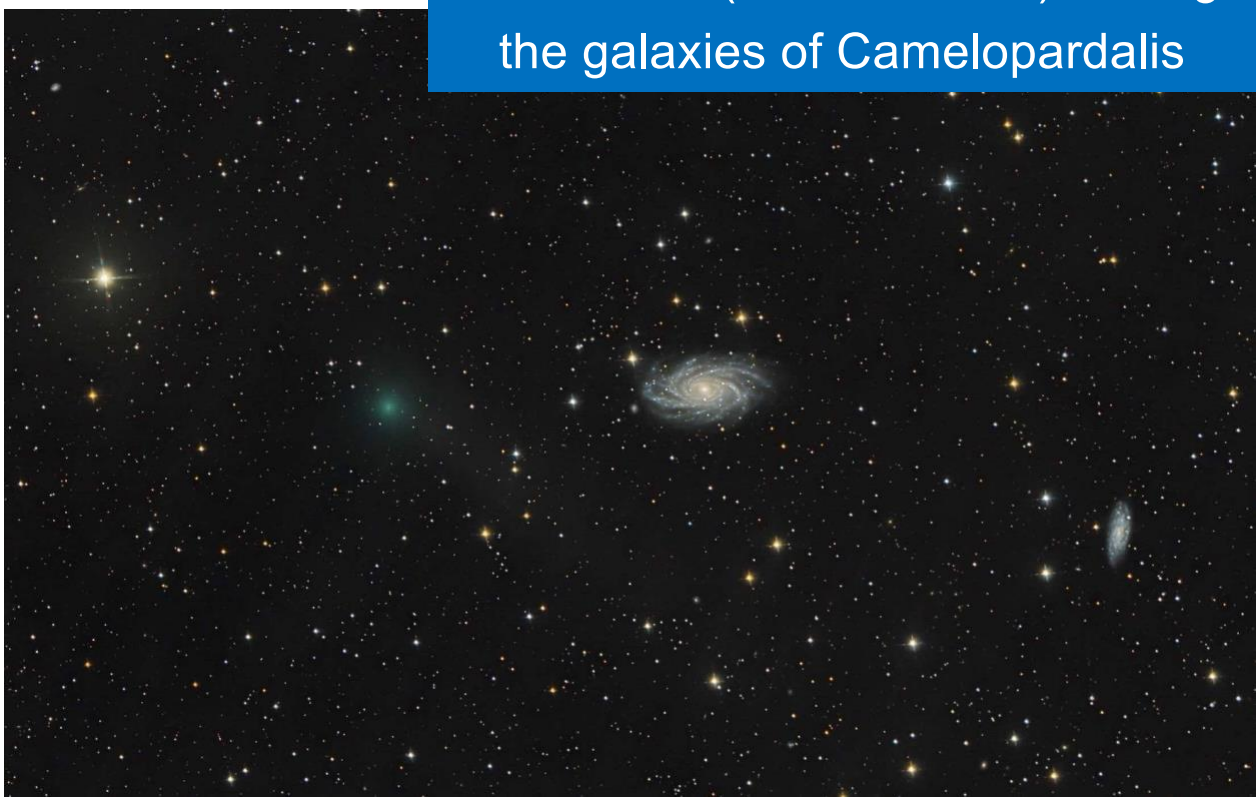
June 2022

ALPO Comet News

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

C/2021 O3 (PANSTARRS) among the galaxies of Camelopardalis



C/2021 O3 (PANSTARRS) was expected to disintegrate due to its intrinsic faintness and a small perihelion distance of 0.29 au. While the comet experienced some instability in brightness as it approached perihelion (though it was out of sight from Earth, it was observable with the SOHO spacecraft). Comet PANSTARRS is fainter than expected at 13th magnitude but is still an active object. Dan Bartlett imaged PANSTARRS om 2022 May 25 UT as it passed by spiral galaxies NGC 2336 and IC 467. The image is a co-add of 138x60 second exposures taken with a Celestron RASA11 Schmidt telescope and ASI2600MC-Pro camera.

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Table of Contents

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/826916-alpo-comet-news-for-june-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

To borrow from Mark Twain, the reports of C/2021 O3 (PANSTARRS)'s demise was an exaggeration. The comet is much fainter than hoped for at 12th magnitude but well placed for northern observers. While C/2021 O3 did not become the bright object we expected, another comet, 45P/Honda-Mrkos-Pajdusakova, is running about 3 magnitudes brighter than expected (starting around 8th magnitude and fading to 10th this month) low in the evening sky. Two other comets will be brighter than 10th magnitude in June, C/2021 E3 (ZTF0 but only observable from the southern hemisphere, and C/2017 K2 (PANSTARRS) which is visible to all. In the magnitude 10 to 13 range are no less than 9 comets, 19P/Borrelly, 22P/Kopff, 169P/NEAT, C/2019 L3 (ATLAS), C/2019 T4 (ATLAS), C/2020 V2 (ZTF), C/2021 E3 (ZTF). C/2021 F1 (Lemmon-PANSTARRS), and C/2021 P4 (PANSTARRS).

In May the ALPO Comets Section received 76 magnitude estimates and 69 images/sketches of comets C/2021 P4 (ATLAS), C/2021 O3 (PANSTARRS), C/2021 E3 (ZTF), C/2021 A1 (Leonard), C/2020 Y2 (ATLAS), C/2020 V2 (ZTF), C/2020 R7 (ATLAS), C/2020 M5 (ATLAS), C/2020 K1 (PANSTARRS), C/2019 U5 (PANSTARRS), C/2019 T4 (ATLAS), C/2019 L3 (ATLAS), C/2017 K2 (PANSTARRS), 274P/Tombaugh-Tenagra, 272P/NEAT, 254P/McNaught, 244P/Scotti, 117P/Helin-Roman-Alu, 116P/Wild, 104P/Kowal, 73P/Schwassmann-Wachmann, 67P/Churyumov-Gerasimenko, 45P/Honda-Mrkos-Pajdusakova, 22P/Kopff, 19P/Borrelly, and 9P/Tempel. A hearty thanks to our April contributors: Dan Bartlett, Michel Deconinck, J. J. Gonzalez, Christian Harder, Michael Jager, Martin Mobberley, Mike Olason, Uwe Pilz, Raymond Ramlow, 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

June 10-12 - Europlanet Pro-Am Comet Workshop
Europlanet 2024 Research Infrastructure (RI), the British Astronomical Association, Planetum Prague, and the Czech cometary community SMPH are hosting a Pro-Am Comet Workshop to bring together professional and amateur members of the cometary science and observational community. The Workshop will be held in a hybrid format at the Stefanik Observatory in Prague and online. The Workshop will last for two and a half days, starting Friday morning from 2022 June 10-12, and will be in English.

Online registration remains open until June 8.
Program details
Abstract details
Registration

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

June 01 - 113P/Spitaler at perihelion (q = 2.14 au, 71.-yr period, V ~ 17, discovered in 1890, rediscovered in 1994, observed at 7 returns)
June 02 - C/2021 P1 (PANSTARRS) at perihelion (q = 4.37 au, V ~ 19-20)
June 05 - 238P/Read at perihelion (q = 2.37 au, 5.6-yr period, Main Belt Comet, V ~18-22 depending on activity level)
June 05 - 19P/Borrelly orbit plane crossing
June 07 - First Quarter Moon
June 07 - C/2021 T2 (Fuls) at perihelion (q = 1.25 au, V ~ 13, not seen since February, at low solar elongation)
June 7 - 22P/Kopff passes a little over a degree southeast of Jupiter
June 09 - C/2019 T4 (ATLAS) at perihelion (q = 4.24 au, V ~ 11, more below)
June 09-10 - C/2021 P4 (ATLAS) passes through a rich field of faint galaxies
June 11 - C/2021 E3 (ZTF) at perihelion (q = 1.78 au, V ~ 9, more below)
June 13 - 148P/Anderson-LINEAR at perihelion (q = 1.63 au, 6.9-yr period, V ~ 17, discovered in 1963, rediscovered in 2001, seen at 6 returns)
June 14 - Full Moon
June 17 - C/2020 Y2 (ATLAS) at perihelion (q = 3.13 au, V ~ 14)
June 17 - 22P/Kopff passes close to 12-13th mag galaxy pair NGC 192 and 196
June 18 - 45P/H-M-P passes very close to 13th mag galaxy NGC 2565
June 19 - P/2013 G4 (PANSTARRS) at perihelion (q = 2.62 au, 9.4-yr period, V ~ ???, discovered in 2013, yet to be observed at this return)
June 19 - C/2017 K2 (PANSTARRS) orbit plane crossing
June 20 - Last Quarter Moon
June 20 - C/2017 K2 (PANSTARRS) grazes the large bright open cluster IC 4665
June 23 - 45P/H-M-P passes a few degrees north of the Beehive Cluster (M44)
June 28 - New Moon

Recent Magnitudes Contributed to the ALPO Comets Section

Comet Des	YYYY MM DD.DD (UT)	Mag	SC	APER	FL	POW	COMA Dia	COMA DC	TAIL LENG	TAIL PA	ICQ CODE	Observer Name
C/2021 P4 (ATLAS)												
2021P4	2022 05 28.94	S 12.6	TI	29.8L	4	132	0.8	3/			ICQ XX	HAR11 Christian Harder
2021P4	2022 05 27.94	S 12.5	TI	29.8L	4	132	1	3/			ICQ XX	HAR11 Christian Harder
2021P4	2022 05 25.91	S 10.8	TK	20.3T10		100	4	2			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2021P4	2022 05 10.16	Z 12.6	U4	7.2R	5A	200	1.8				ICQ xx	HER02 Carl Hergenrother
2021P4	2022 05 04.89	S 10.3	TK	20.3T10		77	5	3			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2021P4	2022 05 03.92	S 12.4	TI	29.8L	4	132	1.5	3			ICQ XX	HAR11 Christian Harder
C/2021 O3 (PANSTARRS)												
2021O3	2022 05 10.15	Z 12.3	U4	7.2R	5a	480	3.1				ICQ xx	HER02 Carl Hergenrother
C/2021 E3 (ZTF)												
2021E3	2022 05 09.17	Z 9.3	U4	20.0L	3a	240	14.8				ICQ xx	HER02 Carl Hergenrother
2021E3	2022 05 09.16	Z 9.7	U4	20.0L	3a	300	15.2				ICQ xx	HER02 Carl Hergenrother
2021E3	2022 05 07.02	k 11.0	U4	20.0L	3a	240	5.2				ICQ xx	HER02 Carl Hergenrother
2021E3	2022 05 06.72	xM 9.8	AQ	40.0L	4	59	5.2	5			ICQ XX	WYA Christopher Wyatt
C/2020 Y2 (ATLAS)												
2020Y2	2022 05 06.47	xM 14.9	AQ	40.0L	4	261	0.5	5			ICQ XX	WYA Christopher Wyatt
2020Y2	2022 05 03.42	xM 14.8	AQ	40.0L	4	261	0.6	5/			ICQ XX	WYA Christopher Wyatt
2020Y2	2022 05 02.39	xM 14.8	AQ	40.0L	4	261	0.5	6			ICQ XX	WYA Christopher Wyatt
C/2020 V2 (ZTF)												
2020V2	2022 05 29.93	S 13.4	TI	29.8L	4	132	0.5	3/			ICQ XX	HAR11 Christian Harder
2020V2	2022 05 28.94	S 13.3	TI	29.8L	4	132	0.5	3/			ICQ XX	HAR11 Christian Harder
2020V2	2022 05 27.92	S 13.1	TI	29.8L	4	132	0.6	4			ICQ XX	HAR11 Christian Harder
2020V2	2022 05 21.27	Z 13.7	U4	7.2R	5A	200	1.5		1	m120	ICQ xx	HER02 Carl Hergenrother
2020V2	2022 05 03.91	S 13.5	TI	29.8L	4	132	0.7	4	1.0	m120	ICQ XX	HAR11 Christian Harder
2020V2	2022 05 02.91	S 13.7	TI	29.8L	4	132	0.8	5	0.8	m120	ICQ XX	HAR11 Christian Harder
C/2020 R7 (ATLAS)												
2020R7	2022 05 06.73	xM 13.9	AQ	40.0L	4	261	0.6	5/			ICQ XX	WYA Christopher Wyatt
C/2020 M5 (ATLAS)												
2020M5	2022 05 03.44	xM 15.4	AQ	40.0L	4	261	0.3	4			ICQ XX	WYA Christopher Wyatt
2020M5	2022 05 02.41	xM 15.4	AQ	40.0L	4	261	0.3	4/			ICQ XX	WYA Christopher Wyatt
C/2020 K1 (PANSTARRS)												
2020K1	2022 05 06.71	xM 14.3	AQ	40.0L	4	261	0.3	4/			ICQ XX	WYA Christopher Wyatt
C/2019 U5 (PANSTARRS)												
2019U5	2022 05 06.51	xM 14.5	AQ	40.0L	4	182	0.6	4			ICQ XX	WYA Christopher Wyatt
C/2019 T4 (ATLAS)												
2019T4	2022 05 27.72	Z 12.5	U4	20.0L	3a	720	3.5		4.4	m 50	ICQ xx	HER02 Carl Hergenrother
2019T4	2022 05 21.29	Z 12.9	U4	7.2R	5A	200	1.5				ICQ xx	HER02 Carl Hergenrother
2019T4	2022 05 13.15	Z 11.9	U4	5.0R	4a	180					ICQ xx	OLAxx Michael Olason
2019T4	2022 05 06.48	xM 12.3	AQ	40.0L	4	59	2.1	6			ICQ XX	WYA Christopher Wyatt
2019T4	2022 05 04.93	S 10.4	TK	20.3T10		77	5	3/			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2019T4	2022 05 03.89	S 11.5	TI	29.8L	4	108	2	4			ICQ XX	HAR11 Christian Harder
2019T4	2022 05 03.44	xM 12.2	AQ	40.0L	4	59	2.2	6			ICQ XX	WYA Christopher Wyatt
2019T4	2022 05 02.89	S 11.2	TI	29.8L	4	108	2.1	4			ICQ XX	HAR11 Christian Harder
2019T4	2022 05 02.40	xM 12.3	AQ	40.0L	4	59	1.5	6			ICQ XX	WYA Christopher Wyatt
C/2019 L3 (ATLAS)												
2019L3	2022 05 25.90	S 9.8	TK	20.3T10		100	2	5			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2019L3	2022 05 13.14	Z 10.2	U4	5.0R	4a	180					ICQ xx	OLAxx Michael Olason
2019L3	2022 05 04.90	S 9.8	TK	20.3T10		77	3	5			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2019L3	2022 05 03.87	S 9.9	TI	29.8L	4	108	2.6	3/			ICQ XX	HAR11 Christian Harder
2019L3	2022 05 03.42	xM 10.6	AQ	40.0L	4	59	2	5/			ICQ XX	WYA Christopher Wyatt
2019L3	2022 05 02.88	S 10.1	TI	29.8L	4	108	2	3/			ICQ XX	HAR11 Christian Harder
2019L3	2022 05 02.37	xM 10.3	AQ	40.0L	4	59	1.9	5/			ICQ XX	WYA Christopher Wyatt
C/2017 K2 (PANSTARRS)												
2017K2	2022 05 29.91	S 9.6	TI	29.8L	4	79	3.3	4			ICQ XX	HAR11 Christian Harder
2017K2	2022 05 28.92	S 9.5	TI	29.8L	4	79	3.1	4			ICQ XX	HAR11 Christian Harder
2017K2	2022 05 27.93	S 9.6	TI	29.8L	4	79	3.3	4			ICQ XX	HAR11 Christian Harder
2017K2	2022 05 26.00	S 9.4	TK	20.3T10		77	3	4			ICQ XX	GON05 Juan Jose Gonzalez Suarez
2017K2	2022 05 24.92	S 10.1	TK	32.0L	5	80	1.6	6			ICQ xx	PIL01 Uwe Pilz
2017K2	2022 05 21.15	Z 10.4	U4	7.2R	5A	200	3.1		6	m340	ICQ xx	HER02 Carl Hergenrother
2017K2	2022 05 06.70	xM 10.3	AQ	40.0L	4	59	2.0	5/			ICQ XX	WYA Christopher Wyatt
117P/Helin-Roman-Alu												
117	2022 05 06.75	xM 14.9	AQ	40.0L	4	261	0.4	5/			ICQ XX	WYA Christopher Wyatt
116P/Wild												
116	2022 05 21.22	Z 14.5	U4	7.2R	5A	200	1.0		0.6	m110	ICQ xx	HER02 Carl Hergenrother
116	2022 05 06.48	xM 13.8	AQ	40.0L	4	108	1.0	5			ICQ XX	WYA Christopher Wyatt
116	2022 05 03.43	xM 13.8	AQ	40.0L	4	108	1.3	3/			ICQ XX	WYA Christopher Wyatt
116	2022 05 02.90	S 13.6	TI	29.8L	4	170	0.8	4/			ICQ XX	HAR11 Christian Harder

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116        2022 05 02.38 xM 13.7 AQ 40.0L 4 182   1    4            ICQ XX WYA   Christopher Wyatt
104P/Kowal
104        2022 05 03.41 xS 14.7 AQ 40.0L 4 182   0.8  2/           ICQ XX WYA   Christopher Wyatt
73P/Schwassmann-Wachmann
 73        2022 05 24.76  Z 14.8 U4 20.0L 3a600   2.2       2.5m115 ICQ xx HER02 Carl Hergenrother
 73        2022 05 21.24  Z 16.2 U4  7.2R 5A200   0.5       0.7m 90 ICQ xx HER02 Carl Hergenrother
45P/Honda-Mrkos-Pajdusakova
 45        2022 05 25.89  S  7.9 TK 20.3T10  77   3    4            ICQ XX GON05 Juan Jose Gonzalez Suarez
 45        2022 05 25.14  Z  8.3 U4  5.0R 4a480   4        0.25m 94 ICQ xx OLAxx Michael Olason
 45        2022 05 19.14 $S  7.6 TK 12.5B    30   1.5  4            ICQ xx HER02 Carl Hergenrother
 45        2022 05 18.14  Z  7.5 U4  5.0R 4a180   2        0.5   87 ICQ xx OLAxx Michael Olason
 45        2022 05 18.14 $S  7.3 TK 12.5B    30   1.5  5            ICQ xx HER02 Carl Hergenrother
 45        2022 05 17.14 $S  7.0 TK 12.5B    30   1.5  6            ICQ xx HER02 Carl Hergenrother
 45        2022 05 13.13  Z  6.8 U4  5.0R 4a180                     ICQ xx OLAxx Michael Olason
 45        2022 05 10.12  Z  6.7 U4  5.0R 4a072                     ICQ xx OLAxx Michael Olason
22P/Kopff
 22        2022 05 06.76 xS 11.8 AQ 40.0L 4 182   2.5  3            ICQ XX WYA   Christopher Wyatt
19P/Borrelly
 19        2022 05 25.92  S 11.2 TK 20.3T10 100   3    3            ICQ XX GON05 Juan Jose Gonzalez Suarez
 19        2022 05 24.90  S 12.1 HS 32.0L 5  80   1.2                       PIL01 Uwe Pilz
 19        2022 05 10.18  Z 12.0 U4  7.2R 5A320   2.7               ICQ xx HER02 Carl Hergenrother
 19        2022 05 04.91  S 10.2 TK 20.3T10  77   4    3            ICQ XX GON05 Juan Jose Gonzalez Suarez
 19        2022 05 03.88  S 11.2 TI 29.8L 4 108   2.2  2            ICQ XX HAR11 Christian Harder
 19        2022 05 02.88  S 11.0 TI 29.8L 4 108   2    2            ICQ XX HAR11 Christian Harder
9P/Tempel
  9        2022 05 06.74 xS 14.7 AQ 40.0L 4 182   0.7  2            ICQ XX WYA   Christopher Wyatt
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New Discoveries, Recoveries and Other Comets News

New Discoveries

C/2022 K1 (Leonard) – Gregg Leonard of the Catalina Sky Survey discovered the 14th comet to bear his name on 2022 May 30 with the University of Arizona Mount Lemmon 1.5-m. C/2022 K1 is currently around magnitude 20 and likely at its brightest as it is already passed a 2021 December 17 perihelion at 3.98 au but still heading towards a minimum Earth-comet distance of 3.4 au in late July. [CBET 5127, MPEC 2022-L53]

A/2022 J2 – A/2022 J2 was discovered on 2022 May 9 at 21-22nd magnitude by a collaboration between the Catalina Sky Survey and Spacewatch with the University of Arizona's 2.3-m Bok telescope on Kitt Peak. Though apparently an inactive object, it is on a long-period comet orbit with an orbital period of ~865 years. Perihelion will occur in 2022 October 27 at 1.82 au. This will be followed a few weeks later by a close approach to the Earth in mid-December at 0.98 au. Assuming it is inactive and remains so, it will brighten to around magnitude 17 at the time of closest approach when it will be a northern object near opposition. If it is active at the time, it could be a few magnitudes brighter and may become a visual object. We'll need to keep our eyes on this one. [MPEC 2022-K80]

C/2022 J1 (Maury-Attard) – This comet is the 4th discovery by the MAP project whose moniker is derived from the last names of its participants, Alain Maury, Georges Attard and Daniel Parrott. They have been using a Celestron RASA 11" located at San Pedro de Atacama in Chile and the Tycho Tracker synthetic tracking detection software. C/2022 J1 was 17th magnitude when found on 2022 May 5. It is a long-period comet with an orbital period of around 300 years. Perihelion happened back on 2022 February 19 at 1.61 au. The comet was found near its maximum brightness. [CBET 5121, MPEC 2022-J88]

C/2022 H1 (PANSTARRS) – The Pan-STARRS survey discovered a 20th magnitude comet on 2022 April 21 with their 1.8-m on Haleakala, Maui. C/2022 H1 is a long-period comet with a large perihelion distance of 7.70 au. Perihelion won't occur till 2024 January 18 when the comet will have brightened to 18-19th magnitude. [CBET 5120, MPEC 2022-J76]

C/2021 X1 (Maury-Attard) – The third discovery of the MAP project was found on 2021 December 2 at 18-19th magnitude. Though it was reported as cometary at the time, the object was announced as an asteroid with the designation A/2021 X1. It was officially acknowledged as a comet on May 5.

C/2021 X1 arrives at perihelion a year from now on 2023 May 27 at 3.23 au. It may be a 14th magnitude object at its brightest in late 2023. [CBET 5119, MPEC 2021-X157, MPEC 2022-J33]

Comets Brighter Than Magnitude 10

45P/Honda-Mrkos-Pajdušáková

Discovered visually on 1948 December 3 by Minoru Honda, on December 6 by Ľudmila Pajdušáková, and December 7 by Antonín Mrkos

Orbit (from Minor Planet Center, MPEC 2022-K19)

```
  45P/Honda-Mrkos-Pajdusakova
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Apr. 26.95069 TT                                  Rudenko
q   0.5571418            (2000.0)            P              Q
n   0.18464275     Peri.  327.90925     +0.56325262     -0.82284500
a   3.0543200      Node    87.70493     +0.77313957     +0.49266914
e   0.8175889      Incl.    4.32288     +0.29155048     +0.28320173
P   5.34
From 1822 observations 2016 Nov. 6-2022 May 19, mean residual 0".7.
     Nongravitational parameters A1 = +0.10, A2 = -0.0566.
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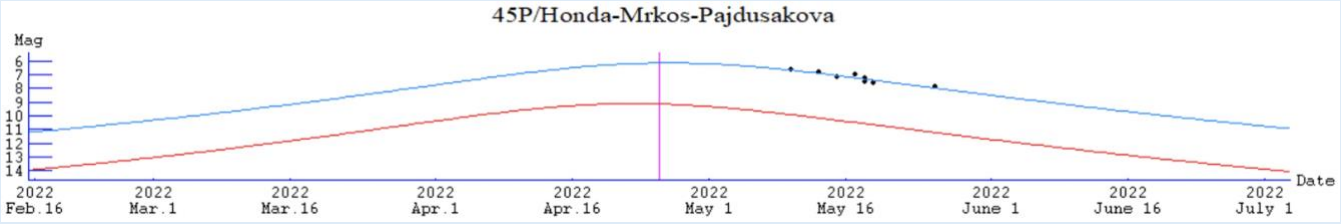
Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

```
45P/Honda-Mrkos-Pajdusakova                                          Max El
                                                                      (deg)
    Date      R.A.    Decl.     r       d    Elong  Const  Mag    40N  40S
2022-Jun-01  06 44   +24 48   0.884   1.601    30E   Gem    8.5     4    3
2022-Jun-06  07 14   +24 21   0.953   1.649    31E   Gem    9.0     4    5
2022-Jun-11  07 41   +23 38   1.023   1.704    33E   Gem    9.4     4    7
2022-Jun-16  08 06   +22 42   1.093   1.767    34E   Cnc    9.8     4    9
2022-Jun-21  08 29   +21 36   1.162   1.835    35E   Cnc   10.1     3   10
2022-Jun-26  08 50   +20 25   1.230   1.909    35E   Cnc   10.5     3   11
2022-Jul-01  09 09   +19 10   1.298   1.986    35E   Cnc   10.8     2   11
2022-Jul-06  09 27   +17 52   1.365   2.066    35E   Leo   11.1     1   12
```

Comet Magnitude Formula (from ALPO & COBS data)

```
m1 = 10.9 + 5 log d + 10.8 log r(t + 4)
m1 =  8.1 + 5 log d + 10.9 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

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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
 45        2022 05 25.89  S  7.9 TK 20.3T10  77   3    4            ICQ XX GON05 Juan Jose Gonzalez Suarez
 45        2022 05 25.14  Z  8.3 U4  5.0R 4a480   4        0.25m 94 ICQ xx OLAxx Michael Olason
 45        2022 05 19.14 $S  7.6 TK 12.5B    30   1.5  4            ICQ xx HER02 Carl Hergenrother
 45        2022 05 18.14  Z  7.5 U4  5.0R 4a180   2        0.5   87 ICQ xx OLAxx Michael Olason
 45        2022 05 18.14 $S  7.3 TK 12.5B    30   1.5  5            ICQ xx HER02 Carl Hergenrother
 45        2022 05 17.14 $S  7.0 TK 12.5B    30   1.5  6            ICQ xx HER02 Carl Hergenrother
 45        2022 05 13.13  Z  6.8 U4  5.0R 4a180                     ICQ xx OLAxx Michael Olason
 45        2022 05 10.12  Z  6.7 U4  5.0R 4a072                     ICQ xx OLAxx Michael Olason
```

Images can be found on the ALPO Comets Section Image Gallery at http://www.alpo-astronomy.org/gallery3/index.php/Comet-Images-and-Observations/001P-050P/45P .

2022 marks 45P/Honda-Mrkos-Pajdušáková's 14th observed return. Since its visual discovery in December 1948 by Minoru Honda of Okayama, Japan and Ľudmila Pajdušáková and Antonín Mrkos of the Skalnate Pleso Observatory in Slovakia, 45P has been seen at every return but one (1959). 2022 was supposed to be a poor return with the comet arriving at perihelion while on the far side of the Sun and at very small solar elongations. To our surprise, the comet which should have been 9th magnitude at perihelion was observed to be ~3 magnitude brighter in images taken by the SOHO coronagraph. On May 10, Mike Olason was able to image 45P at magnitude 6.7 when it was still within 16° of the Sun. By May 17, visual observers were starting to observe 45P at around magnitude 7.0. Since then, H-M-P has dropped to around magnitude 8.0 to 8.5 in photometry submitted to COBS. This is still ~3 magnitudes brighter than expected based on previous returns.

Many images taken by Mike Olason have shown two tails extending in opposite directions. On May 25, the shorter sunward pointing 6' tail was at p.a. 271° while the longer anti-solar tail was 15' long in p.a. 94°. Since H-M-P has a small inclination of 4.3°, we are never very far out of the comet's orbital plane so one or both of the tails may be a dust trail.

45P/Honda-Mrkos-Pajdušáková arrived at perihelion on April 26 at 0.56 au. If it continues to run ~3 magnitudes brighter than expected then it will start June at magnitude 8.5 and fade to 10.8 by the end of the month. H-M-P is an evening object moving through Gemini (Jun 1-14) and Cancer (14-30). It is a difficult object for northern observers being located only a few degrees above the horizon by the end of astronomical twilight. It will become a progressively "easier" object for southern hemisphere observers.

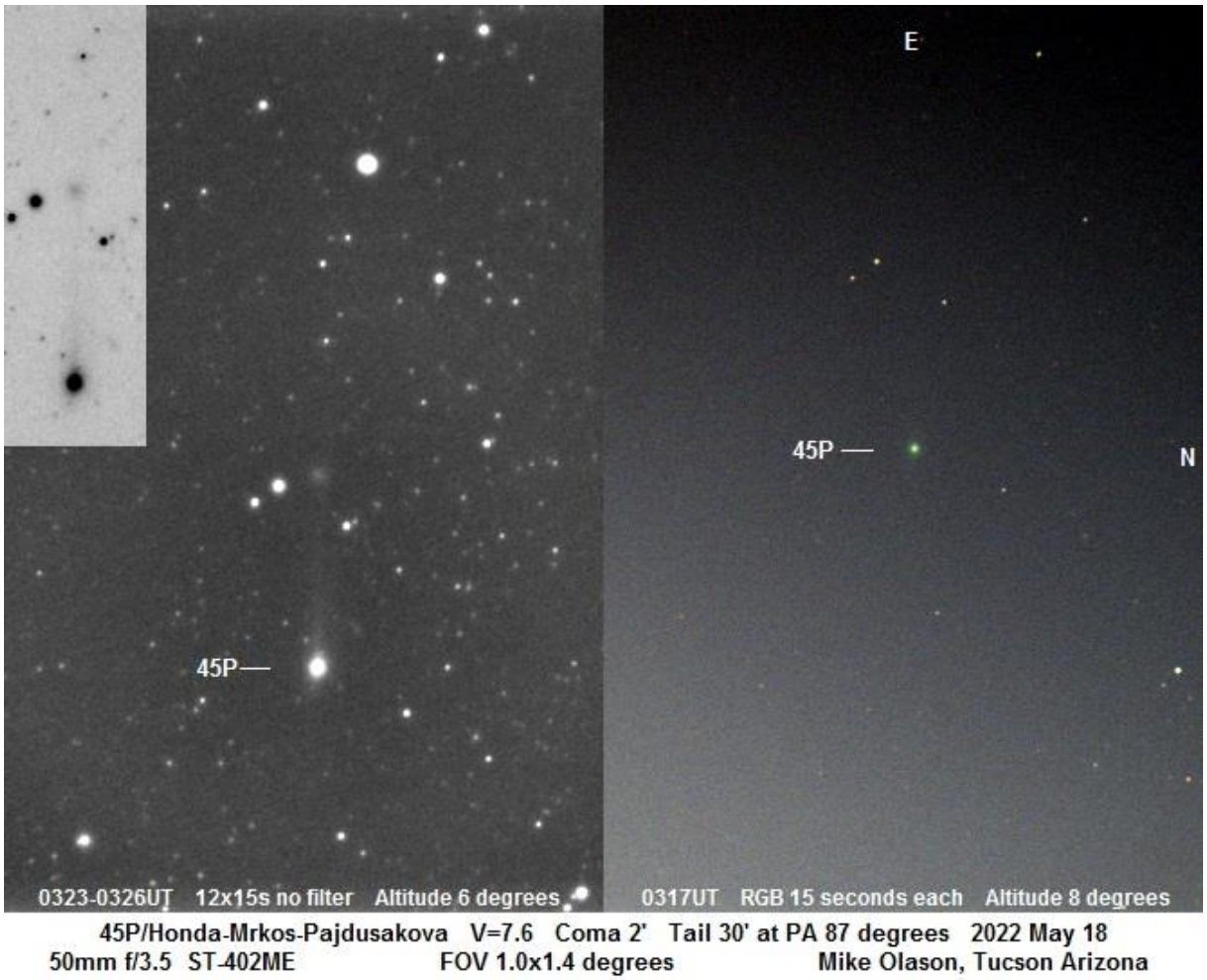


Figure 1 - Image of 45P/H-M-P taken by Mike Olason on 2022 May 18 with a 50mm f/3.5 lens. The image shows the comet's two tails.

C/2017 K2 (PANSTARRS)

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

Orbit (from Minor Planet Center, MPEC 2022-K19)

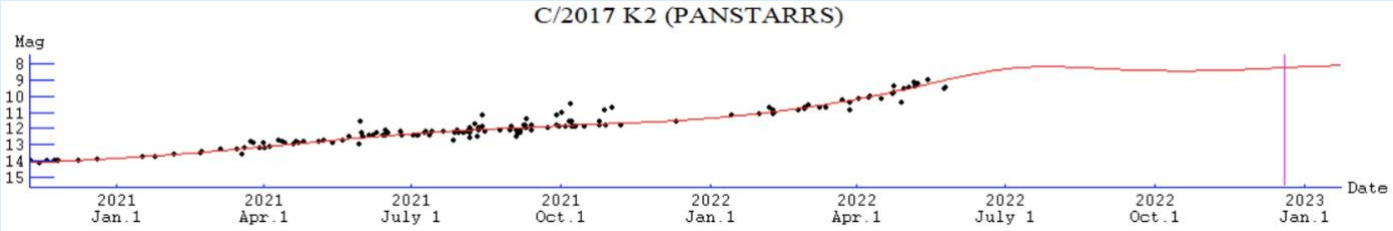
```
    C/2017 K2 (PANSTARRS)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Dec. 19.69736 TT                                  Rudenko
q   1.7970873           (2000.0)            P               Q
z  -0.0003804      Peri.  236.19458     +0.01825662     +0.04925359
 +/-0.0000006      Node    88.23680     -0.18099508     +0.98244721
e   1.0006837      Incl.   87.55883     -0.98331454     -0.17992098
From 7856 observations 2013 May 12-2022 May 19, mean residual 0".5.
1/a(orig) = -0.000022 AU**-1, 1/a(fut) = +0.001170 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-Jun-01  18 22  +09 29   3.033   2.195   138M   Oph    8.9     59   41
2022-Jun-06  18 14  +08 40   2.989   2.114   143M   Oph    8.8     59   41
2022-Jun-11  18 05  +07 41   2.944   2.041   146M   Oph    8.7     58   42
2022-Jun-16  17 56  +06 30   2.900   1.977   149M   Oph    8.6     56   44
2022-Jun-21  17 46  +05 09   2.856   1.923   151M   Oph    8.5     55   45
2022-Jun-26  17 36  +03 37   2.813   1.879   151E   Oph    8.4     54   46
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
```

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

```
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 05 29.91  S  9.6 TI 29.8L 4  79   3.3  4            ICQ XX HAR11 Christian Harder
   2017K2  2022 05 28.92  S  9.5 TI 29.8L 4  79   3.1  4            ICQ XX HAR11 Christian Harder
   2017K2  2022 05 27.93  S  9.6 TI 29.8L 4  79   3.3  4            ICQ XX HAR11 Christian Harder
   2017K2  2022 05 26.00  S  9.4 TK 20.3T10  77   3    4            ICQ XX GON05 Juan Jose Gonzalez Suarez
   2017K2  2022 05 24.92  S 10.1 TK 32.0L 5  80   1.6  6            ICQ xx PIL01 Uwe Pilz
   2017K2  2022 05 21.15  Z 10.4 U4  7.2R 5A200   3.1       6  m340 ICQ xx HER02 Carl Hergenrother
   2017K2  2022 05 06.70 xM 10.3 AQ 40.0L 4  59   2.0  5/           ICQ XX WYA   Christopher Wyatt
```

C/2017 K2 (PANSTARRS) 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 16.1 au from the Sun. Pre-discovery observations have been found back to May of 2013 when the comet was 23.7 au from the Sun which is further than the distance of Uranus. A peer-reviewed study has found evidence of dust production starting even further out at a distance of 35 au from the Sun [David Jewitt et al 2021, Astronomical Journal 161 188, https://doi.org/10.3847/1538-3881/abe4cf].

As mentioned last month, C/2017 K2's recent rate of brightening has slowed substantially. Since late 2021, K2 has brightened at a rate of 2.5n ~ 4. 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. May's observations confirm that the trend has continued. Even though the comet is intrinsically fading, its decreasing distance to the Sun and Earth is still resulting in a brightening apparent magnitude (i.e., how bright the comet appears to us on Earth).

Visual observations were submitted in May by J. J. Gonzalez, Christian Harder, Uwe Pilz, and Chris Wyatt. We also continue to use observations submitted to the COBS site by Thomas Lehmann in our analysis. Near the end of May, the visual observers found C/2017 K2 to be between magnitude 9.4 and 10.1 with a ~3' moderately condensed coma and no tail. After correcting for aperture effects and personal biases, the visual magnitudes were closer to magnitude 9.1 to 9.6.

C/2017 K2 is still beyond 3 au as the month begins. Even at that distance, a large gas coma has started to be imaged. 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 .

K2 still has time to start brightening faster as perihelion won't be till the end of the year on will be 2022 December 19 at 1.80 au. If its current slow brightening rate continues than K2 may only peak at magnitude 8.2 in July and again to around 8.1 in January.

In June, K2 should brighten from magnitude 8.9 to 8.3. It is observable nearly all night long at it will be in Ophiuchus and near opposition all 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.

Figure 2 - C/2017 K2 (PANSTARRS) as imaged by Gregg Ruppel on 2022 May 11 in a 40 min LRGB image taken with an ASA 10N f/3.7 astrograph from Dark Sky, New Mexico.

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-K19)

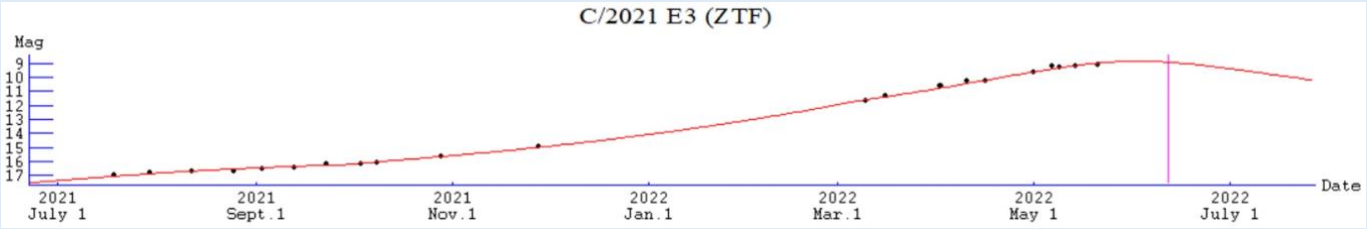
```
    C/2021 E3 (ZTF)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 June 11.90247 TT                                  Rudenko
q   1.7774310           (2000.0)            P              Q
z  -0.0004902      Peri.  228.84442     -0.11524420     -0.43255764
 +/-0.0000007      Node   104.46809     -0.37427364     +0.85277277
e   1.0008713      Incl.  112.55712     -0.92012935     -0.29269864
From 957 observations 2021 Mar. 9-2022 May 17, 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-Jun-01  00 42  -79 08    1.783   1.214    105    Hyi    8.9     0   48
2022-Jun-06  03 34  -81 43    1.779   1.225    104    Men    8.9     0   41
2022-Jun-11  06 17  -79 05    1.777   1.256    102    Men    8.9     0   41
2022-Jun-16  07 33  -74 11    1.778   1.303     99    Vol    9.0     0   45
2022-Jun-21  08 11  -69 05    1.781   1.366     95    Vol    9.1     0   47
2022-Jun-26  08 34  -64 23    1.787   1.440     91    Car    9.2     0   48
2022-Jul-01  08 49  -60 13    1.794   1.523     87    Car    9.4     0   48
2022-Jul-06  09 01  -56 35    1.804   1.612     83    Vel    9.5     0   46
```

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 05 09.17  Z  9.3 U4 20.0L 3a240  14.8                ICQ xx HER02 Carl Hergenrother
   2021E3  2022 05 09.16  Z  9.7 U4 20.0L 3a300  15.2                ICQ xx HER02 Carl Hergenrother
   2021E3  2022 05 07.02  k 11.0 U4 20.0L 3a240   5.2                ICQ xx HER02 Carl Hergenrother
   2021E3  2022 05 06.72 xM  9.8 AQ 40.0L 4  59   5.2  5             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 has brightening rapidly since discovery. This month the comet will be at perihelion (2022 June 11 at 1.78 au) and just past closest approach to Earth (2022 May 31 at 1.21 au). C/2021 E3 starts the month near its brightest (around mag 9) but should fade to ~9.5 by the end of June as it moves away from the Sun and Earth.

C/2021 E3 is located deep in the southern circumpolar sky as it moves through Hydrus (Jun 1-5), Mensa (5-14), Volans (14-25), and Carina (25-30). Northern observers will have to wait till November to get another chance at observing C/2021 E3. By then it should be no brighter than 12th magnitude.

Comets Between Magnitude 10 and 13

19P/Borrelly

Discovered 1904 December 28 by the Alphonse Borrelly

Orbit (from Minor Planet Center, MPEC 2022-K19)

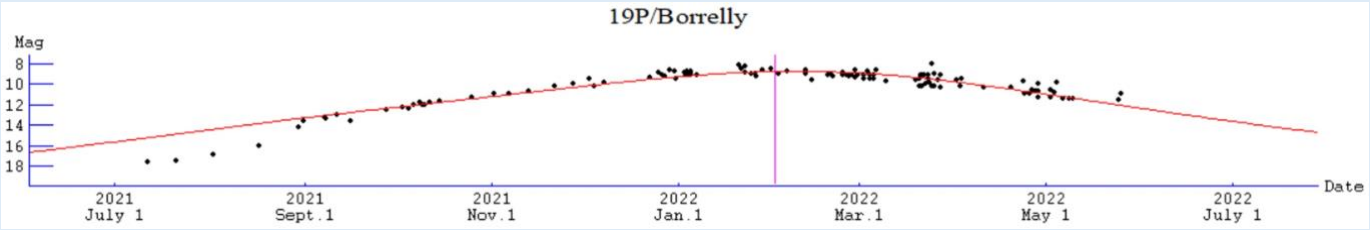
```
  19P/Borrelly
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Feb. 1.82373 TT                                  Rudenko
q   1.3062798           (2000.0)            P              Q
n   0.14399519     Peri.  351.91601     +0.38681564     -0.79275886
a   3.6049900      Node    74.24702     +0.87108123     +0.14646925
e   0.6376467      Incl.   29.30466     +0.30264030     +0.59167571
P   6.84
From 2347 observations 2015 Jan. 11-2022 May 17, mean residual 0".6.
     Nongravitational parameters A1 = +0.34, A2 = +0.0150.
```

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

```
19P/Borrelly                                                          Max El
                                                                       (deg)
    Date       R.A.    Decl.      r       d     Elong  Const  Mag    40N  40S
2022-Jun-01   08 09   +41 47    1.877   2.382     48E    Aur   12.4     28    0
2022-Jun-06   08 25   +41 10    1.914   2.445     47E    Aur   12.6     26    1
2022-Jun-11   08 41   +40 28    1.951   2.508     46E    Gem   12.8     24    1
2022-Jun-16   08 56   +39 40    1.988   2.572     45E    Aur   13.0     23    1
2022-Jun-21   09 10   +38 49    2.026   2.635     43E    Aur   13.2     21    1
2022-Jun-26   09 24   +37 54    2.063   2.699     42E    Lyn   13.4     20    1
2022-Jul-01   09 38   +36 57    2.101   2.762     40E    Lyn   13.6     18    1
2022-Jul-06   09 50   +35 57    2.138   2.825     39E    Lyn   13.8     17    1
```

Comet Magnitude Formula & Lightcurve (from ALPO and COBS photometry)

```
m1 = 6.0 + 5 log d + 18.6 log r(t - 19)
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
 19        2022 05 25.92  S 11.2 TK 20.3T10 100   3    3            ICQ XX GON05 Juan Jose Gonzalez Suarez
 19        2022 05 24.90  S 12.1 HS 32.0L 5  80   1.2                      PIL01 Uwe Pilz
 19        2022 05 10.18  Z 12.0 U4  7.2R 5A320   2.7                 ICQ xx HER02 Carl Hergenrother
 19        2022 05 04.91  S 10.2 TK 20.3T10  77   4    3              ICQ XX GON05 Juan Jose Gonzalez Suarez
 19        2022 05 03.88  S 11.2 TI 29.8L 4 108   2.2  2              ICQ XX HAR11 Christian Harder
 19        2022 05 02.88  S 11.0 TI 29.8L 4 108   2    2              ICQ XX HAR11 Christian Harder
```

It is now 4 months since 19P/Borrelly was at perihelion (q=1.31 au) and peaked at 8th magnitude. In May the comet was observed by multiple observers (J. J. Gonzalez, Christian Harder, Carl Hergenrother, Thomas Lehmann via COBS, and Uwe Pilz) at 11-12th magnitude. June will see Borrelly fade from around magnitude 12.4 to 13.6 as it moves through Auriga (Jun 1-9), Gemini (9-12), Auriga (12-23), and Lynx (23-30) in the evening sky, at least for northern observers. The upcoming returns in 2028 and 2035 will be good ones. The current return saw a minimum distance to Earth of 1.18 au while 2028 will see a closer approach of 0.41 au and 2035 an approach of 0.62 au.

22P/Kopff

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

Orbit (from MPEC 2022-K19)

```
  22P/Kopff
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Mar. 18.12949 TT                                  Rudenko
q   1.5524137            (2000.0)            P              Q
n   0.15446375     Peri.  163.02047     +0.24029608     +0.96810064
a   3.4402104      Node   120.83289     -0.89992716     +0.24959097
e   0.5487445      Incl.    4.74203     -0.36385287     +0.02203389
P   6.38
From 3858 observations 2008 Jan. 30-2022 May 10, 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-Jun-01  00 07  -01 24   1.726   1.807    69M   Psc  11.2    11   43
2022-Jun-06  00 17  -00 35   1.748   1.787    71M   Psc  11.3    13   44
2022-Jun-11  00 27  +00 11   1.770   1.767    73M   Cet  11.3    15   45
2022-Jun-16  00 36  +00 54   1.794   1.747    75M   Cet  11.3    17   45
2022-Jun-21  00 44  +01 33   1.818   1.725    78M   Cet  11.4    20   46
2022-Jun-26  00 52  +02 09   1.843   1.703    81M   Cet  11.4    23   46
2022-Jul-01  01 00  +02 40   1.869   1.680    83M   Psc  11.5    26   46
2022-Jul-06  01 07  +03 08   1.895   1.656    86M   Psc  11.5    29   46
```

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 = 6.2 + 5 log d + 19.1 log r(t-50)
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 05 06.76 xS 11.8 AQ 40.0L 4 182    2.5  3            ICQ XX WYA   Christopher Wyatt
```

22P/Kopff is now almost 3 months passed its March 18 perihelion (q=1.55 au) but still 3 months out from its closest approach to Earth on September 14 at 1.39 au. Visual photometry by Chris Wyatt and digital photometry submitted to COBS by Thomas Lehmann found 22P to have continued to brighten into May. This post-perihelion brightening trend is due to both a seasonal effect, at least for this return Kopff is brighter after perihelion, and a decreasing Earth-comet distance.

Kopff continues to be a morning object and will spend June moving through Pisces (June 1-10), Cetus (10-30) and back into Pisces (30). While well placed for observation from the southern hemisphere, June sees Kopff become easier to see from the northern hemisphere. The comet is likely to finally start fading this month though it should remain around 11th magnitude.

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-K19)

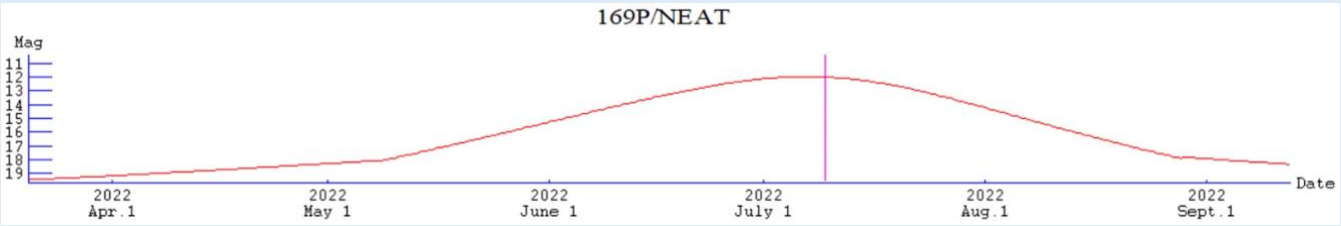
```
169P/NEAT
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 July  9.68847 TT                                  Rudenko
q   0.6027890            (2000.0)            P              Q
n   0.23490829     Peri.  218.04988     +0.82668137     -0.56251317
a   2.6013801      Node   176.10815     +0.55224577     +0.80661054
e   0.7682811      Incl.   11.29888     +0.10780780     +0.18154443
P   4.20
From 1280 observations 1989 Mar. 7-2022 May 10, 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-Jun-01  00 53  +12 44   0.929   1.058    53M   Psc  15.3    11   25
2022-Jun-06  01 26  +14 46   0.867   1.049    49M   Psc  14.7     9   22
2022-Jun-11  02 01  +16 34   0.807   1.054    45M   Ari  14.1     7   19
2022-Jun-16  02 37  +18 01   0.751   1.073    42M   Ari  13.5     5   15
2022-Jun-21  03 13  +19 07   0.700   1.106    38M   Ari  12.9     3   12
2022-Jun-26  03 49  +19 49   0.658   1.151    34M   Tau  12.5     1   10
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
```

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. The Oschin has a long history of comet discovery, via photography in the 1940s through 1990s, as part of the CCD equipped NEAT program in the 2000s, and currently as part of the ZTF (Zwicky Transient Facility) program. It was the NEAT program that found 169P 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. During its next apparition on 2005 July 28, Brian Warner detected cometary activity while conducting lightcurve observations. Including pre-discovery observations, 169P has been observed at 7 returns including 1988 (pre-discovery), 2001 (pre-discovery), 2005, 2009, 2014, 2018, and the current one.

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.

This month should see 169P brighten from around magnitude 15 to 12 as it moves through Pisces (Jun 1-8), Aries (8-22), and Taurus (22-30) in the morning sky. It will become as very difficult object for northern observers by the end of the month. The southern hemisphere will lose sight of it only a few weeks later. By the time the comet reappears later this year, it should be inactive and around 18th magnitude.

169P's orbital evolution between 1950 and 2100 is fairly stable due to it never gets closer than 1 au to Jupiter during that time period. The lack of close Jupiter approaches is due to a 0.98 au Jupiter MOID (Minimum Orbit Intercept Distance), i.e., the closest their orbits approach one another. The large MOID is the result of an aphelion distance of 4.60 au as well as the comet reaching its maximum distance above the ecliptic plane at aphelion. Fernandez & Sosa (2015) found 169P's orbit to be stable over the past 5x10^4 years suggesting a possible origin from the Main Belt rather than the outer solar system [Fernandez & Sosa, 2015, Planetary & Space Sciences 118, 14-24].

The next two returns should be better with the 169P possibly reaching 10th magnitude while passing 0.17 and 0.20 au from Earth in 2026 and 2030, respectively. During both returns the comet will be located at small solar elongations when at its brightest.

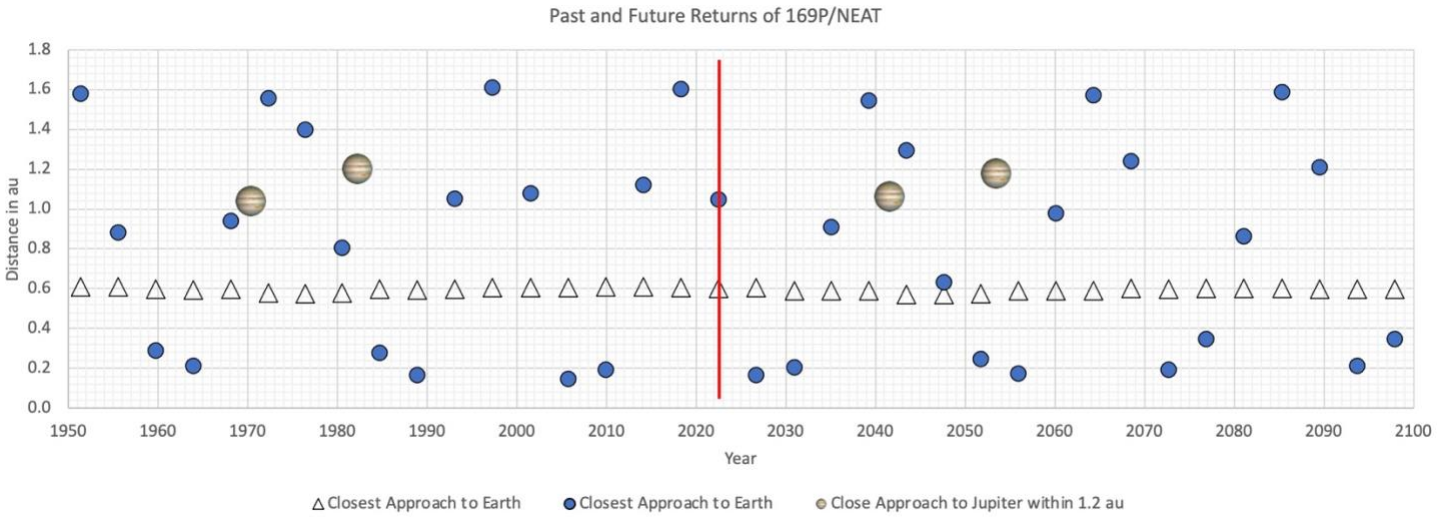


Figure 3 - Orbital evolution of 169P/NEAT between 1950 and 2100.

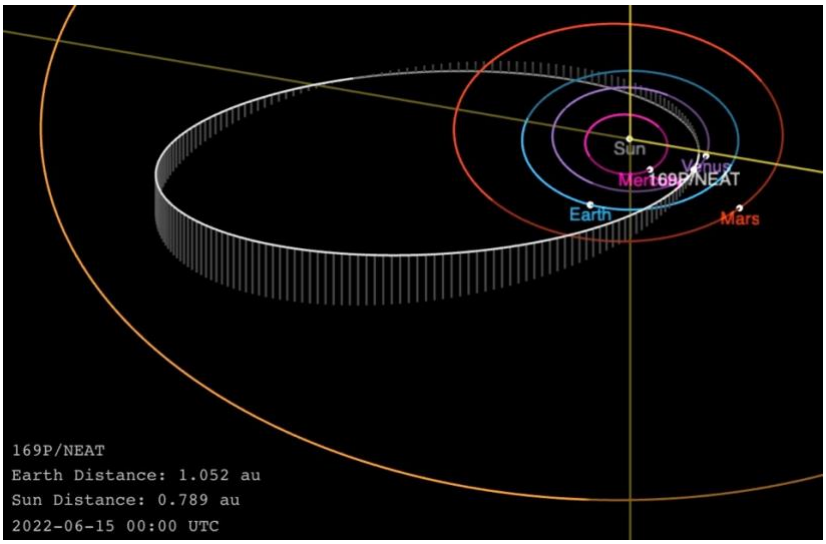


Figure 4 - Orbit of 169P with positions valid for 2022 June 15. From JPL Small Body Browser.

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-K19)

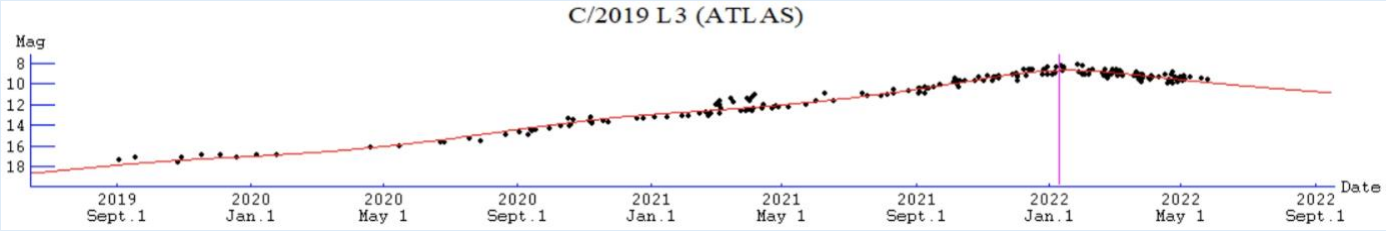
```
    C/2019 L3 (ATLAS)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Jan.  9.62447 TT                                  Rudenko
q   3.5544790           (2000.0)            P               Q
z  -0.0004422      Peri.  171.61174     -0.26052911     -0.66630360
 +/-0.0000003      Node   290.78993     +0.83676486     +0.20516601
e   1.0015716      Incl.   48.36123     +0.48161100     -0.71690056
From 5257 observations 2019 June 10-2022 May 17, 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-Jun-01  07 32   +08 58    3.781   4.435     44E    CMi     9.9     2   23
2022-Jun-06  07 37   +08 19    3.797   4.496     41E    CMi    10.0     0   21
2022-Jun-11  07 42   +07 40    3.813   4.555     38E    CMi    10.0     0   19
2022-Jun-16  07 47   +06 60    3.829   4.610     35E    CMi    10.1     0   17
2022-Jun-21  07 53   +06 18    3.846   4.662     32E    CMi    10.1     0   15
2022-Jun-26  07 58   +05 36    3.864   4.710     30E    CMi    10.2     0   13
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
```

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
   2019L3  2022 05 25.90   S  9.8 TK 20.3T10 100   2    5           ICQ XX GON05 Juan Jose Gonzalez Suarez
   2019L3  2022 05 13.14   Z 10.2 U4  5.0R 4a180                    ICQ xx OLAxx Michael Olason
   2019L3  2022 05 04.90   S  9.8 TK 20.3T10  77   3    5           ICQ XX GON05 Juan Jose Gonzalez Suarez
   2019L3  2022 05 03.87   S  9.9 TI 29.8L 4 108   2.6  3/          ICQ XX HAR11 Christian Harder
   2019L3  2022 05 03.42 xM 10.6 AQ 40.0L 4  59   2    5/          ICQ XX WYA   Christopher Wyatt
   2019L3  2022 05 02.88   S 10.1 TI 29.8L 4 108   2    3/          ICQ XX HAR11 Christian Harder
   2019L3  2022 05 02.37 xM 10.3 AQ 40.0L 4  59   1.9  5/          ICQ XX WYA   Christopher Wyatt
```

C/2019 L3 (ATLAS) has been a fixture in these pages since April of 2021 even though it has been ~6 months since its 2022 January 9 perihelion at 3.55 au. With the comet now getting lower in the sky with each passing evening, we will soon be saying good bye, at least for a few months. Northern observers lose sight of L3 in early June. The comet will remain visible from the southern hemisphere until mid-July.

Observers found L3 between magnitude 9.8 and 10.2 in May. With L3 slowly moving away from the Sun and Earth, June should see it continue to slowly fade around magnitude 9.9 to 10. Following solar conjunction in August, L3 will reappear in August for southern observers and September for northern observers. It should 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-K19)

```
    C/2019 T4 (ATLAS)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 June  9.17485 TT                                  Rudenko
q   4.2423647           (2000.0)            P              Q
z  +0.0009816      Peri.  351.20656     -0.95991870     +0.05616981
 +/-0.0000005      Node   199.94023     -0.18206488     -0.86982812
e   0.9958357      Incl.   53.62597     -0.21309264     +0.49014691
From 1491 observations 2019 Feb. 5-2022 May 18, mean residual 0".6.
1/a(orig) = +0.000726 AU**-1, 1/a(fut) = +0.001034 AU**-1.
```

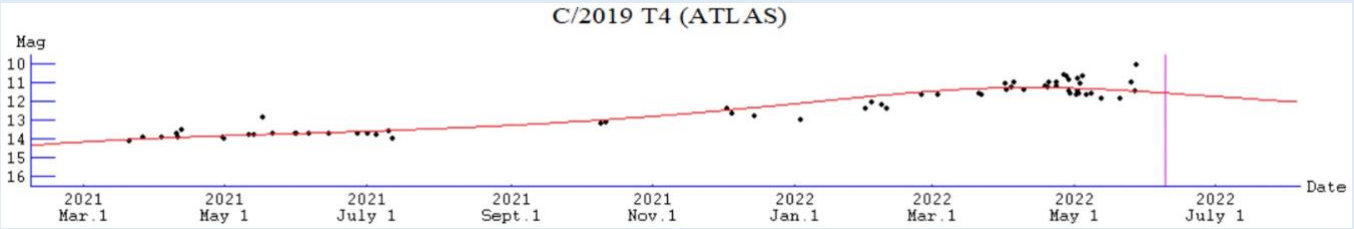
Ephemerides (produced with Seiichi Yoshida's Comets for Windows program)

C/2019 T4 (ATLAS)

Date	R.A.	Decl.	r	d	Elong	Const	Mag	Max El (deg) 40N	40S
2022-Jun-01	11 48	-08 41	4.243	3.782	110E	Crt	11.5	33	59
2022-Jun-06	11 50	-07 56	4.242	3.852	105E	Crt	11.5	31	58
2022-Jun-11	11 52	-07 15	4.242	3.924	101E	Crt	11.6	28	57
2022-Jun-16	11 55	-06 38	4.243	3.999	96E	Vir	11.6	26	57
2022-Jun-21	11 57	-06 04	4.244	4.074	92E	Vir	11.7	23	56
2022-Jun-26	12 00	-05 34	4.245	4.151	88E	Vir	11.7	21	55
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

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 05 27.72  Z 12.5 U4 20.0L 3a720   3.5       4.4m 50 ICQ xx HER02 Carl Hergenrother
   2019T4  2022 05 21.29  Z 12.9 U4  7.2R 5A200   1.5               ICQ xx HER02 Carl Hergenrother
   2019T4  2022 05 13.15  Z 11.9 U4  5.0R 4a180                     ICQ xx OLAxx Michael Olason
   2019T4  2022 05 06.48 xM 12.3 AQ 40.0L 4  59   2.1  6            ICQ XX WYA   Christopher Wyatt
   2019T4  2022 05 04.93  S 10.4 TK 20.3T10  77   5    3/           ICQ XX GON05 Juan Jose Gonzalez Suarez
   2019T4  2022 05 03.89  S 11.5 TI 29.8L 4 108   2    4            ICQ XX HAR11 Christian Harder
   2019T4  2022 05 03.44 xM 12.2 AQ 40.0L 4  59   2.2  6            ICQ XX WYA   Christopher Wyatt
   2019T4  2022 05 02.89  S 11.2 TI 29.8L 4 108   2.1  4            ICQ XX HAR11 Christian Harder
   2019T4  2022 05 02.40 xM 12.3 AQ 40.0L 4  59   1.5  6            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 arrives at perihelion on 2022 June 9 (q=4.24 au). May's aperture corrected observations mainly measured magnitudes between 11 and 12 with a few observations coming in brighter. C/2019 T4 is visible from both hemispheres in the evening sky in the constellations Crater (Jun 1-15) and Virgo (15-30).

C/2020 V2 (ZTF)

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

Orbit (from Minor Planet Center, MPEC 2022-K19)

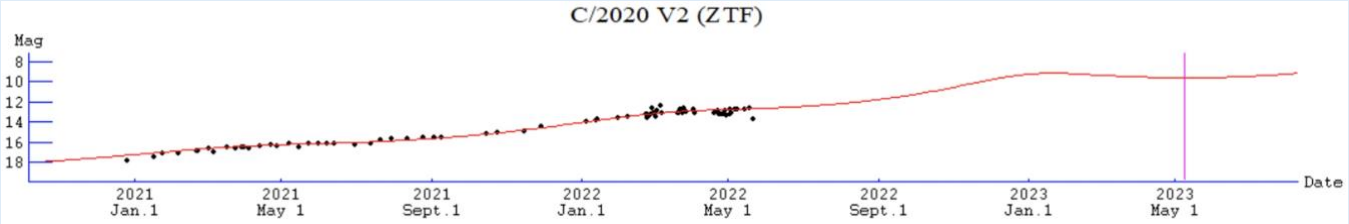
```
    C/2020 V2 (ZTF)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2023 May 8.48996 TT                                   Rudenko
q   2.2282453            (2000.0)            P              Q
z  -0.0005404      Peri.  162.40087     +0.69769072     +0.59419044
 +/-0.0000009      Node   212.36103     +0.53377317     -0.05855894
e   1.0012040      Incl.  131.60871     +0.47782200     -0.80218986
From 2418 observations 2020 Apr. 18-2022 May 18, mean residual 0".6.
1/a(orig) = +0.000023 AU**-1, 1/a(fut) = -0.000213 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-May-01  10 28  +61 04   4.523   4.407     90E    UMa  12.8     68    0
2022-May-06  10 21  +60 44   4.482   4.435     86E    UMa  12.7     66    0
2022-May-11  10 14  +60 21   4.442   4.463     82E    UMa  12.7     64    0
2022-May-16  10 09  +59 55   4.401   4.491     78E    UMa  12.7     61    0
2022-May-21  10 04  +59 27   4.360   4.518     74E    UMa  12.7     57    0
2022-May-26  10 00  +58 58   4.319   4.543     70E    UMa  12.7     53    0
2022-May-31  09 57  +58 28   4.279   4.567     67E    UMa  12.6     50    0
2022-Jun-05  09 55  +57 57   4.238   4.587     63E    UMa  12.6     46    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 05 29.93  S 13.4 TI 29.8L 4 132  0.5   3/           ICQ XX HAR11 Christian Harder
   2020V2  2022 05 28.94  S 13.3 TI 29.8L 4 132  0.5   3/           ICQ XX HAR11 Christian Harder
   2020V2  2022 05 27.92  S 13.1 TI 29.8L 4 132  0.6   4            ICQ XX HAR11 Christian Harder
   2020V2  2022 05 21.27  Z 13.7 U4  7.2R 5A200   1.5       1  m120 ICQ xx HER02 Carl Hergenrother
   2020V2  2022 05 03.91  S 13.5 TI 29.8L 4 132   0.7  4    1.0m120 ICQ XX HAR11 Christian Harder
   2020V2  2022 05 02.91  S 13.7 TI 29.8L 4 132   0.8  5    0.8m120 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 almost a year from its 2023 May 8 perihelion at 2.23 au. Christian Harder and Carl Hergenrother observed C/2020 V2 in May between magnitude 13 and 14. V2 still located far to the north in Ursa Major and only visible to northern observers. 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 F1 (Lemmon-PANSTARRS)

Discovered 2021 March 19 by the Mount Lemmon survey
Dynamically old long-period comet with ~2800-year period

Orbit (from MPEC 2022-H30)

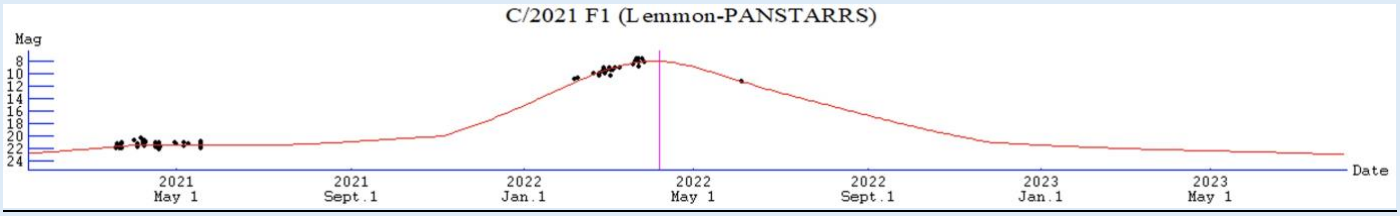
```
    C/2021 F1 (Lemmon-PANSTARRS)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Apr. 6.87358 TT                                  Rudenko
q   0.9954849           (2000.0)            P              Q
z  +0.0042386      Peri.  146.82258     +0.70299125     +0.60122058
 +/-0.0000013      Node   203.45145     +0.23496669     +0.30785692
e   0.9957805      Incl.  107.32451     +0.67126296     -0.73739944
From 659 observations 2021 Mar. 19-2022 Mar. 28, mean residual 0".5.
1/a(orig) = +0.004931 AU**-1, 1/a(fut) = +0.004349 AU**-1.
```

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

```
C/2021 F1 (Lemmon-PANSTARRS)                                          Max El
                                                                       (deg)
    Date       R.A.    Decl.     r       d     Elong  Const  Mag    40N  40S
2022-Jun-01  02 50  -02 10   1.355   2.055     34M    Eri   11.1      0   17
2022-Jun-06  02 59  -04 44   1.410   2.039     39M    Eri   11.4      0   22
2022-Jun-11  03 07  -07 25   1.466   2.021     43M    Eri   11.8      0   26
2022-Jun-16  03 15  -10 12   1.523   2.001     48M    Eri   12.1      0   30
2022-Jun-21  03 23  -13 06   1.581   1.982     52M    Eri   12.4      0   35
2022-Jun-26  03 31  -16 08   1.641   1.963     56M    Eri   12.7      0   39
2022-Jul-01  03 40  -19 17   1.700   1.946     60M    Eri   13.1      0   43
2022-Jul-06  03 48  -22 34   1.760   1.932     64M    Eri   13.4      0   47
```

Comet Magnitude Formula (based on data submitted to the COBS and the MPC)

```
m1 = 14.6, G = 0.15 [through T-155 days and assumed after T+230 days]
m1 =  6.7 + 5 log d + 26.6 log r [T-155 to perihelion]
m1 =  6.7 + 5 log d + 21.3 log r [From perihelion to T+230 days, 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
   2021F1  2022 06 04.17  Z 11.3 U4 20.0L 3a360   6.1              ICQ xx HER02 Carl Hergenrother
```

It takes me a few days to slowly write up these summaries. A few days ago, I wrote the text for C/2021 F1 (Lemmon-PANSTARRS) and wondered what happened to it. After reaching 8th magnitude in late March, it became lost in the glare of the Sun. It should have reappeared for southern observers in late May, but no observations had been reported. To remedy that, I used the Skygems Observatory ASA N8 f/2.9 astrograph at Hakos, Namibia to image whatever had become of C/2021 F1. I'm happy to report the comet is alive and well. My images from June 4 UT found the comet at magnitude 11.3 with a condescend 6' coma but no tail. Based on past experience, my CCD photometry is often too faint so it is possible C/2021 F1 is up to a magnitude brighter than what I measured.

Discovered independently by the Catalina Sky Survey with their Mount Lemmon 1.5-m and Pan-STARRS with their Pan-STARRS1 1.8-m on Haleakala on 2021 March 19, the comet was initially inactive and 20-21st magnitude. An analysis of photometry submitted to the Minor Planet Center in March through May of 2021

found an absolute magnitude of 14.6 corresponding to a diameter of 8 km (assuming albedo of 0.04). C/2021 F1 is a dynamically old long-period comet with an original semi-major axis of ~200 au and orbital period of ~2800 years. It will be interesting to see if C/2021 F1 becomes inactive over the coming months, perhaps allowing the opportunity to observe and study its bare nucleus before it gets too faint.

This month observations will be limited to the southern hemisphere as it moves through Eridanus in the morning sky. The comet will continue to move south and become a southern circumpolar object by August so northern observers have seen the last of F1. Its brightness should fade from around magnitude 11 to 13, though this is based on my single observation which may be up to a magnitude too faint.

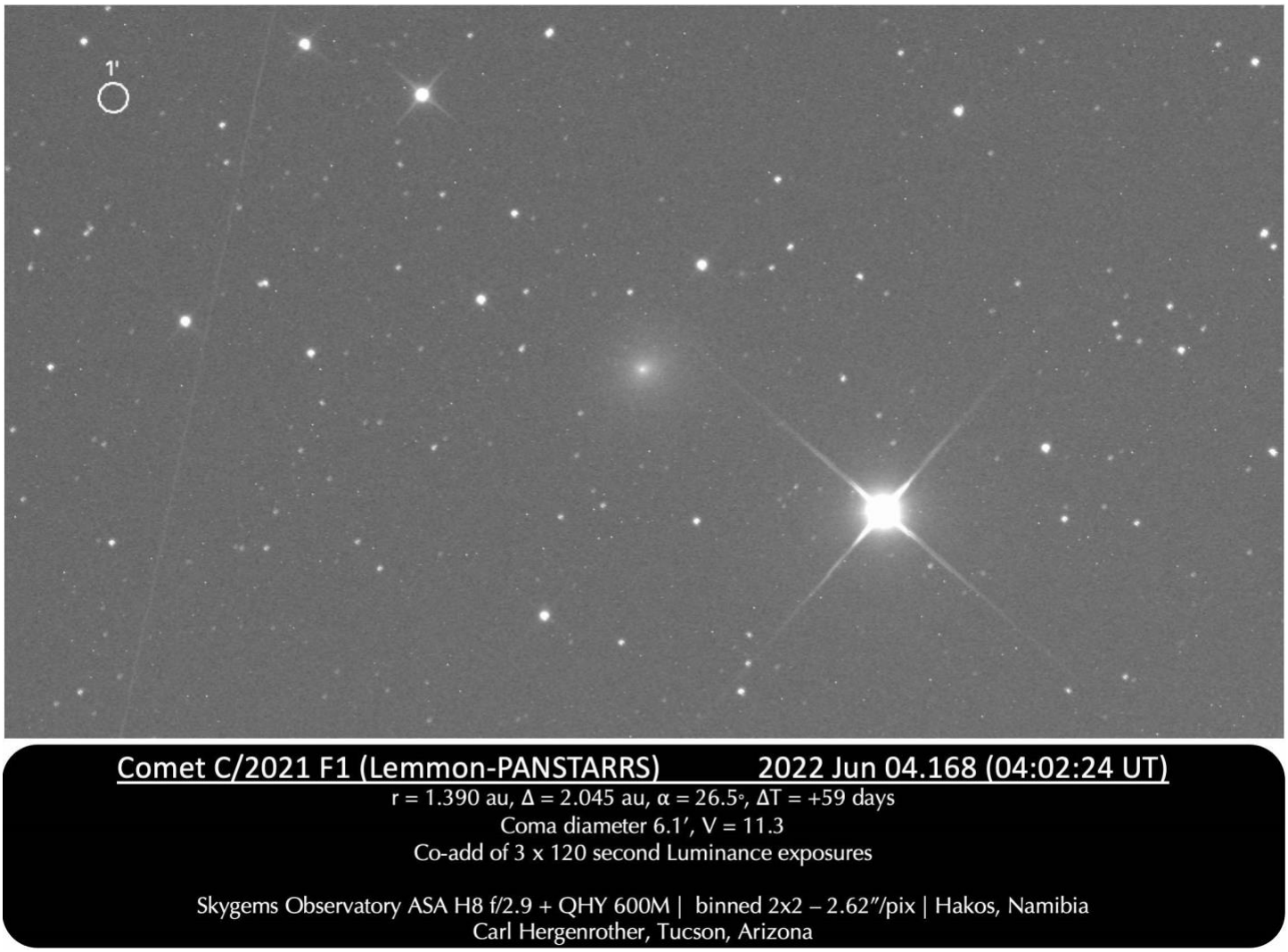


Figure 5 - C/2021 F1 (Lemmon-PANSTARRS) as imaged on 2022 June 4 by Carl Hergenrother with the Skygems Observatory ASA H8 f/3.9 astrograph at Hakos in Namibia. Image can also be found at http://www.alpo-astronomy.org/gallery3/index.php/Comet-Images-and-Observations/Comets-Discovered-in-2021/C-2021-F1-Lemmon-PANSTARRS/C2021F1-Lemmon-PANSTARRS-2022-Jun-04-Carl-Hergenrother .

C/2021 O3 (PANSTARRS)

Discovered 2021 July 26 by Pan-STARRS with the 1.8-m Pan-STARRS1 1.8-m on Haleakala
Dynamically new long-period comet

Orbit (from Minor Planet Center, MPEC 2022-K19)

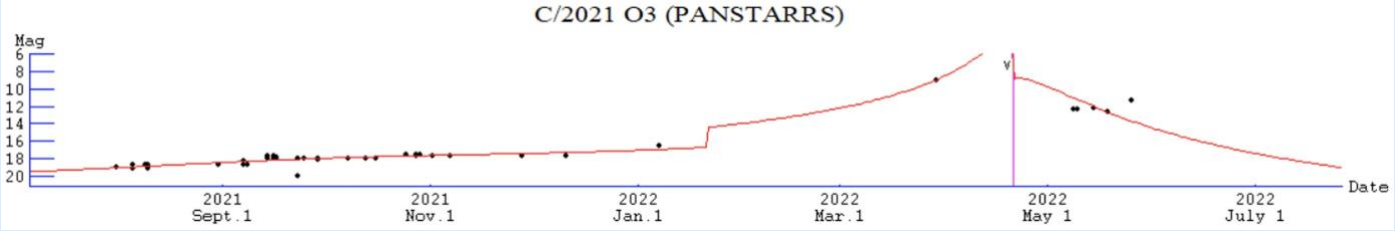
```
   C/2021 O3 (PANSTARRS)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Apr. 21.04515 TT                                  Rudenko
q   0.2873538           (2000.0)            P               Q
z  -0.0004725      Peri.  299.98706     -0.56798891     -0.81251846
 +/-0.0000019      Node   189.01889     +0.64623030     -0.53895928
e   1.0001358      Incl.   56.79100     -0.50968128     +0.22211853
From 759 observations 2021 July 26-2022 May 18, mean residual 0".8.
1/a(orig) = -0.000026 AU**-1, 1/a(fut) = -0.000188 AU**-1.
```

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

```
C/2021 O3 (PANSTARRS)                                                  Max El
                                                                       (deg)
    Date      R.A.    Decl.     r       d     Elong  Const  Mag     Naut Twil
                                                                      40N  40S
2022-Jun-01  11 23  +80 19   1.092   0.869     70E   Cam  14.5     48    0
2022-Jun-06  12 49  +76 39   1.190   0.956     74E   Cam  15.1     52    0
2022-Jun-11  13 31  +72 42   1.286   1.045     77E   UMi  15.6     56    0
2022-Jun-16  13 55  +69 00   1.379   1.137     79E   Dra  16.1     60    0
2022-Jun-21  14 11  +65 36   1.470   1.229     81E   UMi  16.5     62    0
2022-Jun-26  14 23  +62 29   1.559   1.323     82E   UMa  16.9     64    0
2022-Jul-01  14 33  +59 36   1.646   1.418     83E   Dra  17.3     66    0
2022-Jul-06  14 41  +56 55   1.732   1.514     83E   Dra  17.7     66    0
```

Comet Magnitude Formula (based on data submitted to the COBS and the MPC)

```
m1 = 13.2 + 5 log d +  4.7 log r [through -130 days]
m1 = 11.5 + 5 log d +  7.5 log r [-130 days to perihelion, assumed]
m1 = 14.4 + 5 log d + 10.0 log r [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
   2021O3  2022 05 25.98  S 11.6 TK 20.3T10  77   5    1/          ICQ XX GON05 Juan Jose Gonzalez Suarez
   2021O3  2022 05 10.15  Z 12.3 U4  7.2R 5a480   3.1              ICQ xx HER02 Carl Hergenrother
```

C/2021 O3 (PANSTARRS) was a big question mark over the last few months. Discovered on 2021 July 26 at 19th magnitude, the comet brightened at an extremely slow rate until it was lost in the glare of the Sun in early February. Our hopes were raised when it was observed around magnitude 9 at the end of March in the SOHO spacecraft's C3 coronagraph instrument. Starting on April 6, another SOHO instrument, SWAN, imaged the comet as a bright and brightening object. At least that was the case till about April 12/13, after which the comet began to fade as it neared its April 21 perihelion at 0.29 au.

Around the same time, ground-based imagers were able to pick up the comet at around 9th magnitude (Terry Lovejoy on April 17 and 20, a team using the 4.3-m Lowell Discovery Telescope on the 29th, and Michael

Olason on the 30th). Additionally, Twitter posts by Worachate Boonplod, an expert in analyzing and discovering comets in SOHO and STEREO imagery, (https://twitter.com/worachate) showed the comet as a stretched out, faint, elongated object in STEREO-A COR2 images taken on April 27-28. Many of these observations were suggestive of a disintegrating comet leading to my statement in the last ALPO Comet News, "So, it's probably safe to say that C/2021 O3 is in bad shape and in the process of disintegrating if not completely disintegrated already." Well, the comet has proved us wrong.

Images from multiple observers (see images of C/2021 O3 (PANSTARRS) at the ALPO Comets Section image gallery at http://www.alpo-astronomy.org/gallery3/index.php/Comet-Images-and-Observations/Comets-Discovered-in-2021/C-2021-O3-PANSTARRS) show a faint but reasonably healthy comet with a gas coma. An orbit by Syuichi Nakano (Nakano Note 4705) incorporating post-perihelion observations shows that O3 has not diverged from its expected position so the offset measured in post-perihelion images was due to an inaccurate orbit. But why did the comet look like it was disintegrating in the STEREO COR2 images? The likely answer was posted by CloudyNights contributor Qicheng Zhang to the "ALPO Comet News for April 2022" thread:

"STEREO-A is observing at much higher phase angle (>170 deg) and close to the orbital plane, so I think that long, thin feature is probably just the neckline of micron-sized dust released before perihelion reconverging onto the orbital plane after perihelion (like Arend-Roland's famous antitail), with the actual debris cloud of larger grains from the nucleus disintegrating not actually visible at those phase angles, hence, the headless look. Unfortunately, that means this tail probably won't ever be observed from the ground since we never see the comet at such high phase angles from Earth and also won't approach the orbital plane for many months."

Regardless of the "did it or didn't it fall apart" uncertainty, the comet is a faint diffuse object to observe. In May, it seemed to maintain a consistent 11-12th magnitude brightness even though the comet was rapidly moving away from the Sun and Earth. We should expect it to fade rapidly this month as it moves through the northern circumpolar sky [Camelopardalis (Jun 1-6), Draco (6-7), Ursa Minor (7-15), Draco (15-17), Ursa Minor (17-21), Draco (21-25), Ursa Major (25-28), and Draco (28-30)]. Assuming a 10 log r fall off in brightness, O3 might be as faint as magnitude 17 by the end of the month.

Figure 6 – Here's another version of the Dan Bartlett image from this issue's cover. In this version, the images are co-added on the motion of the comet which chances the comet but minimizes the signal from background stars and galaxies. Information on the equipment and exposures used can be found on the cover.

C/2021 P4 (ATLAS)

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

Orbit (from Minor Planet Center, MPEC 2022-K19)

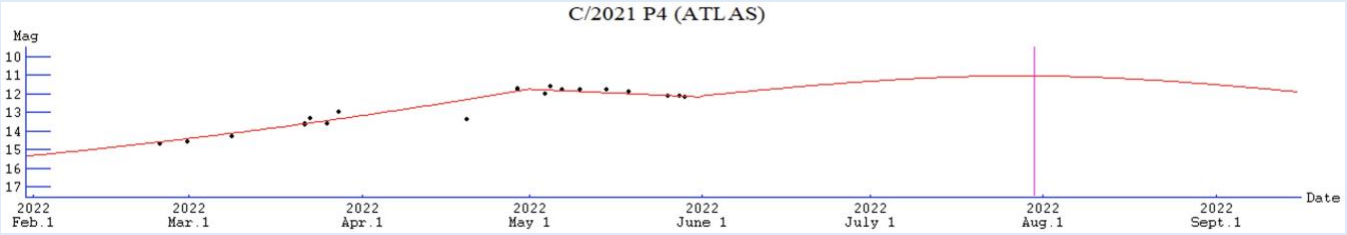
```
    C/2021 P4 (ATLAS)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 July 30.37635 TT                                  Rudenko
q   1.0804713           (2000.0)            P              Q
z  +0.0031843      Peri.  175.82226     -0.96755482     -0.18540626
 +/-0.0000014      Node   348.09497     +0.20093035     -0.15276370
e   0.9965594      Incl.   56.31080     +0.15318177     -0.97071508
From 750 observations 2021 Aug. 10-2022 May 18, mean residual 0".6.
1/a(orig) = +0.003523 AU**-1, 1/a(fut) = +0.003260 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-Jun-01  06 22  +54 26   1.441   2.092     38E    Lyn  12.1    21    0
2022-Jun-06  06 48  +52 22   1.392   2.063     36E    Lyn  11.9    19    0
2022-Jun-11  07 13  +49 57   1.344   2.036     35E    Lyn  11.8    18    0
2022-Jun-16  07 36  +47 13   1.299   2.014     33E    Lyn  11.7    16    0
2022-Jun-21  07 57  +44 11   1.257   1.995     32E    Lyn  11.5    14    0
2022-Jun-26  08 16  +40 54   1.218   1.980     30E    Lyn  11.4    11    0
2022-Jul-01  08 34  +37 24   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
```

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 60 days before perihelion]
m1 =  9.3 + 5 log d +  7.5 log r [From 60 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 05 28.94  S 12.6 TI 29.8L 4 132  0.8   3/           ICQ XX HAR11 Christian Harder
   2021P4  2022 05 27.94  S 12.5 TI 29.8L 4 132  1     3/           ICQ XX HAR11 Christian Harder
   2021P4  2022 05 25.91  S 10.8 TK 20.3T10 100   4    2            ICQ XX GON05 Juan Jose Gonzalez Suarez
   2021P4  2022 05 10.16  Z 12.6 U4  7.2R 5A200   1.8               ICQ xx HER02 Carl Hergenrother
   2021P4  2022 05 04.89  S 10.3 TK 20.3T10  77   5    3            ICQ XX GON05 Juan Jose Gonzalez Suarez
   2021P4  2022 05 03.92  S 12.4 TI 29.8L 4 132   1.5  3            ICQ XX HAR11 Christian Harder
```

Images of C/2021 P4 (ATLAS) can be found at the ALPO Comets Section image gallery at http://www.alpo-astronomy.org/gallery3/index.php/Comet-Images-and-Observations/Comets-Discovered-in-2021/C-2021-P4-ATLAS .

The "Asteroid Terrestrial-Impact Last Alert System" (ATLAS) search program found C/2021 P4 (ATLAS) on 2021 August 10 with a 0.5-m f/2 Schmidt telescope on Haleakala in Hawaii. Though 19th magnitude at discovery, P4 has rapidly brightened is currently on the cusp of breaking magnitude 12.0 this month. A rapid brightening is not a big surprise for a dynamically old long-period comet with an orbital period of ~5500 years.

Unfortunately for us on Earth, 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 ~2 au and a low solar elongation. If perihelion was in early March The comet would have passed within 0.1 au of Earth resulting in a much brighter comet.
In images, C/2021 P4 is a rather aesthetically pleasing comet. Even at a heliocentric distance under 1.5 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 7 - C/2021 P4 (ATLAS) on 2022 May 25 as imaged by Dan Bartlett. Dan imaged the comet from June Lake, CA, USA with a Celestron RASA11 Schmidt telescope and ASI2600MC-Pro camera. It is a co-add of 59 x 60 sec exposures.

On the other hand, P4 has been a difficult one to understand photometrically. Magnitude estimates show a large scatter even after correcting for aperture effects. J. J. Gonzalez and Christian Harder both observed C/2021 P4 visually in May. Gonzalez has consistently been reporting a brightness between magnitude 10 and 11 while Harder's observations are fainter at magnitude 12.4 to 12.6 (aperture corrected to 12.0 to 12.2). Digital photometry obtained by Thomas Lehmann is closer to Harder's values with magnitudes of 11.8 and 11.9. Perhaps the scatter is due to how much of the broad tail is being measured as well as the coma.

Until early May, P4 was brightening at a rapid rate. Since then, the comet has actually shown signs of fading intrinsically. It's anyone's guess if this fading will continue. The prediction above assumes the comet will begin to brighten again at a 7.5 log r rate. If so, we can expect P4 to brighten from around magnitude 12 to 11 over the course of the month as it moves through Lynx (Jun 1-2), Auriga (2-4), and Lynx (4-30) in the northern sky.

Its location in the northern sky means it is already not visible from the southern hemisphere. June should also be the last month to see it easily from the northern hemisphere before it moves too close to the Sun in early July. Southern observers will get a chance to observe P4 in October though it may be a few magnitudes fainter.