77	4	5	0.3	0	ICQ XX	GON05 Juan Jose Gonzalez Suarez
2017K2	2022 07 01.01	S 8.3	TK	5.0B		10	6	6			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2017K2	2022 06 28.00	S 8.5	TK	10.0B		25	5	6			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2017K2	2022 06 27.96	S 8.9	TK	20.3T	10	77	4	5	0.3		ICQ XX	GON05 Juan Jose Gonzalez Suarez
2017K2	2022 06 26.12	C 12.7	BG	30.5H	4	A800					ICQ XX	MAIab John Maikner
2017K2	2022 06 24.48	xM 9.2	TK	40.0L	4	59	4	6	18.5	m354	ICQ XX	WYA Christopher Wyatt
2017K2	2022 06 22.50	xM 9.5	TK	40.0L	4	59	3.2	6	9.5	m000	ICQ XX	WYA Christopher Wyatt
2017K2	2022 06 20.94	S 9.7	TK	32.0L	5	80	6	6/				PIL01 Uwe Pilz
2017K2	2022 06 04.97	S 9.5	TI	29.8L	4	79	3.3	s4			ICQ XX	HAR11 Christian Harder
337P/WISE												
337	2022 06 28.20	C 18.4	BG	30.5H	4	A638					ICQ XX	MAIab John Maikner
327P/Van Ness												
327	2022 06 06.31	C 18.8	BG	30.5H	4	A620					ICQ XX	MAIab John Maikner
325P/Yang-Gao												
325	2022 06 25.22	C 19.1	BG	30.5H	4	A740			12	s240	ICQ XX	MAIab John Maikner
287P/Christensen												
287	2022 06 18.10	C 19.6	BG	30.5H	4	B646					ICQ XX	MAIab John Maikner
117P/Helin-Roman-Alu												
117	2022 06 24.47	xM 13.6	AQ	40.0L	4	182	0.5	6			ICQ XX	WYA Christopher Wyatt
117	2022 06 22.49	xM 13.2	AQ	40.0L	4	182	0.7	6			ICQ XX	WYA Christopher Wyatt
117	2021 06 06.40	xM 15.3	AQ	40.0L	4	182	0.6	4			ICQ XX	WYA Christopher Wyatt
116P/Wild												
116	2022 06 24.45	xM 13.9	AQ	40.0L	4	182	1	4			ICQ XX	WYA Christopher Wyatt
116	2022 06 22.46	xM 13.8	AQ	40.0L	4	182	0.8	4			ICQ XX	WYA Christopher Wyatt
22P/Kopff												

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 22        2022 06 28.10  S 10.8 TK 20.3T10  77   3    2/          ICQ XX GON05 Juan Jose Gonzalez Suarez
12P/Pons-Brooks
 12        2022 06 28.27  C 20.5 BG 30.5H 4F000                    ICQ XX MAIab John Maikner
 12        2022 06 06.21  C 21.5 BG 30.5H 4A920                    ICQ XX MAIab John Maikner
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New Discoveries, Recoveries and Other Comets News

Recent Recoveries

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443P/2022 E1 = 2005 N11 (PANSTARRS-Christensen)  [MPC 139977, WGSBN Bull. 2 #8]
442P/2011 Q3 = 2022 G1 (McNaught)                [MPC 139977, WGSBN Bull. 2 #8]
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New Discoveries

C/2022 L4 (PANSTARRS) – The Pan-STARRS2 1.8-m at Haleakala on Maui discovered a new 21st magnitude long-period comet on 2022 June 4. C/2022 L4 arrived at perihelion back on 2021 December 9 at 3.02 au. As a result, the comet has already peaked in brightness and should fade from here on out.

P/2022 L3 (ATLAS) – The "Asteroid Terrestrial-Impact Last Alert System" or ATLAS program found a new 16-17th magnitude short-period comet on 2022 June 12 with their 0.5-m f/2 Schmidt reflector at Mauna Loa, Hawaii. P/2022 L3 is inbound to a 2022 October 31 perihelion at 2.41 au. At that time, the comet will also be at opposition making this one of its best possible returns. Depending on how rapidly it brightens it could peak at 14-15th magnitude. [CBET 5139, MPEC 2022-M96]

C/2022 L2 (ATLAS) – On 2022 June 10, ATLAS also used their 0.5-m f/2 Schmidt reflector at Mauna Loa to discover a 18th magnitude long-period comet. C/2022 L2 is nearly two years out from a perihelion on 2024 March 17 at 2.76 au. Though it has a large perihelion it could brighten enough to be a faint visual object at 12th magnitude in early 2023. [CBET 5136, MPEC 2022-M18]

C/2022 L1 (Catalina) – A 19th magnitude comet was found by the Catalina Sky Survey with the 0.68-m Catalina Schmidt located near Mount Bigelow in the Catalina Mountains north of Tucson, Arizona. C/2022 L1 should peak around magnitude 17 in late July when near closest approach to Earth at 0.9 au. Perihelion occurs a few months later on 2022 September 28 at 1.59 au. [CBET 5134, MPEC 2022-L97]

C/2022 J2 (Bok) – An apparently asteroidal 21st magnitude object was found on 2022 May 9 as part of the Bok survey which uses the University of Arizona's Bok 2.3-m on Kitt Peak. The object was originally designated A/2022 J2. On June 26, K. J. Meech, E. Bufanda, J. Kleyna, and J. V. Keane found a cometary appearance with the 3.6-m Canada-France-Hawaii Telescope at Mauna Kea. C/2022 J2 will arrive at perihelion on 2022 October 27 at 1.83 au. An assumed 2.5n = 8 brightening rate results in a peak brightness of 18th magnitude in December. Since C/2022 J2 appears to be dynamically old with a ~900-year orbital period, it may brighten at a faster rate. [CBET 5143, MPEC-M98]

P/2022 C4 (WISE-PANSTARRS) = P/2010 LK36 = P/2016 MD = P/2016 PM1 – A. Fitzsimmons of Queen's University in Belfast found this object to be cometary in images taken on 2022 June 6 with the ATLAS 0.5-m f/2 Schmidt reflector at Mauna Loa, Hawaii. Though the June 2022 ATLAS observations were the first to uncover P/2022 C4's cometary behavior, the comet was observed as an asteroid on multiple occasions in the past including: pre-discovery observations during the course of the Sloan Digital Sky Survey on 2003 April 26, an independent discovery on 2010 June 9 by the WISE (Wide-field Infrared Survey Explorer) spacecraft, observations on 2016 June 16 by the same spacecraft though it has been renamed NEOWISE (Near-Earth Object Wide-field Infrared Survey Explorer) by that time, and observations on 2016 August 1 by Pan-STARRS. 2022 marks its 4th observed return with it being observed on many nights in 2022 back to February 7.

This year, perihelion occurs on July 10 at 1.47 au when it should be around magnitude 17. Though P/2022 C4's orbital period has stayed around 6.4 years, its perihelion distance was larger in 2003 and 2010 at 1.60 au. [CBET 5137, MPEC 2022-M81]

C/2021 QM45 (PANSTARRS) – On 2021 August 17, Pan-STARRS found an apparently asteroidal object at 22nd magnitude. New observations and a re-inspection of older observations show this object to also be a comet. C/2021 QM45 is a dynamically old long-period comet with perihelion on 2022 August 13 at 2.77 au. A peak brightness around 17th magnitude may be reached in November. [CBET 5145, MPEC 2022-N12]

Comets Brighter Than Magnitude 10

C/2017 K2 (PANSTARRS)

Discovered 2017 May 21 by the Pan-STARRS survey with the Pan-STARRS1 1.8-m on Haleakala
Dynamically ??? long-period comet

Orbit (from Minor Planet Center, MPEC 2022-M21)

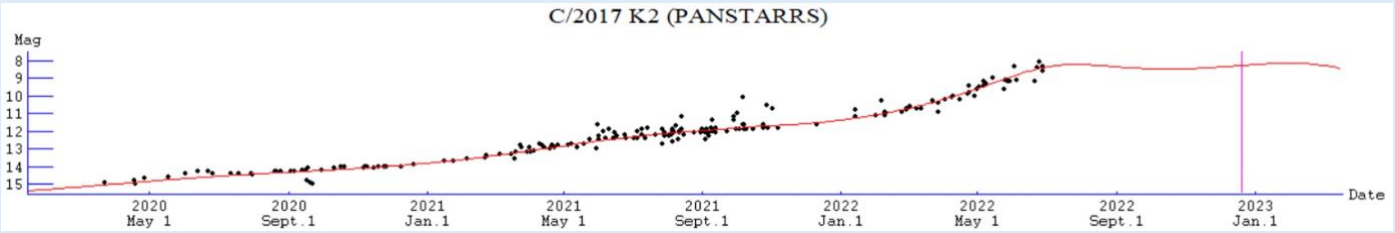
```
    C/2017 K2 (PANSTARRS)
Epoch 2022 Aug. 9.0 TT = JDT 2459800.5
T 2022 Dec. 19.68283 TT                                  Rudenko
q   1.7969226           (2000.0)            P               Q
z  -0.0004447      Peri.  236.19727     +0.01819887     +0.04924513
 +/-0.0000006      Node    88.23524     -0.18094729     +0.98245586
e   1.0007991      Incl.   87.56193     -0.98332440     -0.17987606
From 8845 observations 2013 May 12-2022 June 20, mean residual 0".5.
1/a(orig) = -0.000019 AU**-1, 1/a(fut) = +0.001173 AU**-1.
```

Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

```
C/2017 K2 (PANSTARRS)                                                Max El
                                                                      (deg)
    Date       R.A.    Decl.      r       d     Elong  Const  Mag    40N  40S
2022-Jul-01  17 26  +01 55   2.769   1.846    149E    Oph    8.4     52   48
2022-Jul-06  17 15  +00 04   2.726   1.823    146E    Oph    8.3     50   50
2022-Jul-11  17 05  -01 54   2.683   1.811    141E    Oph    8.3     48   52
2022-Jul-16  16 55  -03 57   2.641   1.810    136E    Oph    8.2     46   54
2022-Jul-21  16 45  -06 04   2.599   1.818    130E    Oph    8.2     44   56
2022-Jul-26  16 36  -08 11   2.557   1.836    124E    Oph    8.2     41   58
2022-Jul-31  16 28  -10 18   2.516   1.862    119E    Oph    8.2     37   60
2022-Aug-05  16 21  -12 24   2.475   1.894    113E    Sco    8.2     34   62
```

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 =  2.7 + 5 log d + 7.6 log r [to T-425 days, where T = date of perihelion]
m1 =  5.3 + 5 log r + 3.9 log r [T-425 days and onwards]
```



Recent Magnitude Measurements Contributed to the ALPO Comets Section

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Recent Magnitude Measurements in ICQ format:
Comet Des  YYYY MM DD.DD     Mag SC APER FL POW    COMA     TAIL     ICQ    CODE  Observer Name
              (UT)                        T        Dia  DC  LENG  PA
   2017K2  2022 06 28.00  S  8.5 TK 10.0B    25   5    6                ICQ XX GON05 Juan Jose Gonzalez Suarez
   2017K2  2022 06 27.96  S  8.9 TK 20.3T10  77   4    5   0.3          ICQ XX GON05 Juan Jose Gonzalez Suarez
   2017K2  2022 06 26.12  C 12.7 BG 30.5H 4A800                         ICQ XX MAIab John Maikner
   2017K2  2022 06 24.48 xM  9.2 TK 40.0L 4  59   4    6  18.5 m354    ICQ XX WYA   Christopher Wyatt
   2017K2  2022 06 22.50 xM  9.5 TK 40.0L 4  59   3.2  6    9.5m000    ICQ XX WYA   Christopher Wyatt
   2017K2  2022 06 20.94  S  9.7 TK 32.0L 5  80   6    6/                      PIL01 Uwe Pilz
   2017K2  2022 06 04.97  S  9.5 TI 29.8L 4  79   3.3 s4                  ICQ XX HAR11 Christian Harder
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The comet of the moment is certainly C/2017 K2 (PANSTARRS). It's been a long wait, but C/2017 K2 is finally bright enough to be seen in small telescopes and binoculars. When it was discovered at a distance of 16 au from the Sun, there was hope it would eventually brighten to around 5-6th magnitude. Now it looks like magnitude 8 or so is about as bright as it will get. Still, C/2017 K2 has turned into a visually and photographically interesting object.

C/2017 K2 was discovered on 2017 May 21 by the Pan-STARRS1 1.8-m telescope at Haleakala on the Hawaiian island of Maui. At discovery the comet was around 18-19th magnitude and, as mentioned above, 16 au from the Sun. Pre-discovery observations were found back to May of 2013 when the comet was 23 au from the Sun which is further than the distance of Uranus. A research paper published by a team led by David Jewitt found evidence of dust production starting as far out as 35 au from the Sun [David Jewitt et al 2021, Astronomical Journal 161 188, https://doi.org/10.3847/1538-3881/abe4cf]!

The reason why C/2017 K2 has not gotten as bright as hoped is the comet's slow rate of brightening. Up until late last year, it brightened at a 2.5n ~ 7.5 rate which is typically for a dynamically new long-period comet making its first trip through the inner solar system though there has been some uncertainty in the literature as to whether it is dynamically new or old. Since late last year, its rate of brightening has slowed to a crawl. In fact, the comet has brightened at a rate of 2.5n ~ 4, where a 2.5n value less than 5 means a production rate that is decreasing with time even though the comet is still approaching the Sun. Even though it is intrinsically fading, the decreasing distance to the Sun and Earth results in a brightening apparent magnitude (i.e., how bright the comet appears to us on Earth).

Why is the comet intrinsically fading? Part of the problem may be due to what is measured by our magnitude estimates. Usually, magnitude estimates are of a comet's total magnitude (i.e., the brightness of the comet's entire coma). Rather than a measure of the comet's current production (or recently released dust), it is a measure of production that occurred over past months or even years. What this means is that the total magnitude may be dominated by light reflected by large slow-moving particles released in the past, rather than new dust released recently. The older dust particles in the coma may be experiencing sublimation and falling apart as the comet gets closer to the Sun resulting in an absolute fading even though the nucleus' level of activity may be increasing.

Visual observations were reported by J. J. Gonzalez, Christian Harder, Uwe Pilz, and Chris Wyatt while images and sketches were contributed by Dan Bartlett, John Chumack, Christian Harder, Carl Hergenrother, Eliot Herman, Michael Jäger, John Maikner, Martin Mobberley, Uwe Pilz, Raymond Ramlow, Michael Rosolina, Gregg Ruppel, John D. Sabia, Chris Schur, Tenho Tuomi, and Chris Wyatt. Check out the ALPO Comets Section Image Gallery for more C/2017 K2 images at http://www.alpo-astronomy.org/gallery3/index.php/Comet-Images-and-Observations/Comets-Discovered-in-2017/C2017K2 .

Visual observers found a coma diameter ranging between 3-6' with a northward pointing tail up to 0.3 deg in length. Imagers are detecting a much larger coma up to 10-12' in diameter as well as a longer tail (up to 1 deg). The difference in coma diameters is likely due to whether a large relatively low surface brightness gas coma is being detected. This gas coma extends well beyond the brighter smaller dust coma.

The near nucleus region has also shown structure recently. A persistent strongly curved jet-like structure has been observed over the past few weeks. The structure does not appear to change orientation. I imaged the comet on July 2 and 3 with the Skygems Observatory 0.5-m iDK telescope at Hakos, Namibia and the jet-like structure appeared similar on both nights.

In July, K2 should brighten slightly by a few tenths of magnitude to around magnitude 8.2. It is now an evening object and will be located all month in Ophiuchus as it slowly moves south crossing the celestial equator early in the month. The comet's southerly motion will result in it being lost to northern hemisphere observers by the end of September or early October of this year. Northerners will once again be able to see K2 from their backyards during the 2nd half of 2023 though it should be a faint visual object by then. Southern hemisphere observers will have an uninterrupted view through the middle of 2024.

Though C/2017 K2 reaches perihelion on 2022 December 19 at 1.80 au, changes in its distance from Earth result in two brightness maxima at magnitude 8.2 in July and again to around 8.1 in January 2023.

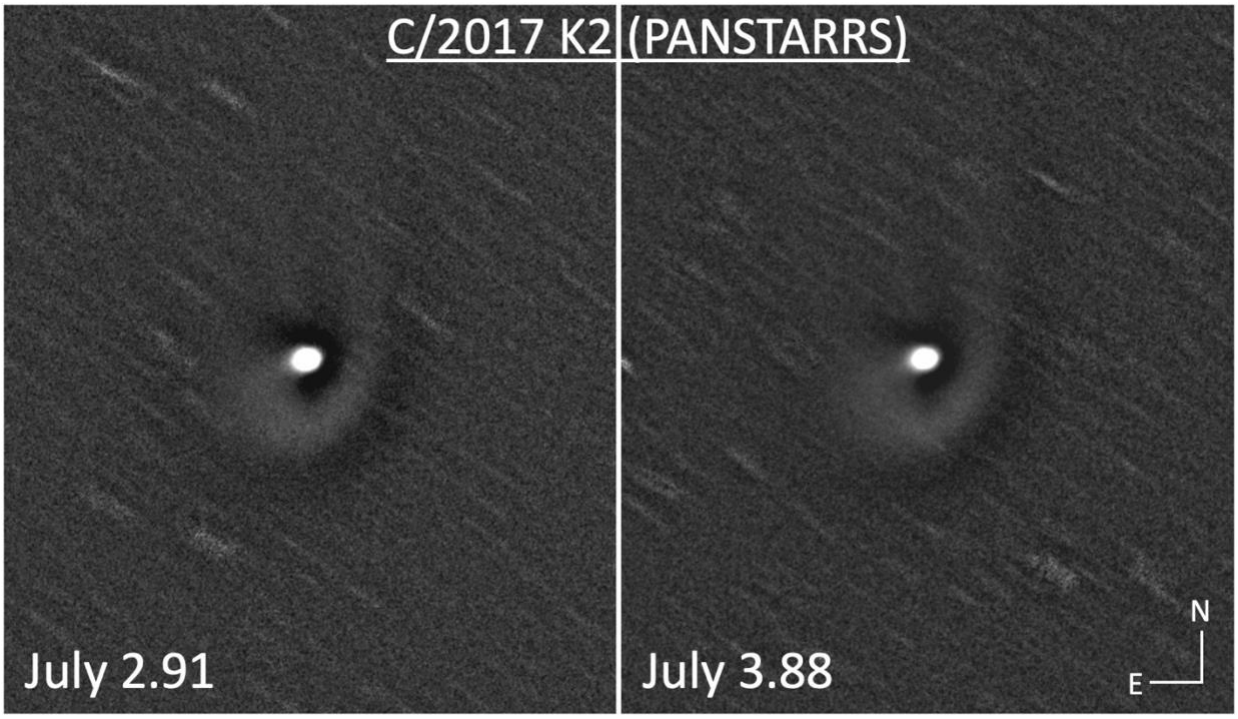


Figure 1 - C/2017 K2 (PANSTARRS)'s persistent jet structure was seen on consecutive nights in images taken by Carl Hergenrother with the Skygems Observatory 0.5-m iDK at Hakos, Namibia. Both images are a co-add of 15 60-s exposures in a Luminance filter. The images were processed with a radial gradient filter to minimize the contribution of background coma and enhance the view of fin structure like jets and shells.

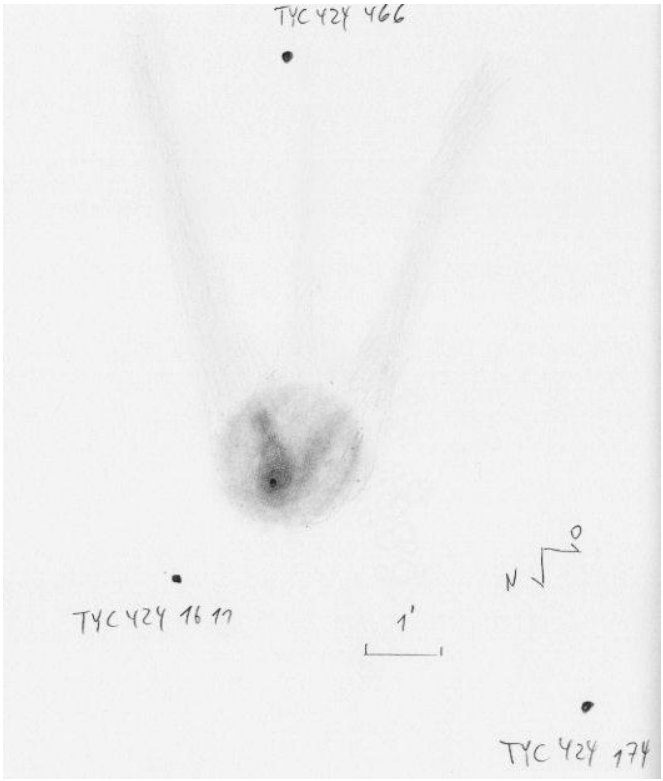


Figure 2 - Uwe Pilz sketched C/2017 K2 on June 21. Similar to Michael Rosolina's sketch on this issue's cover, the Uwe visually saw fine structure within K2's coma.

Figure 3 -Dan Bartlett produced this image of C/2017 K2 from 87 90-s co-added exposures taken on June 24 with a RASA11 schmidt telescope and ASI2600MC-Pro camera. The image shows a broad dust tail extending to the north (towards top) and a fainter gas tail to the south (towards bottom).

C/2021 E3 (ZTF)

Discovered 2021 March 9 by the Zwicky Transient Facility on Mount Palomar
Dynamically new long-period comet

Orbit (from Minor Planet Center, MPEC 2022-N37)

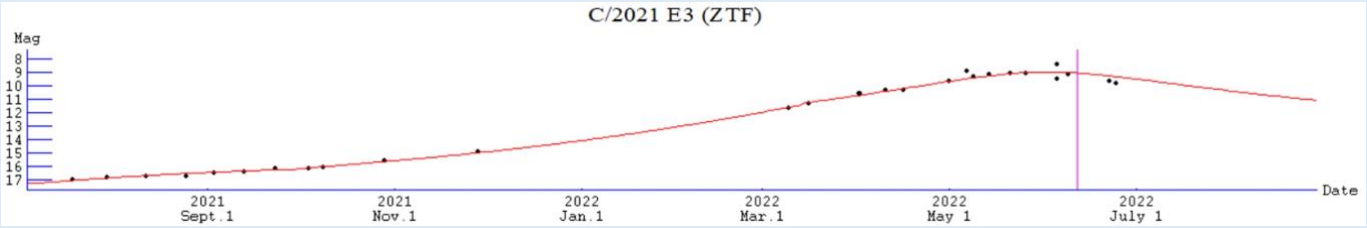
```
    C/2021 E3 (ZTF)
Epoch 2022 Aug. 9.0 TT = JDT 2459800.5
T 2022 June 11.91204 TT                                  Rudenko
q   1.7773866           (2000.0)            P               Q
z  -0.0005070      Peri.  228.85104     -0.11525527     -0.43253508
 +/-0.0000006      Node   104.46919     -0.37416676     +0.85281739
e   1.0009011      Incl.  112.55497     -0.92017143     -0.29260196
From 1023 observations 2021 Mar. 9-2022 July 1, mean residual 0".4.
1/a(orig) = -0.000044 AU**-1, 1/a(fut) = +0.000607 AU**-1.
```

Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

```
C/2021 E3 (ZTF)                                                      Max El
                                                                      (deg)
    Date       R.A.    Decl.      r       d     Elong  Const  Mag   40N  40S
2022-Jul-01  08 49  -60 13    1.794   1.523     87E    Car    9.5     0   48
2022-Jul-06  09 01  -56 35    1.804   1.612     83E    Vel    9.6     0   46
2022-Jul-11  09 10  -53 29    1.816   1.704     79E    Vel    9.8     0   44
2022-Jul-16  09 18  -50 49    1.831   1.799     75E    Vel    9.9     0   41
2022-Jul-21  09 25  -48 33    1.847   1.894     71E    Vel   10.1     0   38
2022-Jul-26  09 30  -46 39    1.865   1.988     68E    Vel   10.2     0   35
2022-Jul-31  09 36  -45 02    1.886   2.080     64E    Vel   10.4     0   31
2022-Aug-05  09 41  -43 41    1.908   2.169     61E    Vel   10.5     0   28
```

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 = 8.7 + 5 log d +  9.0 log r [through T-255 days]
m1 = 3.0 + 5 log d + 19.4 log r [T-255 to T-100 days and onwards]
m1 = 5.3 + 5 log d + 12.5 log r [T-100 and onwards]
```



Recent Magnitude Measurements Contributed to the ALPO Comets Section

```
Recent Magnitude Measurements in ICQ format:
Comet Des  YYYY MM DD.DD     Mag SC APER FL POW    COMA     TAIL     ICQ    CODE  Observer Name
               (UT)                    T          Dia  DC  LENG  PA
   2021E3  2022 06 24.46 xM 10.7 AQ 40.0L 4  59   4    6   5.5 m160 ICQ XX WYA   Christopher Wyatt
   2021E3  2022 06 22.48 xM 10.6 AQ 40.0L 4  59   4.1  5            ICQ xx WYA   Christopher Wyatt
   2021E3  2022 06 05.46 xM  9.3 AQ 40.0L 4  59   5.5  6            ICQ xx WYA   Christopher Wyatt
   2021E3  2022 06 05.45 xM  9.8 TK  7.0B    11   7.8  3/           ICQ xx WYA   Christopher Wyatt
```

The Zwicky Transient Facility discovered C/2021 E3 on 2021 March 9 at 19th magnitude. Though a dynamically new long-period comet, it had brightening rapidly since discovery. C/2021 E3 was at perihelion last month on the 11th at 1.78 au. Unfortunately, it never got very close to Earth with a minimum comet-Earth distance of 1.21 back on May 31.

Chris Wyatt visually observed C/2021 E3 on three nights in June. He found the comet to have faded from around magnitude 9.3-9.8 on June 6 to magnitude 10.6-10.7 on June 22 and 24. His most recent observations detected a 5.5' long tail and 4' coma. An observation from July 2 submitted by Thomas Lehmann to COBS on found a much larger coma at 9.8' and 0.17 deg long tail.

Based on Chris' magnitude estimates, it appears that C/2021 E3 is already fading which is not surprising as it is moving away from the Sun (1.79 to 1.89 au in July) and Earth (1.52 to 2.10 au). It should drop from around magnitude 9.5 to 10.4 this month.

As has been the case for past few months, C/2021 E3 is a southern hemisphere object as it is located deep in the southern sky moving through Carina (July 1-5) and Vela (5-31). Northern observers will have to wait till November to get another chance at observing C/2021 E3. By then it may be no brighter than 12th magnitude.

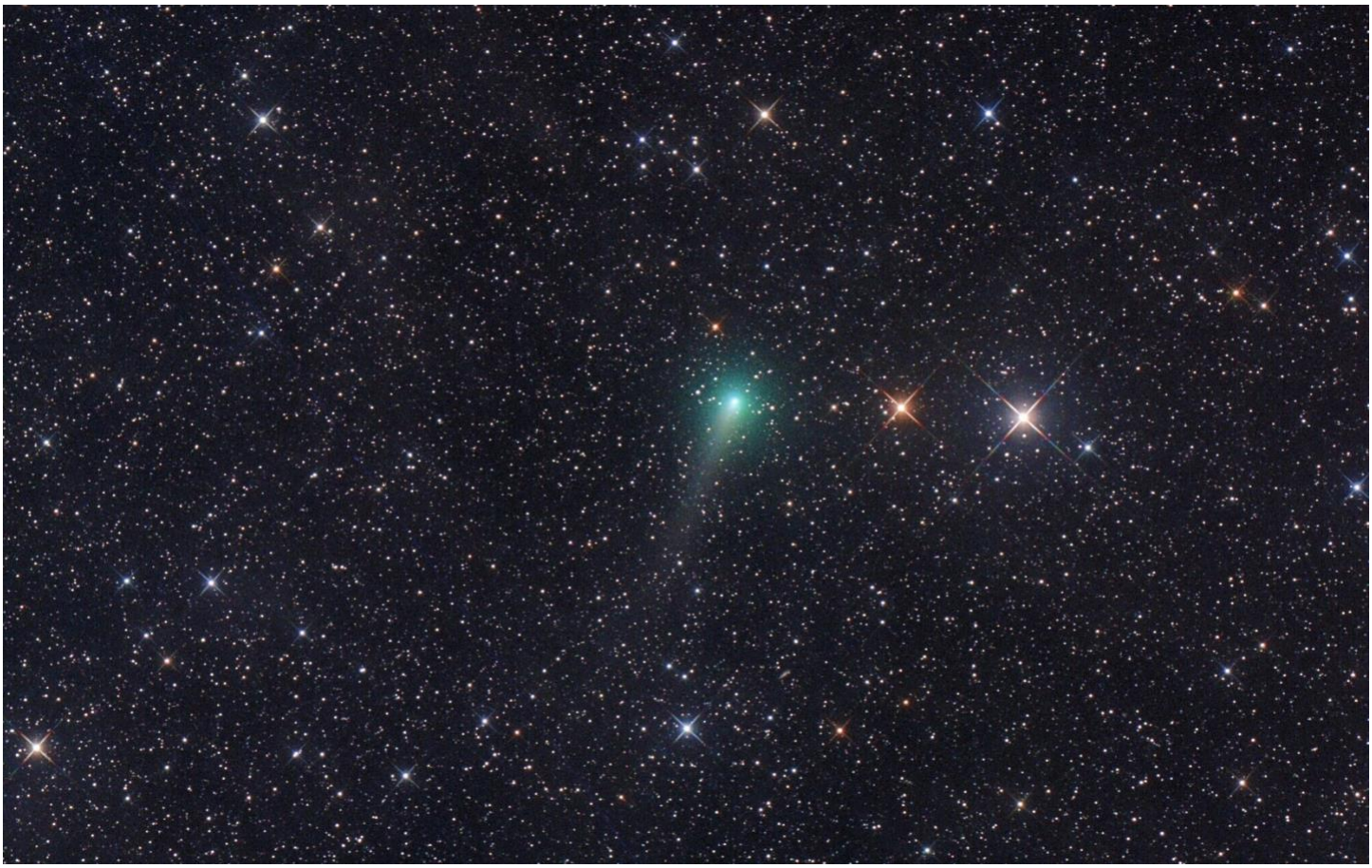


Figure 4 -Michael Jager and Lukas Demetz used a ASA H8 telescope equipped with a QHY600 camera at the Skygems Observatory site in Hakos, Namibia on 2022 June 27 to image C/2021 E3 (ZTF). The image is a LRGB composite with 600/150/150/150-s total exposures in each band.

Comets Between Magnitude 10 and 13

22P/Kopff

Discovered photographically on 1906 August 23 by August Kopff at the Königstuhl Observatory in Heidelberg, Germany

Orbit (from Minor Planet Center MPEC 2022-N37)

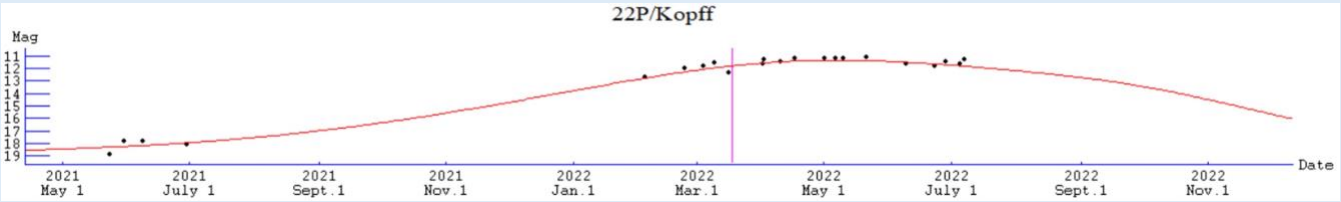
```
  22P/Kopff
Epoch 2022 Aug. 9.0 TT = JDT 2459800.5
T 2022 Mar. 18.14995 TT                                  Rudenko
q   1.5523748            (2000.0)            P              Q
n   0.15434357     Peri.  163.03397     +0.24042658     +0.96806818
a   3.4419959      Node   120.82713     -0.89989008     +0.24971239
e   0.5489899      Incl.    4.74180     -0.36385836     +0.02208447
P   6.39
From 3924 observations 2008 Jan. 30-2022 July 5, mean residual 0".7.
     Nongravitational parameters A1 = +0.04, A2 = -0.0394.
```

Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

```
22P/Kopff                                                          Max El
                                                                    (deg)
    Date       R.A.    Decl.     r       d     Elong  Const  Mag   40N  40S
2022-Jul-01  01 00  +02 41   1.868   1.679    83M    Psc  11.8    26   46
2022-Jul-06  01 07  +03 09   1.894   1.655    86M    Psc  11.8    29   46
2022-Jul-11  01 14  +03 32   1.921   1.631    89M    Psc  11.9    33   46
2022-Jul-16  01 20  +03 51   1.948   1.606    93M    Psc  12.0    36   46
2022-Jul-21  01 25  +04 05   1.976   1.581    96M    Psc  12.0    40   46
2022-Jul-26  01 29  +04 15   2.004   1.556   100M    Psc  12.1    43   46
2022-Jul-31  01 33  +04 21   2.032   1.531   104M    Psc  12.2    47   46
2022-Aug-05  01 36  +04 21   2.061   1.506   108M    Psc  12.3    49   46
```

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 = 6.1 + 5 log d + 19.4 log r(t-42)
where "t" is date of perihelion, "d" is Comet-Earth distance in au, and "r" is Comet-Sun distance in au
```



Recent Magnitude Measurements Contributed to the ALPO Comets Section

```
Recent Magnitude Measurements in ICQ format:
Comet Des  YYYY MM DD.DD     Mag SC APER FL POW    COMA     TAIL    ICQ CODE Observer Name
              (UT)                    T         Dia  DC  LENG  PA
22         2022 07 07.10  S 11.3 TK 20.3T10  77   4    2/           ICQ XX GON05 Juan Jose Gonzalez
22         2022 06 28.10  S 10.8 TK 20.3T10  77   3    2/           ICQ XX GON05 Juan Jose Gonzalez
```

Though 22P/Kopff is ~4 months removed from its 2022 March 18 perihelion (q=1.55 au), it is still close to maximum brightness. This is due to a strong seasonal effect resulting in the comet's activity peaking ~2 months after perihelion and the fact that Kopff is still moving closer to Earth (minimum distance on September 14 at 1.39 au).

Kopff is a morning object and, like last month, will spend the month in Pisces. Kopff should fade from around magnitude 11.8 to 12.2 in July. Imagers should be on the lookout for any sign of dust trail or anti-tail as orbit plane crossing occurs on July 24.

73P/Schwassmann-Wachmann

Discovered photographically on 1930 May 30 by Arnold Schwassmann and Arno Arthur Wachmann at Hamburg Observatory in Bergedorf, Germany

Orbit (from Minor Planet Center MPEC 2022-N37)

```
  73P/Schwassmann-Wachmann
Epoch 2022 Aug. 9.0 TT = JDT 2459800.5
T 2022 Aug. 25.79326 TT                                  Rudenko
q   0.9729675            (2000.0)            P              Q
n   0.18127566     Peri.  199.48952     -0.02170306     +0.98296417
a   3.0920254      Node    69.60989     -0.88948690     +0.06436104
e   0.6853300      Incl.   11.22788     -0.45644500     -0.17216012
P   5.44
From 2358 observations 2016 Feb. 13-2022 July 2, mean residual 0".8.
```

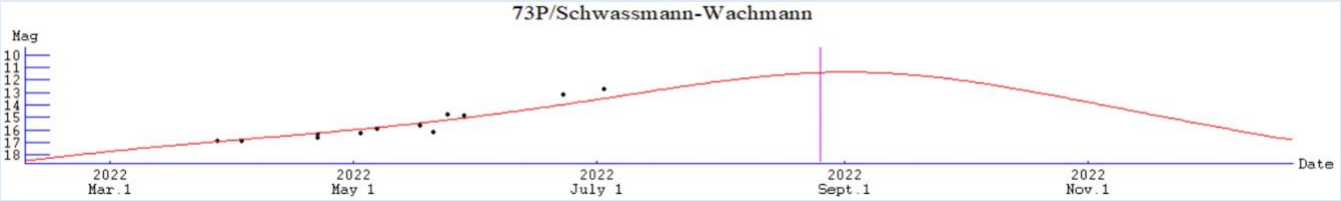
Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

73P/Schwassmann-Wachmann

Date	R.A.	Decl.	r	d	Elong	Const	Mag	Max El (deg) 40N	40S
2022-Jul-01	10 59	+14 07	1.245	1.340	62E	Leo	13.6	19	30
2022-Jul-06	11 10	+12 14	1.205	1.321	60E	Leo	13.3	17	30
2022-Jul-11	11 21	+10 14	1.167	1.300	59E	Leo	13.1	14	31
2022-Jul-16	11 34	+08 06	1.131	1.276	57E	Leo	12.8	13	31
2022-Jul-21	11 46	+05 50	1.098	1.250	56E	Vir	12.6	11	32
2022-Jul-26	12 00	+03 26	1.068	1.223	56E	Vir	12.4	9	32
2022-Jul-31	12 14	+00 53	1.041	1.194	55E	Vir	12.1	8	33
2022-Aug-05	12 29	-01 47	1.018	1.165	55E	Vir	11.9	7	34

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 = 11.7 + 5 log d + 15.0 log r
where "t" is date of perihelion, "d" is Comet-Earth distance in au, and "r" is Comet-Sun distance in au
```



Recent Magnitude Measurements Contributed to the ALPO Comets Section

```
Recent Magnitude Measurements in ICQ format:
Comet Des  YYYY MM DD.DD     Mag SC APER FL POW    COMA     TAIL    ICQ CODE Observer Name
               (UT)                    T         Dia  DC  LENG  PA
None
```

Friedrich Karl Arnold Schwassmann and Arno Arthur Wachmann worked together at the Bergedorf Observatory in Hamburg, Germany where they discovered 4 comets including C/1930 D1 (Peltier-Schwassmann-Wachmann), outburst Centaur 29P/Schwassmann-Wachmann, 31P/Schwassmann-Wachmann, and 73P/Schwassmann-Wachmann. 73P was discovered photographically on 1930 May 2 at 9-10th magnitude. A pre-discovery image was found by H. Schneller of the Berlin-Babelsberg Observatory on plates exposed on April 27 and 29. The 1930 return was excellent with the comet passing 0.062 au from Earth on May 31 and reaching 6-7th magnitude.

A series of poor returns after 1930 led to 73P being lost until it was accidentally rediscovered in 1979 by J. Johnston and M. Buhagiar of Perth Observatory. The 1979 return was very similar to this year's with 73P reaching 12th magnitude. It was well observed in 1990 when it passed 0.37 au from Earth and peaked at 9th magnitude. The 1995 return was not expected to be a bright one but a series of outbursts resulted in a jump in brightness from 12th to 6th magnitude. The outbursts were the result of a splitting events that saw the release of 3-4 secondary

components. The next return in 2000 was poor. Even then, two nuclei were observed. 2006 saw the comet's best return since 1930 with a close approach to Earth of 0.07 au. Visual observers were treated to a bright double comet with components B and C reaching 4-5th magnitude. Imagers detected dozens of fainter components with some components like B and G shedding hundreds of short-lived smaller components during the course of the apparition. While only a single component, the primary C, was seen in 2011, 2017 saw the C component return as well as a new secondary, designated BT. 2017 also saw 73P experience a ~2 magnitude brightening many months after perihelion.

73P is an evening object and should brighten from magnitude 13.6 to 12.1 this month as it moves through Leo (July 1-17) and Virgo (17-31). Though only a single component, the primary 'C', has been observed so far, observers should always be on the lookout for additional components. A peak brightness around magnitude 11.5 may be reached in early September. The comet will be well placed for southern hemisphere observers. It will be much more difficult for northern observers during the entire bright part of the apparition, especially around the time of maximum brightness.

Looking at 73P's orbital evolution between 1900 and 2022, perihelion has stayed around 1.0 au with a maximum of 1.07 au and minimum of 0.89 au. Currently, perihelion is at 0.93 au though a close approach to Jupiter in 2025 will drop it further with a new minimum of 0.89 au being reached in the coming decades. As is common when perihelia are around 1 au, most returns see the comet passing at 1 au or further from Earth. The best apparitions between 1900 and 2100 are the aforementioned 1930 and 2006 returns. Three additional good to very good apparitions will occur throughout the remainder of the century (close approaches to Earth of 0.60 au in 2033, 0.20 au in 2054, and 0.12 au in 2070).

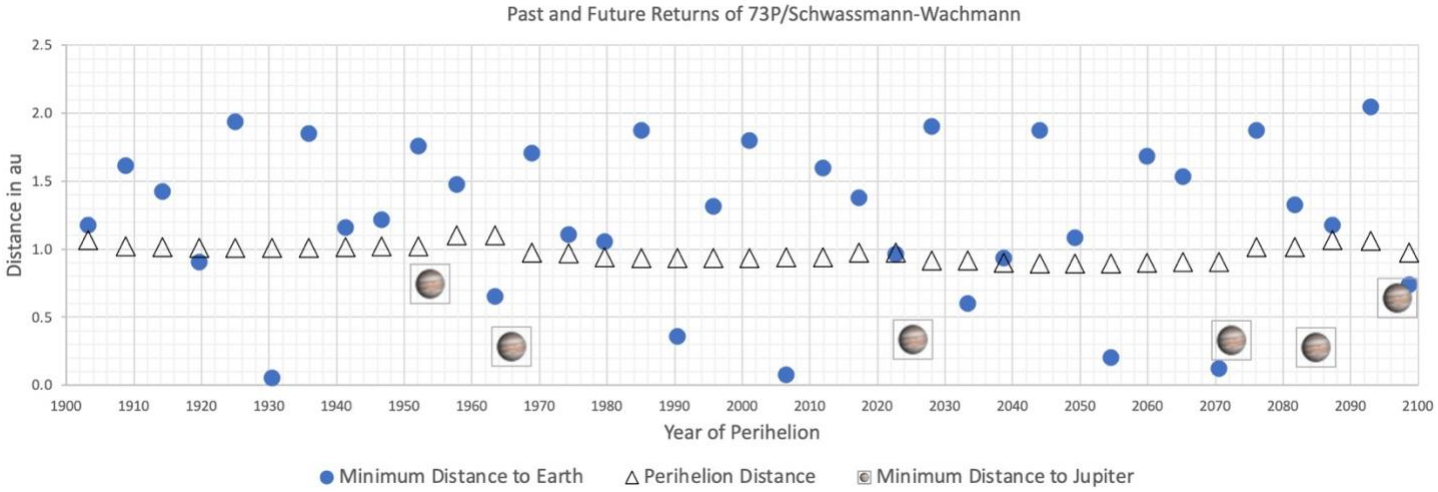


Figure 5 - Orbital evolution of 73P/Schwassmann-Wachmann. From the JPL Horizons service.

169P/NEAT

Discovered digitally on 2002 March 15 by the NEAT program with the 1.2m Schmidt on Mount Palomar

Orbit (from Minor Planet Center, MPEC 2022-M88)

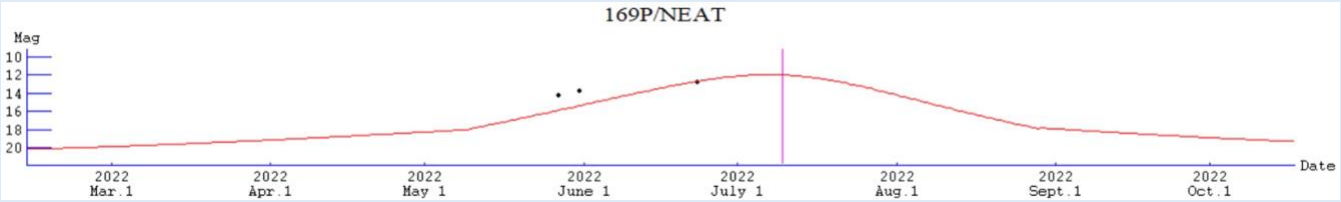
```
169P/NEAT
Epoch 2022 Aug. 9.0 TT = JDT 2459800.5
T 2022 July  9.68234 TT                                  Rudenko
q   0.6028241            (2000.0)            P              Q
n   0.23480837     Peri.  218.04514     +0.82678564     -0.56235944
a   2.6021180      Node   176.10213     +0.55209863     +0.80670940
e   0.7683333      Incl.   11.29854     +0.10776182     +0.18158139
P   4.20
From 1299 observations 1989 Mar. 7-2022 June 26, mean residual 0".5.
```

Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

```
169P/NEAT                                                          Max El
                                                                    (deg)
    Date       R.A.    Decl.      r       d     Elong  Const  Mag   40N  40S
2022-Jul-01  04 24  +20 09   0.626   1.206     31M   Tau  12.1     0    7
2022-Jul-06  04 58  +20 10   0.607   1.269     28M   Tau  12.0     0    5
2022-Jul-11  05 31  +19 54   0.603   1.338     25M   Tau  12.0     0    2
2022-Jul-16  06 03  +19 23   0.615   1.410     22M   Ori  12.3     0    1
2022-Jul-21  06 32  +18 41   0.641   1.483     20M   Gem  12.8     0    0
2022-Jul-26  07 00  +17 50   0.679   1.556     18M   Gem  13.4     0    0
2022-Jul-31  07 26  +16 52   0.726   1.628     17M   Gem  14.1     0    0
2022-Aug-05  07 50  +15 49   0.780   1.698     16M   Gem  14.8     0    0
```

Comet Magnitude Formula (from Yoshida Seiichi's page)

```
H  = 15.3, G = 0.15 [before T-61 and after T+50 days]
m1 = 15.8 + 5 log d + 20.0 log r [between T-61 and T+50 days]
where "t" is date of perihelion, "d" is Comet-Earth distance in au, and "r" is Comet-Sun distance in au
```



Recent Magnitude Measurements Contributed to the ALPO Comets Section

```
Recent Magnitude Measurements in ICQ format:
Comet Des   YYYY MM DD.DD     Mag SC APER FL POW    COMA     TAIL    ICQ CODE Observer Name
               (UT)                    T         Dia  DC  LENG  PA
None
```

169P/NEAT was found with the 1.2-m Oschin Schmidt on Mount Palomar on 2002 March 15, around 8 months after perihelion. Since no cometary activity was noticed in 2002, the object was designated as asteroid 2002 EX12. 169P/NEAT is an example of a short-period comet that is only active for a few months around perihelion. According to Yoshida Seiichi, 169P is active from ~60 days before to ~50 days after perihelion. This year those times correspond to May 9 when it will be 1.22 au from the Sun through perihelion on July 9 at 0.60 au and back to inactivity on August 28 at 1.06 au.

169P should peak around magnitude 12 around perihelion as it moves through Taurus (July 1-13), Orion (13-18), and Gemini (18-31) in the morning sky. Invisible from the northern hemisphere, it will also disappear from the southern hemisphere by mid-month.

C/2019 L3 (ATLAS)

Discovered 2019 June 10 by the ATLAS survey with one of their 0.5-m f/2 Schmidt

Orbit (from Minor Planet Center, MPEC 2022-M88)

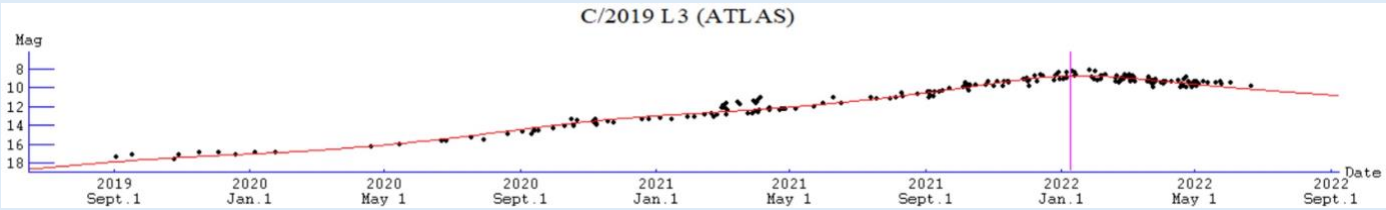
```
    C/2019 L3 (ATLAS)
Epoch 2022 Aug. 9.0 TT = JDT 2459800.5
T 2022 Jan.  9.61852 TT                                  Rudenko
q   3.5544249           (2000.0)            P               Q
z  -0.0005067      Peri.  171.61011     -0.26046920     -0.66637164
 +/-0.0000003      Node   290.78799     +0.83677328     +0.20516884
e   1.0018011      Incl.   48.35648     +0.48162877     -0.71683652
From 5317 observations 2019 June 10-2022 June 8, mean residual 0".4.
1/a(orig) = +0.000113 AU**-1, 1/a(fut) = -0.000870 AU**-1.
```

Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

```
C/2019 L3 (ATLAS)                                                    Max El
                                                                      (deg)
    Date       R.A.    Decl.      r       d     Elong  Const  Mag    40N  40S
2022-Jul-01  08 03   +04 54    3.881    4.755    27E    CMi   10.2     0   10
2022-Jul-06  08 08   +04 10    3.900    4.796    25E    CMi   10.3     0    8
2022-Jul-11  08 14   +03 25    3.918    4.834    22E    Hya   10.3     0    5
2022-Jul-16  08 19   +02 39    3.937    4.868    21E    Hya   10.4     0    2
2022-Jul-21  08 24   +01 52    3.956    4.899    19E    Hya   10.4     0    0
2022-Jul-26  08 29   +01 04    3.976    4.925    18E    Hya   10.5     0    0
2022-Jul-31  08 35   +00 14    3.996    4.948    18E    Hya   10.5     0    0
2022-Aug-05  08 40   -00 35    4.017    4.967    18E    Hya   10.5     0    0
```

Comet Magnitude Formula and Lightcurve (from ALPO and COBS data)

```
m1 = -3.8 + 5 log d + 18.8 log r(t - 64)
where "t" is date of perihelion, "d" is Comet-Earth distance in au, and "r" is Comet-Sun distance in au
```



Recent Magnitude Measurements Contributed to the ALPO Comets Section

```
Recent Magnitude Measurements in ICQ format:
Comet Des YYYY MM DD.DD    Mag SC APER FL POW   COMA     TAIL   ICQ CODE Observer Name
               (UT)                  T       Dia  DC  LENG  PA
```

Another comet already lost to northern hemisphere observers and soon to disappear from the southern hemisphere sky as well is long-period comet. C/2019 L3 (ATLAS) is now well passed its 2022 January 9 perihelion at 3.55 au but still close to its maximum brightness. Observations of L3 have been scarce recently. Thomas Lehmann reported two observations to COBS in June. On June 2, Thomas imaged the comet at magnitude 10.0 with an 8.7' coma and 0.3 deg long tail. A few weeks later on June 21, the comet was fainter at magnitude 10.3 with a smaller 5.4' coma and shorter 0.24 deg tail.

For those intrepid observers able to observe L3 at low elevations just after the end of dusk, the comet should still be around magnitude 10.2 to 10.5 as it moves through Canis Minor (July 1-8) and Hydra (8-31). After solar conjunction, L3 will reappear in August for southern observers and September for northern observers. It may still be brighter than magnitude 11 at that time.

C/2019 T4 (ATLAS)

Discovered 2019 October 9 by the ATLAS survey
Dynamically old long-period comet

Orbit (from Minor Planet Center, MPEC 2022-N37)

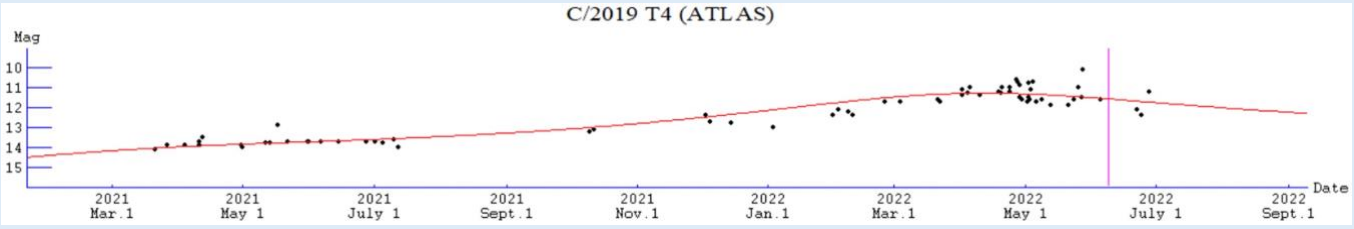
```
    C/2019 T4 (ATLAS)
Epoch 2022 Aug. 9.0 TT = JDT 2459800.5
T 2022 June  9.09878 TT                                  Rudenko
q   4.2423864           (2000.0)            P              Q
z  +0.0010045      Peri.  351.19516     -0.95993308     +0.05594340
 +/-0.0000003      Node   199.93879     -0.18187480     -0.86983189
e   0.9957384      Incl.   53.63024     -0.21319015     +0.49016611
From 1639 observations 2019 Feb. 5-2022 July 2, mean residual 0".4.
1/a(orig) = +0.000628 AU**-1, 1/a(fut) = +0.000967 AU**-1.
```

Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

```
C/2019 T4 (ATLAS)                                                    Max El
                                                                      (deg)
    Date       R.A.    Decl.      r       d     Elong  Const  Mag   40N  40S
2022-Jul-01  12 04   -05 07    4.246   4.228     84E    Vir   11.8    18   54
2022-Jul-06  12 07   -04 43    4.248   4.305     79E    Vir   11.8    16   52
2022-Jul-11  12 11   -04 22    4.251   4.382     75E    Vir   11.8    14   49
2022-Jul-16  12 14   -04 04    4.253   4.458     71E    Vir   11.9    12   47
2022-Jul-21  12 19   -03 49    4.257   4.532     67E    Vir   11.9    11   44
2022-Jul-26  12 23   -03 36    4.260   4.606     64E    Vir   12.0     9   41
2022-Jul-31  12 27   -03 25    4.264   4.677     60E    Vir   12.0     8   38
2022-Aug-05  12 32   -03 17    4.269   4.746     56E    Vir   12.0     7   35
```

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 = -1.3 + 5 log d + 15.8 log r
```



Recent Magnitude Measurements Contributed to the ALPO Comets Section

```
Recent Magnitude Measurements in ICQ format:
Comet Des  YYYY MM DD.DD     Mag SC APER FL POW    COMA     TAIL     ICQ    CODE  Observer Name
               (UT)                      T         Dia  DC  LENG  PA
   2019T4  2022 06 27.93  S 10.9 TK 20.3T10  77   4    3           ICQ XX GON05 Juan Jose Gonzalez Suarez
   2019T4  2022 06 24.45 xM 13.0 AQ 40.0L 4 108   1    6           ICQ XX WYA   Christopher Wyatt
   2019T4  2022 06 22.47 xM 12.7 AQ 40.0L 4 108   1.6  6           ICQ XX WYA   Christopher Wyatt
   2019T4  2022 06 05.44 xM 12.2 AQ 40.0L 4  59   1.9  5/          ICQ xx WYA   Christopher Wyatt
```

C/2019 T4 (ATLAS) was discovered on 2019 October 6 at 19th magnitude with the ATLAS 0.5-m reflector at Haleakala when at a still distant 8.6 au from the Sun. T4 finally arrived at perihelion on 2022 June 9 (q = 4.24 au). Visual observers J. J. Gonzalez and Chris Wyatt both observed T4 in June. Chris found the comet between magnitude 12.2 and 13.0 with a 1.0 to 1.9' coma in a 0.4-m reflector. J. J. found the comet brighter at magnitude 10.9 in a 0.2-m SCT with a 4' coma. Applying aperture and personal corrections results in magnitude between 11.2 and 12.4. July should see more of the same with C/2019 T4 is visible from both hemispheres (though getting difficult from the northern hemisphere) in the evening sky in the constellation Virgo and slowly fading around magnitude 12.

C/2020 V2 (ZTF)

Discovered 2020 November 2 by the ZTF survey
Dynamically new long-period comet

Orbit (from Minor Planet Center, MPEC 2022-M88)

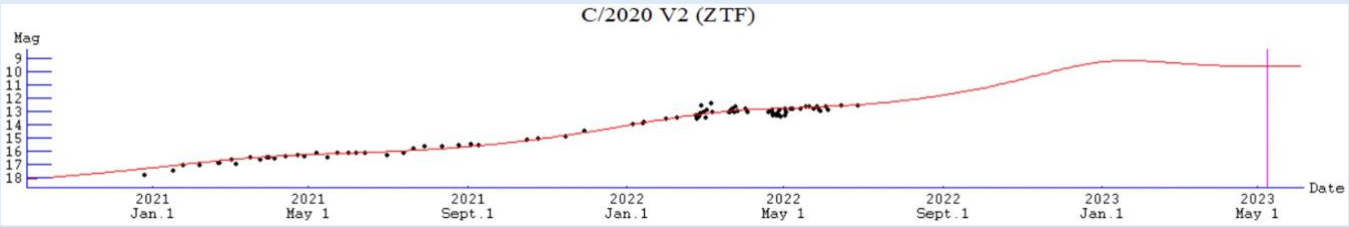
```
    C/2020 V2 (ZTF)
Epoch 2022 Aug. 9.0 TT = JDT 2459800.5
T 2023 May 8.53701 TT                                    Rudenko
q   2.2280130          (2000.0)            P               Q
z  -0.0004464      Peri.  162.41920     +0.69776675     +0.59404260
 +/-0.0000005      Node   212.37023     +0.53386761     -0.05867504
e   1.0009946      Incl.  131.61104     +0.47760542     -0.80229087
From 2661 observations 2020 Apr. 18-2022 June 23, mean residual 0".4.
1/a(orig) = -0.000146 AU**-1, 1/a(fut) = -0.000384 AU**-1.
```

Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

```
C/2020 V2 (ZTF)                                                      Max El
                                                                      (deg)
    Date       R.A.    Decl.      r       d     Elong  Const  Mag    40N  40S
2022-Jul-01  09 52  +55 26   4.027   4.635     48E    UMa   12.5     30    0
2022-Jul-06  09 53  +55 01   3.986   4.630     45E    UMa   12.4     28    0
2022-Jul-11  09 55  +54 37   3.946   4.620     43E    UMa   12.4     26    0
2022-Jul-16  09 56  +54 14   3.905   4.605     41E    UMa   12.3     24    0
2022-Jul-21  09 58  +53 54   3.865   4.584     40E    UMa   12.3     22    0
2022-Jul-26  10 00  +53 35   3.825   4.558     39E    UMa   12.3     21    0
2022-Jul-31  10 03  +53 19   3.784   4.525     38E    UMa   12.2     20    0
2022-Aug-05  10 06  +53 05   3.744   4.487     38E    UMa   12.1     19    0
```

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 =  1.3 + 5 log d + 12.4 log r [through -400 days]
m1 =  4.3 + 5 log d +  8.0 log r [-400 days and onward, assumed]
```



Recent Magnitude Measurements Contributed to the ALPO Comets Section

```
Recent Magnitude Measurements in ICQ format:
Comet Des  YYYY MM DD.DD     Mag SC APER FL POW    COMA     TAIL    ICQ    CODE  Observer Name
              (UT)                    T          Dia  DC  LENG  PA
   2020V2  2022 06 27.94  S 12.9 AQ 20.3T10 133   1.1  6           ICQ XX GON05 Juan Jose Gonzalez Suarez
   2020V2  2022 06 04.98  S 13.3 TI 29.8L 4 132   0.8  3/          ICQ XX HAR11 Christian Harder
```

The Zwicky Transient Facility (ZTF) used the 1.2-m Oschin Schmidt on Mount Palomar to discover C/2020 V2 (ZTF) on 2020 November 2 at 19th magnitude (the same telescope used by NEAT to find 169P). At discovery, the comet was approximately 2.5 years from perihelion and over 8 au from the Sun. The comet is a few months shy of a year from its 2023 May 8 perihelion at 2.23 au.

J. J. Gonzalez and Christian Harder observed C/2020 V2 in June between magnitude 12.9 and 13.3 (aperture corrected to between 12.6 and 12.9). V2 is located far to the north in Ursa Major and only visible to northern observers. It should continue to slowly brighten to around magnitude 12 by the end of July. Assuming a 2.5n = 8 brightening rate, V2 may reach magnitude 9 in January-February 2023 when it will still be a northern circumpolar object and again in September 2023 when it will be visible from both hemispheres.

C/2021 P4 (ATLAS)

Discovered 2021 August 10 by the ATLAS survey
Dynamically old long-period comet

Orbit (from Minor Planet Center, MPEC 2022-N37)

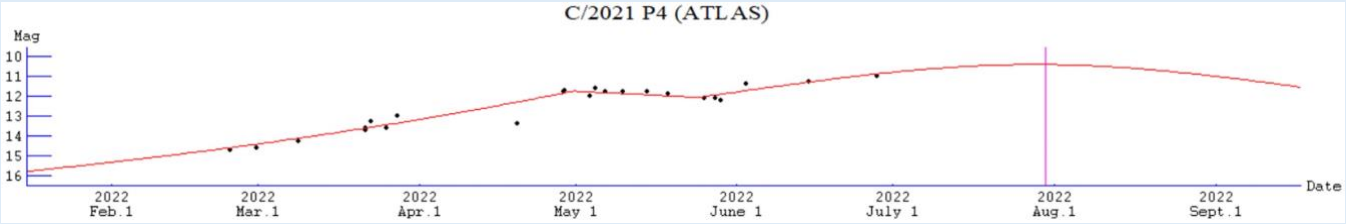
```
    C/2021 P4 (ATLAS)
Epoch 2022 Aug. 9.0 TT = JDT 2459800.5
T 2022 July 30.36797 TT                                  Rudenko
q   1.0804548           (2000.0)            P              Q
z  +0.0030941      Peri.  175.81939     -0.96754335     -0.18545958
 +/-0.0000011      Node   348.09446     +0.20094589     -0.15275294
e   0.9966570      Incl.   56.31075     +0.15323385     -0.97070659
From 951 observations 2021 Aug. 10-2022 July 4, mean residual 0".6.
1/a(orig) = +0.003512 AU**-1, 1/a(fut) = +0.003250 AU**-1.
```

Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

```
C/2021 P4 (ATLAS)                                                    Max El
                                                                      (deg)
    Date       R.A.    Decl.      r       d     Elong  Const  Mag   40N  40S
2022-Jul-01  08 34  +37 23    1.183   1.969     28E    Lyn  11.3     9    0
2022-Jul-06  08 51  +33 43    1.152   1.962     27E    Lyn  11.2     6    0
2022-Jul-11  09 07  +29 53    1.127   1.958     25E    Cnc  11.1     3    0
2022-Jul-16  09 21  +25 57    1.106   1.958     23E    Cnc  11.1     0    0
2022-Jul-21  09 35  +21 56    1.091   1.962     22E    Leo  11.0     0    0
2022-Jul-26  09 48  +17 53    1.083   1.968     21E    Leo  11.0     0    0
2022-Jul-31  10 00  +13 48    1.081   1.977     20E    Leo  11.0     0    1
2022-Aug-05  10 12  +09 44    1.084   1.988     19E    Leo  11.1     0    1
```

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 =  6.0 + 5 log d + 15.6 log r [Through 90 days before perihelion]
m1 = 11.7 + 5 log d -  7.1 log r [Between 90 and 67 days before perihelion]
m1 =  8.6 + 5 log d + 10.0 log r [From 67 days before perihelion and onwards, assumed]
```



Recent Magnitude Measurements Contributed to the ALPO Comets Section

```
Recent Magnitude Measurements in ICQ format:
Comet Des  YYYY MM DD.DD     Mag SC APER FL POW    COMA     TAIL    ICQ    CODE  Observer Name
              (UT)                        T         Dia  DC  LENG  PA
   2021P4  2022 06 27.92  S  9.7 TK 20.3T10  77   6    2           ICQ XX GON05 Juan Jose Gonzalez Suarez
```

C/2021 P4 (ATLAS) was discovered by the "Asteroid Terrestrial-Impact Last Alert System" (ATLAS) program on 2021 August 10 with a 0.5-m f/2 Schmidt telescope on Haleakala in Hawaii. At discovery, C/2021 P4 was 19th magnitude but has brightened considerably since then, perhaps due to it being a dynamically old long-period comet with an orbital period of ~5600 years.

Last month we showed some concern as P4 seemed to cease its brightening trend in May. June saw a resumption of its brightening bringing the comet to around magnitude 11 in July. It is possible P4 is brighter than this. The sole estimate submitted to the ALPO last month was by J. J. Gonzalez who found the comet at magnitude 9.7 on June 27.92 UT. While J. J.'s estimates can be brighter than most, his total magnitude estimate for P4 is ~1.5 magnitudes brighter than those of other observers (according to the COBS site). Perhaps the

difference in brightness is due to how much of the tail is included in the estimate. Differentiating the coma from the tail can be difficult especially for visual observations.

Unfortunately, P4 arrives at perihelion on 2022 July 30 at 1.08 au when it will be located on the other side of the Sun at a geocentric range of 1.98 au and at a low solar elongation. If perihelion had been in early March the comet would have passed within 0.1 au of Earth resulting in a much brighter comet. Though poorly placed, the comet may still be visible low in the evening sky for northern hemisphere observers during the first week or two of July. By the end of the month, southern hemispheres may get a chance to observe P4 though it will be a horizon hugger at an elevation of only 1 deg at the end of astronomical twilight at the end of July. August and September will see more of the same (low for SH observers, invisible for NH observers) with P4 not becoming better placed for observation until October, and then only for southern observers.

In images, C/2021 P4 remains a rather aesthetically pleasing comet. Even at a heliocentric distance under 1.2 au, it appears to be a dusty comet with a yellowish coma and tail and none of the usual blue-green due to gas. The comet's tail is also broad and nicely curved.

Figure 6 - Michael Jäger took this co-added 900-s exposure of C/2021 P4 with a 0.4-m on 2022 June 15.

C/2022 E3 (ZTF)

Discovered 2021 August 10 by the ATLAS survey
Dynamically old long-period comet

Orbit (from Minor Planet Center, MPEC 2022-N37)

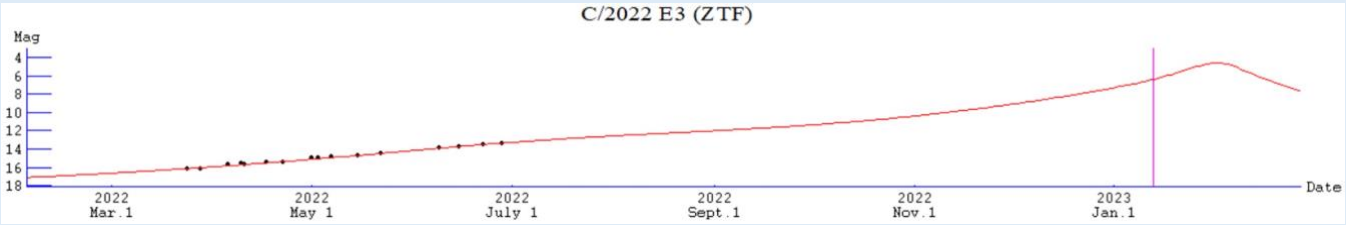
```
    C/2022 E3 (ZTF)
Epoch 2022 Aug. 9.0 TT = JDT 2459800.5
T 2023 Jan. 12.78644 TT                                  Rudenko
q   1.1122587          (2000.0)            P              Q
z  -0.0002535      Peri.  145.81435     -0.60062726     -0.07339958
 +/-0.0000049      Node   302.55393     +0.33752539     +0.87941795
e   1.0002820      Incl.  109.16859     +0.72479204     -0.47035792
From 1219 observations 2021 Oct. 25-2022 July 5, mean residual 0".4.
1/a(orig) = +0.000754 AU**-1, 1/a(fut) = -0.000036 AU**-1.
```

Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

```
C/2022 E3 (ZTF)                                                    Max El
                                                                    (deg)
    Date      R.A.    Decl.     r       d     Elong  Const  Mag   40N  40S
2022-Jul-01  19 01  +31 43   2.990   2.290   124M   Lyr  13.3    82   18
2022-Jul-06  18 48  +32 57   2.934   2.239   124E   Lyr  13.1    83   17
2022-Jul-11  18 35  +33 59   2.878   2.197   122E   Lyr  13.0    84   16
2022-Jul-16  18 20  +34 49   2.822   2.165   120E   Lyr  12.9    85   15
2022-Jul-21  18 06  +35 25   2.766   2.141   117E   Her  12.8    85   15
2022-Jul-26  17 51  +35 47   2.709   2.125   114E   Her  12.7    86   14
2022-Jul-31  17 37  +35 54   2.652   2.118   110E   Her  12.6    86   14
2022-Aug-05  17 23  +35 48   2.595   2.117   106E   Her  12.5    84   14
```

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 =  6.3 + 5 log d + 10.8 log r [Through 200 days before perihelion]
m1 =  6.7 + 5 log d + 10.0 log r [After 200 days after perihelion, assumed]
```



Recent Magnitude Measurements Contributed to the ALPO Comets Section

```
Recent Magnitude Measurements in ICQ format:
Comet Des  YYYY MM DD.DD     Mag SC APER FL POW    COMA     TAIL    ICQ    CODE  Observer Name
              (UT)                      T          Dia  DC  LENG  PA
   2022E3  2022 06 28.03  I 13.7 AQ 20.3T10 133   0.4  7            ICQ XX GON05 Juan Jose Gonzalez Suarez
   2022E3  2022 06 26.21  C 14.4 BG 30.5H 4a900             6   m170 ICQ XX MAIab John Maikner
   2022E3  2022 06 24.49 xM 14.1 AQ 40.0L 4 261   0.3  5/           ICQ XX WYA   Christopher Wyatt
   2022E3  2022 06 22.53 xM 14.1 AQ 40.0L 4 261   0.3  5/           ICQ XX WYA   Christopher Wyatt
   2022E3  2022 06 06.24  C 14.7 BG 30.5H 4a999                316 ICQ XX MAIab John Maikner
```

An early contender for Best Comet of 2023 is C/2022 E3 (ZTF) [not to be confused with the similarly designated C/2021 E3 (ZTF) described above]. It was discovered on 2022 March 2 at 17th magnitude by the Zwicky Transient Facility with the 1.2-m f/2.4 Schmidt on Mount Palomar. Pre-discovery observations also made by the ZTF were found in October and November 2021 when the comet was 20th magnitude.

C/2022 E3 is looking like it will a nice object at the end of 2022 and the first few months of 2023. Unlike C/2021 P4 (ATLAS), C/2022 E3 will be close to Earth at perihelion. With a perihelion on 2023 January 13 at 1.11 au and a minimum Earth-comet distance of 0.29 au on February 1, C/2022 E3 may get as bright as 4-6th magnitude.

At its brightest in late January / early February, C/2022 E3 will be well located for northern observers as a northern circumpolar object. Though it will spend the period between October 2022 and early February 2023 invisible from the southern hemisphere, southern observers will be able to pick up the comet again only a week or after closest approach to Earth when it will still be within 0.5-1.0 magnitude of peak brightness.

Visual observations by Chris Wyatt and J. J. Gonzalez and digital photometry by Thomas Lehmann and John Maikner found C/2022 E3 between magnitude 13.7 and 14.7 in June with a compact coma between 0.3 and 1.0' in diameter and short ~1' tail.

This month, C/2022 E3 is visible from both hemispheres though it is better placed for northern observers as it moves through the dense star fields of Lyra (July 1-18) and Hercules (18-31) near opposition (which occurs on July 4). With a heliocentric distance dropping from 2.99 to 2.64 au and geocentric distance falling from 2.29 to 2.12 au, C/2022 E3 should brighten from around magnitude 13.3 to 12.7 during July.

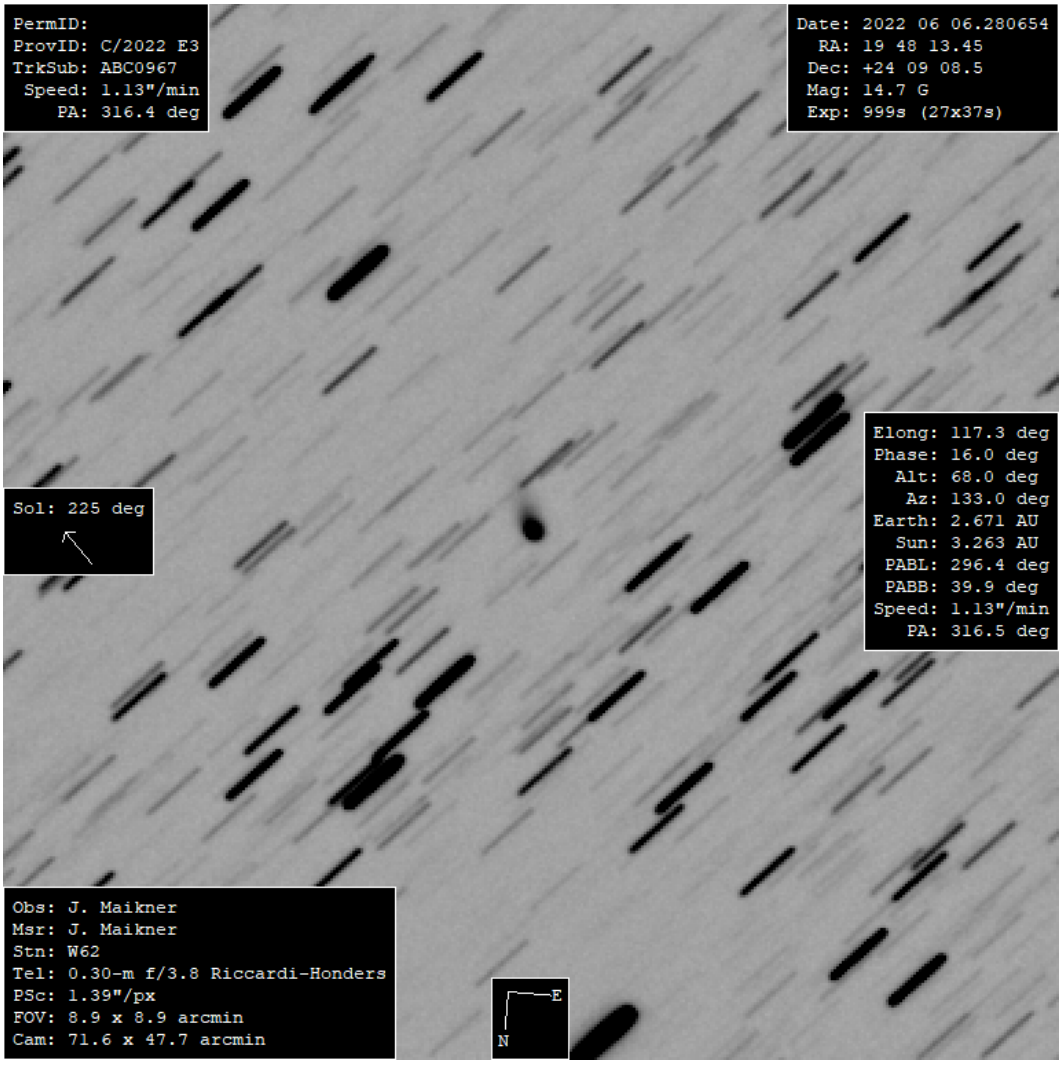


Figure 7 - John Maikner imaged C/2022 E3 (ZTF) on 2022 June 6 with a 0.30-m f/3.8 Riccardi-Honders. The image above was produced from 27 37-s exposures.