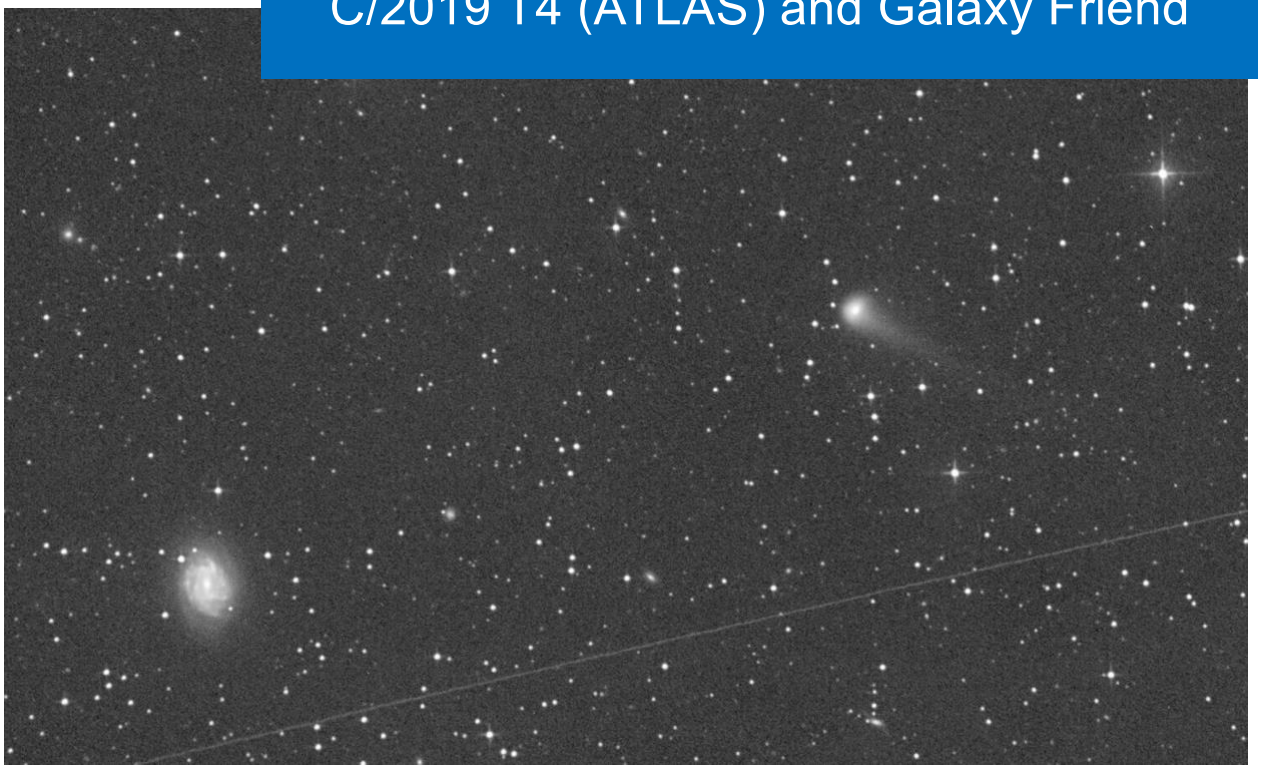
May 2022

ALPO Comet News

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

C/2019 T4 (ATLAS) and Galaxy Friend



C/2019 T4 (ATLAS) is a dynamically old long period comet. It is inbound to a perihelion on 2022 June 9 at a distant 4.24 au from the Sun. Comet ATLAS is currently around magnitude 11 and visible in the constellation of Crater in the evening sky. Michael Jager caught the comet passing by the 10th magnitude spiral galaxy NGC 3887 on 2022 April 21.30 UT. The image is a co-add of 8x80 second exposures taken with a 0.4-m f/3.2 telescope and QHY600 camera.

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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/822424-alpo-comet-news-for-may-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

Last month's big question was "What's up with C/2021 O3 (PANSTARRS)?" Would it survive passing 0.29 au from the Sun or disintegrate like many other dynamically new, intrinsically faint comets? We now have our answer. C/2021 O3 has likely disintegrated with a remnant dust cloud being all that's remains of the comet. Still as of the end of April, some ground-based observers have been able to detect a diffuse remnant at ~9th magnitude. This at least gives us some hope of being able to monitor the slow dispersal of the dusty remains as it heads into the northern circumpolar evening sky.

Of course, C/2021 O3 isn't the only comet in the sky. While May won't see any very bright comets, a number will be in the 9-10th magnitude range including C/2017 K2 (PANSTARRS), C/2019 L3 (ATLAS), C/2021 E3 (ZTF), and C/2021 F1 (Lemmon-PANSTARRS) (the last two only visible from the southern hemisphere). Observers who can push fainter to around 12th magnitude can also observe 9P/Tempel, 19P/Borrelly, 22P/Kopff, 45P/Honda-Mrkos-Pajdusáková, C/2019 T4 (ATLAS), C/2020 (ZTF), and C/2021 P4 (ATLAS).

April saw the ALPO Comets Section receive 89 magnitude estimates and 15 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 M5 (ATLAS), C/2020 K1 (PANSTARRS), C/2020 J1 (SONEAR), C/2019 T4 (ATLAS), C/2019 L3 (ATLAS), C/2017 K2 (PANSTARRS), 116P/Wild, 104P/Kowal, 73P/Schwassmann-Wachmann, 67P/Churyumov-Gerasimenko, 29P/Schwassmann-Wachmann, 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, Mike Olason, Uwe Pilz, Raymond Ramlow, Chris Schur, and Chris Wyatt.

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.

Comets Calendar for May 2022

May 01 - C/2021 E3 (ZTF) very close to 11th magnitude galaxy NGC 7079
May 03 - C/2021 O3 (PANSTARRS) skirts to the west of the omicron Persei Cloud
May 03 - C/2021 O3 (PANSTARRS) passes to the west of the California Nebula
May 07-08 - C/2021 E3 (ZTF) passes ~20' from 12th magnitude galaxy NGC 7124
May 08 - First Quarter Moon
May 08-09 - C/2019 T4 (ATLAS) passes of ~10' from 10th magnitude galaxy NGC 3831
May 09 - C/2021 O3 (PANSTARRS) clips the eastern edge of the Fossil Footprint Nebula, NGC 1491
May 10 - 22P/Kopff and Mars within 0.5 deg of each other. The pair are within a deg for almost 2 weeks.
May 12 - 182P/LONEOS at perihelion (q = 0.99 au, 5.1-yr period, V ~ 19, discovered in 2001, observed again in 2007 and 2012, not seen at return in 2017, yet to be recovered at current return)
May 12 - 286P/Christensen at perihelion (q = 2.36 au, 8.3-yr period, V ~ 19, discovered in 2005, also seen at 2014 and current return)
May 12 - 9P/Tempel passes near galaxies NGC 7180, 7184, 7185, and 7188
May 12 - C/2021 O3 (PANSTARRS) passes nearly over open cluster IC 361
May 12-13 - C/2021 O3 (PANSTARRS) and C/2021 P4 (ATLAS) are within ~2 deg of each other
May 15 - Full Moon
May 15 - 45P/Honda-Mrkos-Pajdusakova passes within arc minutes of open clusters NGC 1746, 1750, and 1758
May 20 - 22P/Kopff and Neptune within ~25' of each other
May 22 - 420P/Hill at perihelion (q = 2.79 au, 13.0-yr period, V ~ 19, discovered in 2009 by ALPO Solar Section coordinator Rik Hill, pre-discovery observations found from 1996 and 1998, also observed at current return)
May 22 - Last Quarter Moon
May 22 - C/2021 O3 (PANSTARRS) passes close to 10th magnitude galaxy NGC 2146
May 24-25 - 45P/Honda-Mrkos-Pajdusakova passes within 0.5 deg of open clusters M35 and NGC 2158
May 26 - 9P/Tempel passes 0.75 deg north of the bright Helix Nebula
May 26-27 - C/2021 F1 (Lemmon-PANSTARRS) passes within arc minutes of galaxies NGC 1055 and M77
May 29 - P/2012 O3 (McNaught) at perihelion (q = 1.61 au, 9.8-yr period, V ~ 19-20, discovered in 2012, yet to be recovered)
May 30 - 179P/Jedicke at perihelion (q = 4.12 au, 14.5-yr period, V ~ 18, discovered in 1993, observed at return in 2007 and current return, though currently at very small solar elongations in May)
May 30 - 9P orbit plane crossing
May 30 - New Moon

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 new long-period comet

Orbit (email communication from Syuichi Nakano)

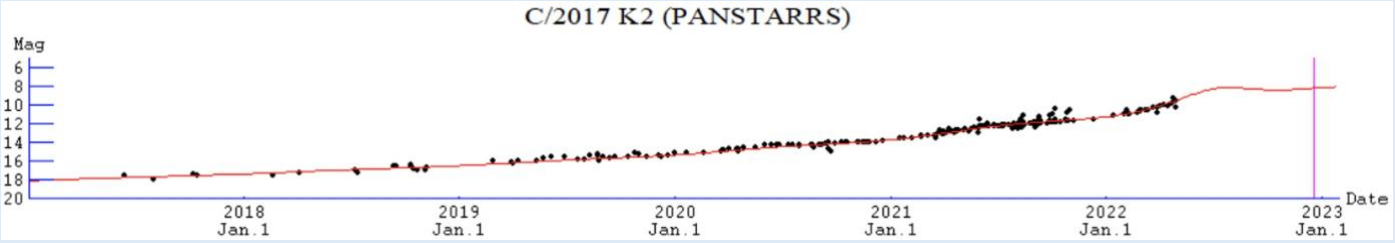
```
C/2017 K2 (PANSTARRS) computed on 2022 Apr. 14
Epoch 2022 Dec. 7.0 TT = JDT 2459920.5
T 2022 Dec. 19.68261 TT                                  Nakano
q   1.7969235           (2000.0)            P              Q
z  -0.0004644      Peri.  236.19839     +0.01818656     +0.04922961
 +/-0.0000003      Node    88.23554     -0.18092724     +0.98246013
e   1.0008344      Incl.   87.56305     -0.98332832     -0.17985700
From 7550 observations 2013 May 12-2022 Apr. 12, mean residual 0".46.
(1/a)org.= +0.000037, (1/a)fut.= +0.001130 (+/-0.000000), Q= 9.
The comet will pass 2.66 AU from Jupiter on 2024 Oct. 15 UT. Due to this
approach, the semi-major axis will decline to 885 AU (P=26000 years).
```

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-May-01  18 51  +11 43   3.312   2.823   110M   Aql    9.6    59   38
2022-May-06  18 48  +11 35   3.267   2.711   114M   Aql    9.5    60   38
2022-May-11  18 45  +11 24   3.222   2.602   119M   Oph    9.4    61   39
2022-May-16  18 40  +11 08   3.177   2.497   124M   Oph    9.2    61   39
2022-May-21  18 35  +10 45   3.132   2.397   128M   Oph    9.1    61   39
2022-May-26  18 30  +10 16   3.087   2.301   133M   Oph    9.0    60   40
2022-May-31  18 23  +09 38   3.042   2.212   138M   Oph    8.9    60   40
2022-Jun-05  18 15  +08 51   2.998   2.130   142M   Oph    8.8    59   41
```

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 04 30.48  S 10.0 TK 12.5B    30   2.0  4            ICQ xx HER02 Carl Hergenrother
   2017K2  2022 04 29.02  S 10.3 TK 20.3T10  77   3    3/           ICQ XX GON05 Juan Jose Gonzalez Suarez
   2017K2  2022 04 24.05  S 10.3 TI 53.1L   139   2    4            ICQ XX HAR11 Christian Harder
   2017K2  2022 04 23.02  S 10.3 TI 29.8L 4 108   2    3/           ICQ XX HAR11 Christian Harder
   2017K2  2022 04 08.48  S 10.5:TK 12.5B    30   1.5  3            ICQ xx HER02 Carl Hergenrother
   2017K2  2022 04 02.48  Z 11.1 AQ 10.6R 5a180   2.6       5.5m343 ICQ XX RAMaa Raymond Ramlow
```

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].

The comet's rate of brightening was steady from mid-2017 through the later months of 2021 at 2.5n ~ 7.6. Since late 2021, PANSTARRS has brightened at a much slower rate of 2.5n ~ 4. To put that in perspective, a 2.5n = 5 value signifies steady state production, i.e., the comet's production of dust and gas is constant. A 2.5n value less than 5 suggests a production rate that is decreasing with time. If you are asking how the comet can continue to appear brighter as seen by us on Earth, the decrease in distance between the comet and the Sun and the comet and Earth is more than compensating for the decrease in production. Considering that C/2017 K2 has been followed for nearly a decade now, the occasional period of steady state or negative production is not uncommon. Hopefully C/2017 K2 will see an increase in production resulting in more rapid brightening.

This April, 6 magnitude estimates were submitted to the ALPO by J. J. Gonzalez, Christian Harder, Carl Hergenrother, and Raymond Ramlow. We have also been using observations submitted to the COBS site by Thomas Lehmann for our analysis. Near the end of April, visual observers (Gonzalez, Harder and Hergenrother) found magnitudes between 10.0 to 10.3 with a small 2-3' coma and no tail. After correcting for aperture effects, the visual magnitudes are closer to magnitude 9.4 to 9.9). Digital observations (Lehmann and Ramlow) found a slightly larger coma at 2.6' to 3.6' and 5-6' tail in April.

C/2017 K2 will be with us for quite some time as perihelion does not occur until 2022 December 19 at 1.80 au. Its current slow brightening rate of 2.5n ~ 4 results in a comet that may only peak around 8.2 in July, fade to 8.5 in October as it moves away from the Earth, and peak again around 8.1 next January. Hopefully this is a worst-case prediction and the comet becomes brighter.

For May, a brightening from magnitude 9.6 to 8.9 is expected. It is still well placed for observations from both hemispheres in the morning sky in Aquila (May 1-10) and Ophiuchus (10-31). 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.

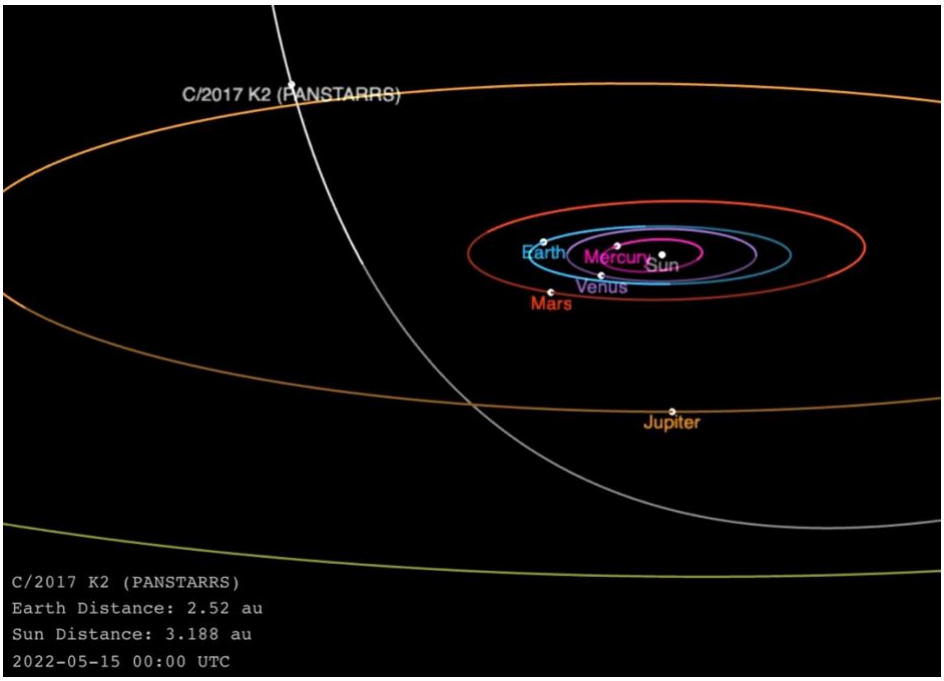


Figure 1 - Orbit diagram for C/2017 K2 (PANSTARRS) for 2022 May 15 from the JPL Small Body Browser.

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-H30)

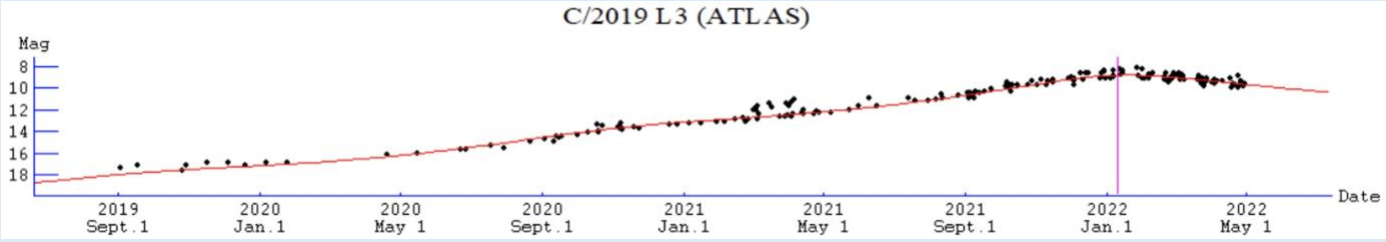
```
    C/2019 L3 (ATLAS)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Jan.  9.62458 TT                                  Rudenko
q   3.5544778           (2000.0)            P                Q
z  -0.0004422      Peri.  171.61176     -0.26052949     -0.66630351
 +/-0.0000003      Node   290.78993     +0.83676494     +0.20516556
e   1.0015717      Incl.   48.36123     +0.48161066     -0.71690078
From 5083 observations 2019 June 10-2022 Apr. 22, 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-May-01  07 03   +12 49    3.695   3.993     65E    Gem    9.5     30   29
2022-May-06  07 07   +12 12    3.708   4.070     62E    CMi    9.5     25   29
2022-May-11  07 12   +11 35    3.721   4.145     58E    CMi    9.6     21   28
2022-May-16  07 16   +10 58    3.735   4.218     55E    CMi    9.6     16   27
2022-May-21  07 21   +10 21    3.749   4.289     51E    CMi    9.7     11   26
2022-May-26  07 26   +09 44    3.763   4.357     48E    CMi    9.8      7   25
2022-May-31  07 31   +09 06    3.778   4.422     45E    CMi    9.8      2   23
2022-Jun-05  07 36   +08 27    3.794   4.484     42E    CMi    9.9      0   21
```

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

m1 = -3.7 + 5 log d + 18.8 log r(t – 70)
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 04 29.87  S 10.0 TI 29.8L 4 108   2.4  3            ICQ XX HAR11 Christian Harder
   2019L3  2022 04 28.90  S  9.8 TK 20.3T10  77   2.5  5            ICQ XX GON05 Juan Jose Gonzalez Suarez
   2019L3  2022 04 28.86  S 10.3 TI 29.8L 4 108   2.2  3            ICQ XX HAR11 Christian Harder
   2019L3  2022 04 27.86  S 10.0 TI 29.8L 4 108   2.6  3/           ICQ XX HAR11 Christian Harder
   2019L3  2022 04 26.86  S 10.0 TI 29.8L 4 108   2.5  3/           ICQ XX HAR11 Christian Harder
   2019L3  2022 04 25.86  S  9.8 TI 29.8L 4 108   2.5  3/           ICQ XX HAR11 Christian Harder
   2019L3  2022 04 23.88  S  9.8 TI 53.1L   139   2.2  4/           ICQ XX HAR11 Christian Harder
   2019L3  2022 04 23.83  S 10.6 TK 32.0L 5  80   0.5  6   1.6   59 ICQ XX PIL01 Uwe Pilz
   2019L3  2022 04 22.15  Z  9.8 AQ 10.6R 5a180   7.1       8.0m 29 ICQ XX RAMaa Raymond Ramlow
   2019L3  2022 04 20.36 xM 10.5 AQ 40.0L 4 108   1.3  6    4.0m132 ICQ XX WYA   Christopher Wyatt
   2019L3  2022 04 19.85  S 10.0 TI 29.8L 4 108   2.5  4            ICQ XX HAR11 Christian Harder
   2019L3  2022 04 18.85  S 10.4 TI 29.8L 4 108   1.5  4            ICQ XX HAR11 Christian Harder
   2019L3  2022 04 10.84  S  9.7 TI 25.2L 4  92   2.5  4            ICQ XX HAR11 Christian Harder
   2019L3  2022 04 05.41 xM 10.2 AQ 40.0L 4  59   2.3  6            ICQ XX WYA   Christopher Wyatt
   2019L3  2022 04 04.44 xM 10.2 AQ 40.0L 4  59   3.5  6    8.7m 93 ICQ XX WYA   Christopher Wyatt
   2019L3  2022 04 03.84  S  9.7 TI 29.8L    92   2.6  4            ICQ XX HAR11 Christian Harder
   2019L3  2022 04 03.13  Z  9.6 AQ 10.6R 5a180   7.7       7.0m 28 ICQ XX RAMaa Raymond Ramlow
   2019L3  2022 04 01.85  S  9.7 TK 20.3T10  77   2.5  6            ICQ XX GON05 Juan Jose Gonzalez Suarez
```

It seems like we have been talking about C/2019 L3 (ATLAS) for months now. And well, that's because we have. C/2019 L3 has been highlighted in these pages since April 2021, so for over 1 year now. It helps that it's an intrinsically bright comet with a large perihelion distance [2022 January 9 at 3.55 au]. The large perihelion distance results in slow changes in the distance to the Sun and slow changes in brightness.

Eighteen magnitude estimates and one image were submitted to the ALPO in April by Michel Deconinck, J J Gonzalez, Christian Harder, Michael Jager, Uwe Pilz, Raymond Ramlow, and Chris Wyatt. We also incorporated into our analysis a single estimate submitted by Thomas Lehmann to the COBS site.

Most visual observers found L3 to have a coma between 2-3' with digital observers finding the coma to be larger at 7-9'. A short tail, less than 10', was seen by some visual observers. Most estimates placed L3's brightness between magnitude 9.5 and 10.5 (aperture corrected to between 9.0 and 10.0).

C/2019 L3 (ATLAS) is still an evening object as it moves through Gemini (May 1-5) and Canis Minor (5-31). Starting the month around magnitude 9.5, L3 should only fade to magnitude 9.8 by the end of the month. Its lightcurve shows evidence of as seasonal lag with the comet being intrinsically brightest nearly 2 months after perihelion. This asymmetric lightcurve is helping keep L3 brighter even months after perihelion. Being located south of the Sun, it is well placed for southern hemisphere observers all month long. Its elevation in a dark sky will become lower and lower for northern hemisphere observers as the month progresses and the comet approaches solar conjunction. Northerners will lose sight of L3 in late May or early June though it will become visible once again in September.

Figure 2 – Color image of C/2019 L3 by Michael Jager on 2022 April 21.

C/2021 E3 (ZTF)

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

Orbit (email communication from Syuichi Nakano)

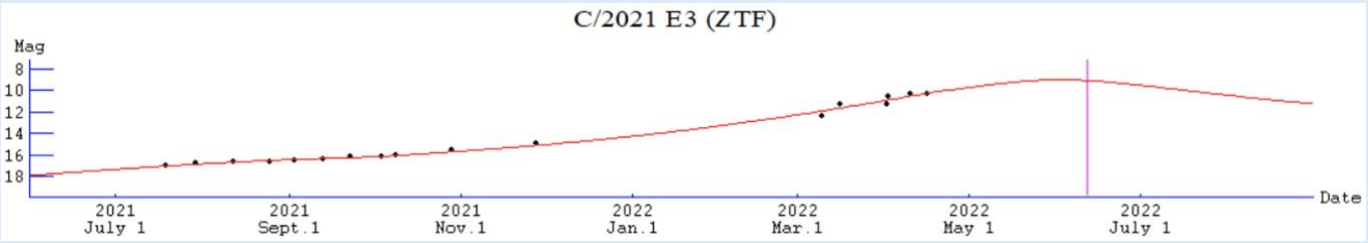
```
   C/2021 E3 (ZTF)
Epoch 2022 June 30.0 TT = JDT 2459760.5
T 2022 June 11.91106 TT                                  Nakano
q   1.7773798           (2000.0)            P              Q
z  -0.0005020      Peri.  228.85024     -0.11525701     -0.43252774
 +/-0.0000005      Node   104.46849     -0.37417702     +0.85281734
e   1.0008923      Incl.  112.55489     -0.92016704     -0.29261295
From 887 observations 2021 Mar. 9-2022 Apr. 16, mean residual 0".39.
(1/a)org.= +0.000013, (1/a)fut.= +0.000582 (+/-0.000001), Q= 8.
The comet has passed 3.60 AU from Jupiter on 2021 Oct. 8 UT
```

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-May-01  21 31  -43 50   1.857   1.562     89M   Gru   9.8     0   71
2022-May-06  21 41  -48 26   1.840   1.468     94M   Gru   9.6     0   72
2022-May-11  21 53  -53 38   1.824   1.385     98M   Ind   9.4     0   71
2022-May-16  22 09  -59 26   1.811   1.316    101M   Tuc   9.3     0   67
2022-May-21  22 31  -65 42   1.800   1.263    104M   Tuc   9.2     0   62
2022-May-26  23 07  -72 10   1.791   1.228    105M   Ind   9.1     0   56
2022-May-31  00 19  -78 08   1.784   1.214    106E   Hyi   9.0     0   49
2022-Jun-05  02 54  -81 38   1.780   1.221    105E   Hyi   9.0     0   42
```

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 = 8.7 + 5 log d +  9.0 log r [through T-250 days]
m1 = 3.8 + 5 log d + 18.0 log r [T-250 to T-50 days and onwards]
m1 = 6.1 + 5 log d + 10.0 log r [T-50 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
   2021E3  2022 04 01.78  Z 11.3 AQ 10.6R 5a180   5.5              ICQ XX RAMaa Raymond Ramlow
```

The Zwicky Transient Facility discovered C/2021 E3 on 2021 March 9 at 19th magnitude. Closest approach to Earth occurs on 2022 May 31 at 1.21 au followed days later by perihelion on 2022 June 11 at 1.78 au. Though a dynamically new long-period comet, it appears to have been brightening rapidly since discovery. Raymond Ramlow found E3 at magnitude of 11.3 and with a 5.5' coma in images taken on April 1. Thomas Lehmann also observed E3 and found it at magnitude 10.3 on the 10th and 16th with a 10-12' coma.

C/2021 E3 is currently only a southern hemisphere object and will become a southern circumpolar object in May. For those who can see it, C/2021 E3 should brighten to around magnitude 9.0 by the end of the month as it moves through Grus (May 1-7), Indus (7-15), Tucana (15-21), Indus again (21-27), Octans (27-30), and Hydrus (30-31). It passes through opposition from the morning into the evening near the end of May.

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-C56)

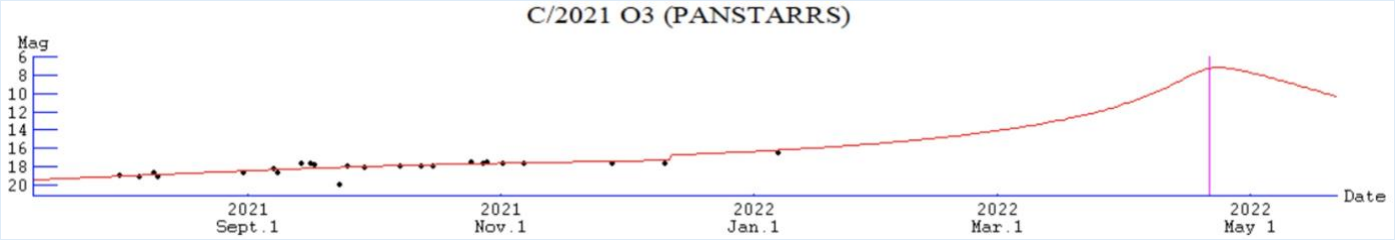
```
    C/2021 O3 (PANSTARRS)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Apr. 21.04633 TT                                  Rudenko
q   0.2873237           (2000.0)            P              Q
z  -0.0004079      Peri.  299.98975     -0.56804074     -0.81247970
 +/-0.0000022      Node   189.02021     +0.64621182     -0.53901783
e   1.0001172      Incl.   56.78868     -0.50964694     +0.22211824
From 686 observations 2021 July 26-2022 Jan. 25, mean residual 0".4.
1/a(orig) = +0.000038 AU**-1, 1/a(fut) = -0.000123 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-May-01  03 33  +23 46   0.420   0.663    17E   Tau    ?.?      0    0
2022-May-06  03 49  +38 39   0.531   0.608    25E   Per    ?.?      8    0
2022-May-11  04 08  +53 20   0.644   0.605    37E   Cam    ?.?     18    0
2022-May-16  04 40  +65 53   0.756   0.640    48E   Cam    ?.?     27    0
2022-May-21  05 41  +75 25   0.864   0.698    57E   Cam    ?.?     34    0
2022-May-26  07 55  +80 58   0.970   0.771    64E   Cam    ?.?     41    0
2022-May-31  10 56  +80 53   1.072   0.852    69E   Cam    ?.?     47    0
2022-Jun-05  12 37  +77 26   1.171   0.938    73E   Cam    ?.?     51    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, who knows after perihelion]
```



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 04 19.36 xI[ 7.6 AQ 25.0L 5  74                    ICQ XX WYA  Christopher Wyatt
```

There was hope that C/2021 O3 (PANSTARRS) would become a nice object due to its small perihelion distance of 0.29 au on April 21. There was also a fear that due to its intrinsic faintness, the small perihelion distance would result in a disintegration event. New observations from both the ground and space are suggesting that the latter is true and the comet is in the process of disintegrating.

C/2021 O3 was first seen on 2021 July 26 at 19th magnitude by the Pan-STARRS1 1.8-m Ritchey-Chretien on Haleakala. From discovery till this January, C/2021 O3 brightened at a very slow rate of less than 2.5n ~ 5. Like mentioned above with C/2017 K2, such a slow rate is indicative of an object intrinsically fading (i.e., producing less dust and gas with time).

Last month we were hoping for a peak brightness around 7th magnitude. That is looking way too optimistic. Though the comet has been deep in the Sun's glare since early February, two space-based assets were able to observe it. First the SOHO spacecraft and its C3 imager caught the comet at the end of March around magnitude 9 which is close to its limiting magnitude. Starting on April 6, the SWAN instrument on SOHO picked up the comet as a bright and brightening object. At least that was the case till about April 12/13, after which the comet started to fade. Though still visible in SWAN images on April 23/24, it is a much fainter object than it was about 10 days before.

During April, C/2021 O3 has been located too close to the Sun for most observers. But that hasn't stopped a few dedicated comet watchers from trying and succeeding. Terry Lovejoy in Australia may have imaged the comet on April 17 and 20 (check out this post with the April 20 image: https://groups.io/g/...l/message/30608). He estimated PANSTARRS to be around magnitude 9 or fainter. Michael Olason in Tucson, Arizona, may have also imaged the comet on the evening of April 30 (see https://groups.io/g/comets-ml/message/30622). He also estimated a brightness near magnitude 9. A team using the 4.3-m Lowell Discovery Telescope found a diffuse 9th magnitude cloud of debris matching the comet's expected motion but offset about 2' from the expected position. No point sources down to a limiting magnitude of 14 were detected within the remnant cloud. (see https://www.astronomerstelegram.org/?read=15358)

Additionally, Twitter posts by Worachate Boonplod, an expert in analyzing and discovering comets in SOHO and STEREO imagery, (https://twitter.com/worachate) show the comet in STEREO-A COR2 images taken on April 27-28. His brightness and contrast enhanced versions of the images show a stretched out, faint, elongated comet suggestive of a disintegrating comet.

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. That's doesn't mean there won't be anything to observe. A total diffuse cloud with a total magnitude of ~9 won't be easy to observe but should be within reach of imagers. In fact, if the remnant is still visible in another week or so, it will be a northern circumpolar object as it moves through Taurus (May 1-3), Perseus (3-10), Camelopardalis (11-29), Draco (29-30), and Camelopardalis again (30-31). How bright is a major unknown, and it probably isn't even worth making a prediction? We'll have a much better idea of the comet's state and brightness in a few days when it will finally be observable against a dark sky.

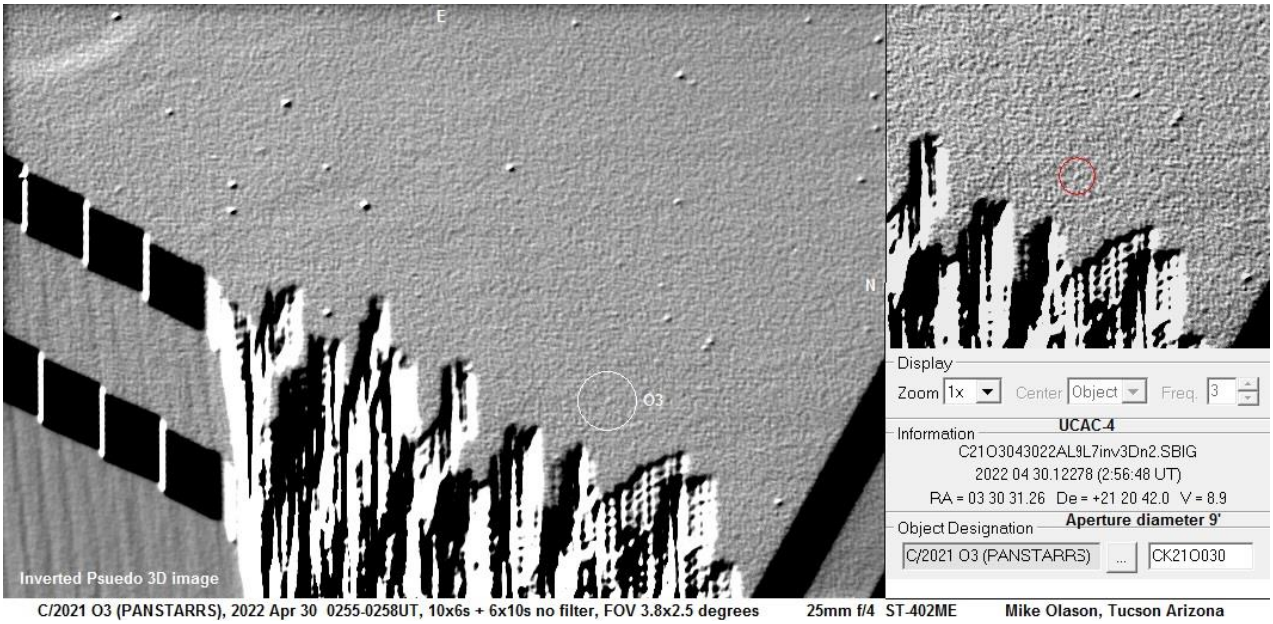


Figure 3 - Could this be C/2021 O3 (PANSTARRS) in a differenced image taken by Michael Olason on 2022 April 30?

9P/Tempel

Discovered visually on 1867 April 3 by Ernst Wilhelm Leberecht Tempel of Marseille, France

Orbit (from MPEC 2022-H30)

```
   9P/Tempel
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Mar. 4.94885 TT                                  Rudenko
q   1.5442334            (2000.0)            P             Q
n   0.17662630     Peri.  179.34904     -0.37340944     +0.91208281
a   3.1460513      Node    68.71403     -0.85193662     -0.26493361
e   0.5091519      Incl.   10.46997     -0.36710950     -0.31291395
P   5.58
From 1778 observations 2015 Nov. 11-2022 Apr. 21, mean residual 0".5.
     Nongravitational parameters A1 = -0.14, A2 = -0.0610.
```

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

```
9P/Tempel                                                          Max El
                                                                    (deg)
    Date      R.A.   Decl.     r       d    Elong  Const  Mag    40N  40S
2022-May-01  21 37  -21 05   1.642   1.469    80M   Cap  12.0     10   60
2022-May-06  21 48  -20 49   1.659   1.447    82M   Cap  12.0     10   62
2022-May-11  21 59  -20 35   1.677   1.425    85M   Aqr  12.1     10   64
2022-May-16  22 09  -20 23   1.696   1.402    87M   Aqr  12.1     11   65
2022-May-21  22 19  -20 14   1.716   1.380    90M   Aqr  12.2     11   67
2022-May-26  22 28  -20 07   1.736   1.358    93M   Aqr  12.2     12   68
2022-May-31  22 36  -20 04   1.758   1.336    95M   Aqr  12.3     13   69
2022-Jun-05  22 44  -20 06   1.781   1.314    98M   Aqr  12.3     14   70
```

Comet Magnitude Formula (from Yoshida Seiichi's page)

```
m1 = 7.5 + 5 log d + 18.0 log r(t-15)
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
  9        2022 04 01.77  Z 13.9 AQ 10.6R 5a300   2.1       2.7m259 ICQ XX RAMaa Raymond Ramlow
```

William Tempel of Marseilles, France discovered 12 comets visually between 1859 and 1877. 9P/Tempel was his 6th discovery and one of four periodic comets including 10P/Tempel, 11P/Tempel-Swift-LINEAR, and 55P/Tempel-Tuttle. 9P/Tempel is best known as the target of two spacecraft missions, Deep Impact and Stardust. Thanks to the two missions, we have accurate measurements of its nucleus which is rather large for a short-period comet with dimensions of 7.6 x 4.9 km (4.7 x 3.0 miles).

Raymond Ramlow observed 9P on April 1.77 UT with an iTelescopes.net FSQ 106 refractor. He found the comet at magnitude 13.9 with a 2.1' coma and 2.7' long tail. Thomas Lehmann (observation submitted to COBS) found 9P at magnitude 13.0 on April 10.14 UT with a 4.4' coma and 12' long tail. These measurements are about one to two magnitudes fainter than the prediction published by Seiichi Yoshida based on 9P's previous returns. No visual observations have been submitted to the ALPO or COBS. Perhaps the comet is visually brighter than the above prediction suggests.

This month, Tempel will be moving through the morning constellations of Capricornus (May 1-10) and Aquarius (10-31). Though observable from both hemispheres it is much better placed for the southern hemisphere as it slowly fades from its current 12-13th magnitude. Imagers are asked to be on the lookout for any sign of a dust trail around the time of orbit plane crossing on May 30.

19P/Borrelly

Discovered 1904 December 28 by the Alphonse Borrelly

Orbit (from Minor Planet Center, MPEC 2022-H30)

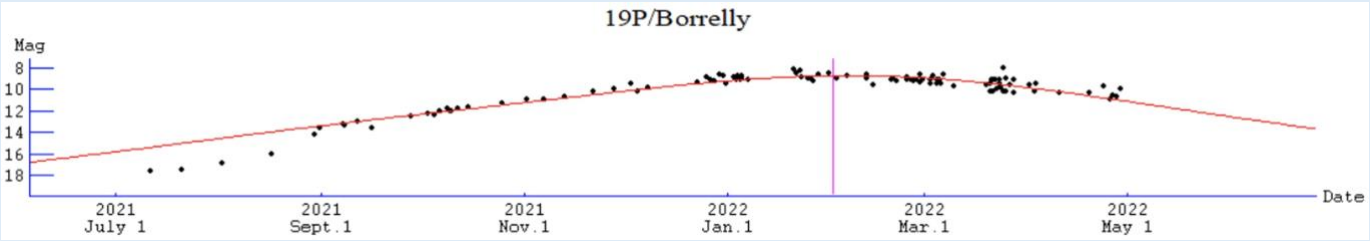
```
  19P/Borrelly
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Feb. 1.82421 TT                                    Rudenko
q   1.3062768            (2000.0)            P              Q
n   0.14399732     Peri.  351.91640     +0.38680830     -0.79276252
a   3.6049543      Node    74.24715     +0.87108298     +0.14646202
e   0.6376440      Incl.   29.30463     +0.30264466     +0.59167260
P   6.84
From 2121 observations 2015 Jan. 11-2022 Apr. 20, mean residual 0".6.
     Nongravitational parameters A1 = +0.24, A2 = -0.0754.
```

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-May-01   06 17   +42 43    1.659   2.007    55E    Aur   11.1     37    0
2022-May-06   06 36   +42 59    1.692   2.065    54E    Aur   11.4     36    0
2022-May-11   06 55   +43 04    1.727   2.124    53E    Aur   11.6     35    0
2022-May-16   07 13   +43 00    1.762   2.184    52E    Aur   11.8     33    0
2022-May-21   07 31   +42 46    1.798   2.245    51E    Lyn   12.1     32    0
2022-May-26   07 49   +42 24    1.834   2.307    50E    Lyn   12.3     30    0
2022-May-31   08 06   +41 54    1.870   2.370    49E    Lyn   12.5     28    0
2022-Jun-05   08 22   +41 18    1.907   2.433    47E    Lyn   12.7     26    1
```

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

```
m1 = 5.9 + 5 log d + 19.4 log r(t – 16)
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 04 28.91  S 10.3 TK 20.3T10  77   3.5  4            ICQ XX GON05 Juan Jose Gonzalez Suarez
 19        2022 04 28.90  S 11.1 TI 29.8L 4 108   2.9  2            ICQ XX HAR11 Christian Harder
 19        2022 04 27.87  S 11.1 TI 29.8L 4 108   1.8  2            ICQ XX HAR11 Christian Harder
 19        2022 04 26.87  S 11.0:TI 29.8L 4 108   2    2            ICQ XX HAR11 Christian Harder
 19        2022 04 25.91  S 11.4 TI 29.8L 4 108   2    2            ICQ XX HAR11 Christian Harder
 19        2022 04 23.89  S 10.6 TI 53.1L   139   2    2            ICQ XX HAR11 Christian Harder
 19        2022 04 19.87  S 10.8 TI 29.8L 4  92   2.5  2            ICQ XX HAR11 Christian Harder
 19        2022 04 10.84  S 10.6 TI 25.2L 4  92   1.5  2/           ICQ XX HAR11 Christian Harder
 19        2022 04 03.83  S  9.9 TI 29.8L    92   2.4  3            ICQ XX HAR11 Christian Harder
 19        2022 04 03.12  Z 10.2 AQ 10.6R 5a180   8.3       5.5m 75 ICQ XX RAMaa Raymond Ramlow
 19        2022 04 01.86  S  9.9 TK 20.3T10  77   3.5  5            ICQ XX GON05 Juan Jose Gonzalez Suarez
```

Though still well observed, 19P/Borrelly should be fading fast from magnitude 11.1 to 12.5 as it moves through Auriga (May 1-20) and Lynx (20-31) in the evening sky for northern observers. Unfortunately, it is no longer observable from the southern hemisphere. The next two returns in 2028 and 2035 will be better than the current one. The current return saw a close approach distance to Earth of 1.18 au while 2028 will see an approach to 0.41 au and 0.62 au in 2035.

22P/Kopff

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

Orbit (from MPEC 2022-H30)

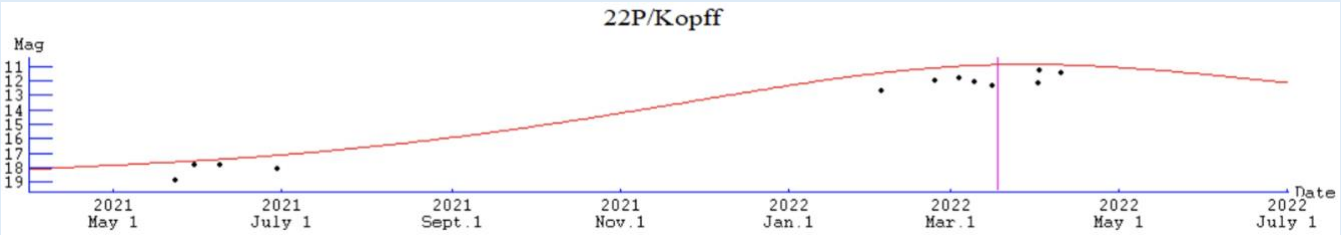
```
  22P/Kopff
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Mar. 18.12945 TT                                  Rudenko
q   1.5524138            (2000.0)            P              Q
n   0.15446376     Peri.  163.02045     +0.24029600     +0.96810066
a   3.4402103      Node   120.83291     -0.89992719     +0.24959090
e   0.5487445      Incl.    4.74203     -0.36385284     +0.02203385
P   6.38
From 3836 observations 2008 Jan. 30-2022 Apr. 19, 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-May-01  22 57  -07 26   1.616   1.913    57M   Aqr  11.1     6   37
2022-May-06  23 09  -06 23   1.630   1.897    59M   Aqr  11.1     6   38
2022-May-11  23 21  -05 22   1.646   1.880    60M   Aqr  11.2     7   39
2022-May-16  23 33  -04 22   1.663   1.863    62M   Aqr  11.3     8   40
2022-May-21  23 44  -03 24   1.682   1.846    64M   Aqr  11.4     9   41
2022-May-26  23 55  -02 28   1.701   1.829    66M   Psc  11.5    10   42
2022-May-31  00 05  -01 35   1.722   1.810    68M   Psc  11.5    11   43
2022-Jun-05  00 15  -00 45   1.743   1.791    70M   Psc  11.6    13   44
```

Comet Magnitude Formula (from Yoshida Seiichi's page)

```
m1 = 5.3 + 5 log d + 21.0 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
 22        2022 04 01.79  Z 12.2:AQ 10.6R 5a180   4.2              ICQ XX RAMaa Raymond Ramlow
```

22P/Kopff was at perihelion on 2022 March 18 at 1.55 au. Closest approach to Earth won't be until 2022 September 14 at 1.39 au though it will be a more distant 2.30 au from Sun at that time.

Raymond Ramlow was able to image Kopff on April 1 at 12.2 with a 4.2' coma. Michael Lehmann submitted observations to the COBS site from April 2, 10, and 17. He found Kopff between magnitude 11.2 and 11.5 with a 5' to 8' coma. Like the aforementioned 9P/Tempel, these measurements are fainter than the prediction published by Seiichi Yoshida based on Kopff's previous returns.

Kopff should fade by ~0.5 magnitudes this month. It will be observable in the morning sky in Aquarius (May 1-21) and Pisces (21-31) from both hemispheres though more difficult from the northern hemisphere.

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 MPC 103849)

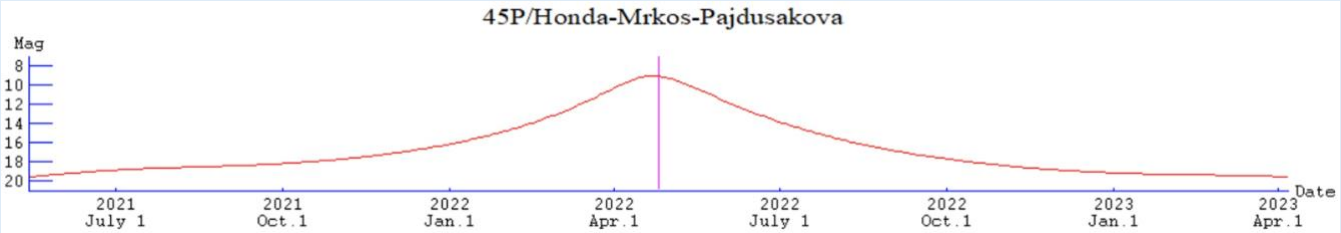
```
45P/Honda-Mrkos-Pajdusakova
Epoch 2022 Apr. 11.0 TT = JDT 2459680.5
T 2022 Apr. 25.54709 TT                                   MPCW
q   0.5571806            (2000.0)            P               Q
n   0.18478014     Peri.  327.90889     +0.56328381     -0.82282410
a   3.0528058      Node    87.70313     +0.77311929     +0.49269923
e   0.8174857      Incl.    4.32261     +0.29154400     +0.28321013
P   5.33
From 1163 observations 2016 Nov. 6-2017 Mar. 8, mean residual 0".7.
     Nongravitational parameters A1 = -1.29, A2 = -0.6735.
```

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-May-01  03 18  +17 50   0.568   1.518    11E    Ari    9.3     0    0
2022-May-06  03 53  +20 16   0.597   1.505    15E    Tau    9.6     0    0
2022-May-11  04 29  +22 13   0.640   1.501    19E    Tau   10.0     0    0
2022-May-16  05 05  +23 38   0.694   1.508    22E    Tau   10.4     0    0
2022-May-21  05 39  +24 31   0.755   1.525    25E    Tau   10.8     2    0
2022-May-26  06 12  +24 54   0.820   1.553    28E    Gem   11.2     4    2
2022-May-31  06 44  +24 51   0.889   1.592    30E    Gem   11.6     4    4
2022-Jun-05  07 13  +24 25   0.958   1.639    32E    Gem   12.0     5    6
```

Comet Magnitude Formula (from Yoshida Seiichi's page)

```
m1 = 5.3 + 5 log d + 21.0 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
```

45P/Honda-Mrkos-Pajdušáková arrived at perihelion on April 25 at 0.56 au. Though it was located very close to the Sun at perihelion, the SOHO spacecraft was able to spot the comet. Surprisingly it appeared 1-2 magnitude brighter than its expected brightness of 9th magnitude. 45P will become visible to ground-based observers in mid to late May from both hemispheres at ~11-12th magnitude (or perhaps brighter if it continues to run 1-2 magnitude ahead of the prediction). It will spend May moving through Aries (May 1-2), Taurus (2-24), and Gemini (24-31) in the evening sky.

45P/H-M-P was discovered visually by three observers in December 1948. Minoru Honda of Okayama, Japan was first to spot the comet on December 3. A few nights later on December 6, Ľudmila Pajdušáková of Skalnate Pleso Observatory in Slovakia found the comet with 25x100 binoculars. Due to an encroaching dawn, she didn't have time to confirm if the object was really a comet and not the nearby galaxy M83. The following morning

Antonín Mrkos, who was not aware of Pajdušáková's find, used the same 25x100 binoculars to make the third independent discovery. Honda has 12 comets to his name while Mrkos has 13 and Pajdušáková 5. Only Mrkos discovered additional short-period comets, 18D/Perrine-Mrkos, 124P/Mrkos and 143P/Kowal-Mrkos. Mrkos was also the discoverer of the great comet C/1957 P1 (Mrkos). This comet along with C/1956 R1 (Arend-Roland) provided the inspiration for the formation of the ALPO Comets Section.

An analysis of H-M-P's orbital evolution between 1900 and 2100 find little change in perihelion distance with a range of 0.53 and 0.68 au. The current return's perihelion at 0.56 au is near the smaller end of the range. Since 1959, apparitions have been alternating between 2 poor and 2 good returns. This return is in the poor category with a minimum close approach to Earth of 1.51 au meaning the comet is on the other side of the Sun at perihelion. The previous two returns were the best between 1900 and 2100 with very close approaches to Earth in 2011 at 0.06 au and 2016 at 0.08 au. 45P reached 6th magnitude during both returns.

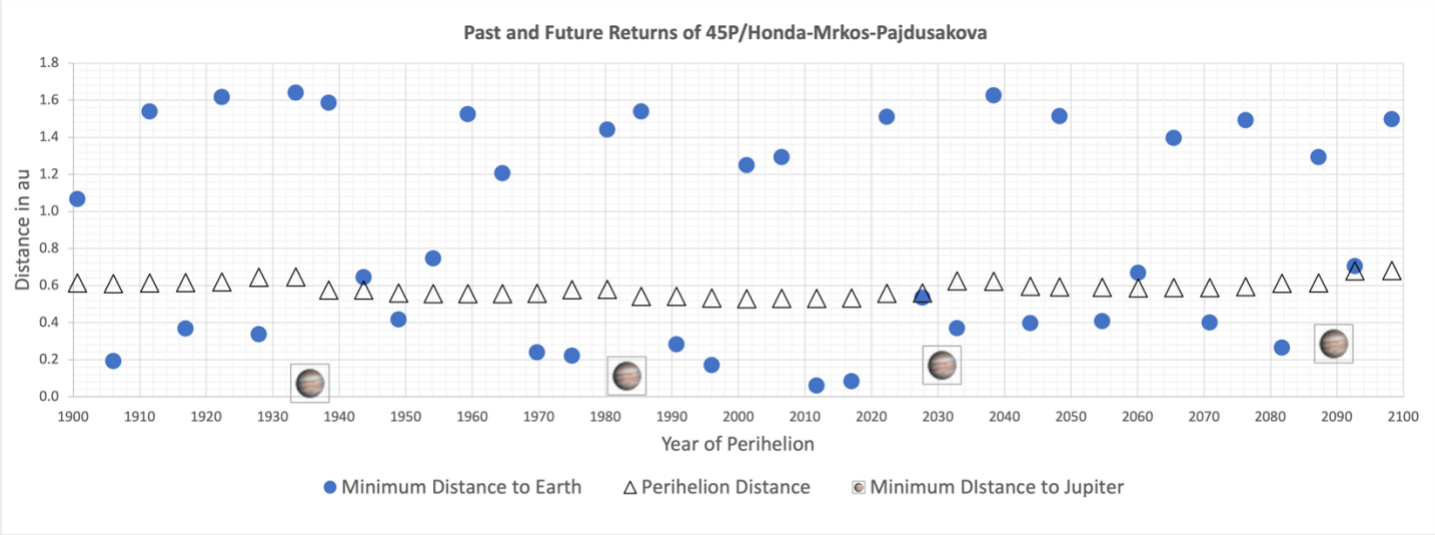


Figure 4 - Orbital evolution of 45P/H-M-P from orbital elements at JPL Horizons.

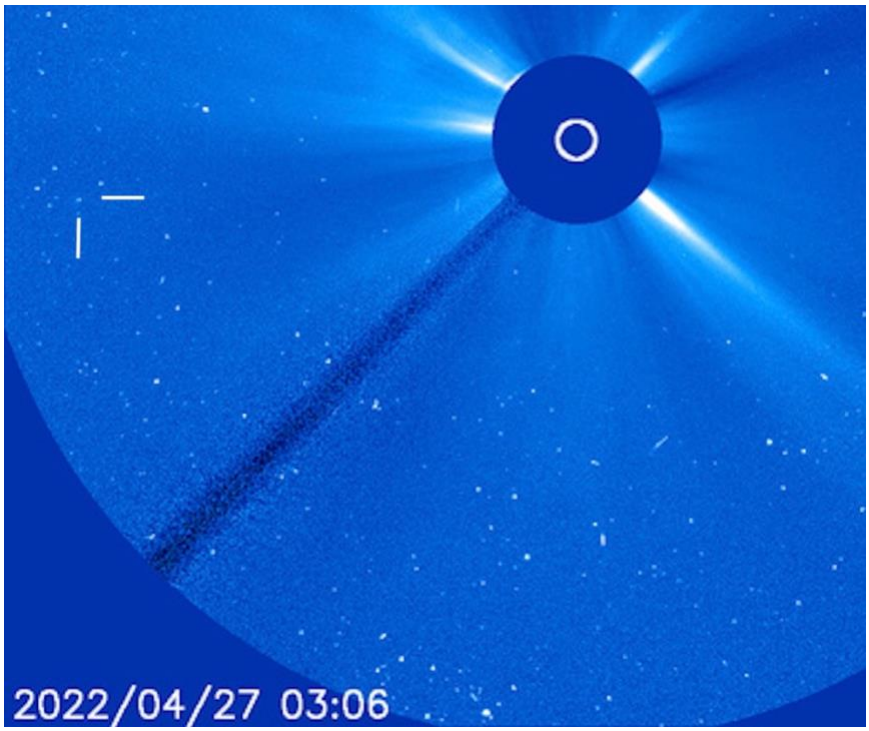


Figure 5 – The LASCO C2 instrument on the SOHO spacecraft caught 45P/H-M-P in this 2022 April 27 image. Credit: ESA & NASA/SOHO.

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

Orbit (from MPEC 2022-H30)

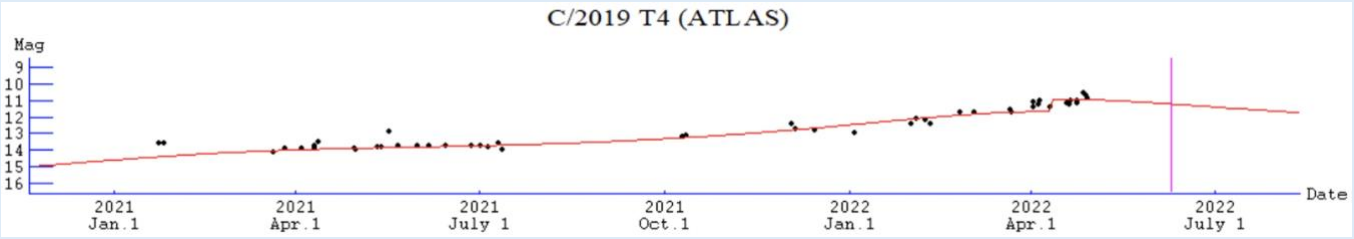
```
    C/2019 T4 (ATLAS)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 June  9.17396 TT                                  Rudenko
q   4.2423678           (2000.0)            P               Q
z  +0.0009796      Peri.  351.20645     -0.95991874     +0.05616815
 +/-0.0000005      Node   199.94025     -0.18206347     -0.86982844
e   0.9958444      Incl.   53.62598     -0.21309366     +0.49014654
From 1129 observations 2019 Feb. 5-2022 Apr. 21, mean residual 0".4.
1/a(orig) = +0.000626 AU**-1, 1/a(fut) = +0.000965 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-May-01  11 44   -14 38    4.255   3.437    139E   Crt   11.0    35   65
2022-May-06  11 43   -13 32    4.252   3.480    134E   Crt   11.0    36   64
2022-May-11  11 44   -12 30    4.249   3.528    130E   Crt   11.0    37   63
2022-May-16  11 44   -11 30    4.247   3.581    125E   Crt   11.1    37   62
2022-May-21  11 45   -10 33    4.245   3.639    120E   Crt   11.1    37   61
2022-May-26  11 46   -09 40    4.244   3.702    115E   Crt   11.1    35   60
2022-May-31  11 48   -08 51    4.243   3.768    111E   Crt   11.2    34   59
2022-Jun-05  11 50   -08 05    4.243   3.838    106E   Crt   11.2    31   58
```

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 = 1.3 + 5 log d + 12.3 log r [Through -60 days from perihelion]
m1 = 2.0 + 5 log d + 10.0 log r [Since -60 days from 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
   2019T4  2022 04 29.88  S 12.0 TI 29.8L 4 132   1.2  3/           ICQ XX HAR11 Christian Harder
   2019T4  2022 04 28.92  S 10.6 TK 20.3T10  77   4    3            ICQ XX GON05 Juan Jose Gonzalez Suarez
   2019T4  2022 04 28.88  S 11.9 TI 29.8L 4 108   1.8  3/           ICQ XX HAR11 Christian Harder
   2019T4  2022 04 27.88  S 11.1 TI 29.8L 4 132   1.5  3/           ICQ XX HAR11 Christian Harder
   2019T4  2022 04 26.88  S 11.0:TI 29.8L 4 132   1.7  3/           ICQ XX HAR11 Christian Harder
   2019T4  2022 04 23.87  S 11.9 TI 53.1L   155   1.8  4            ICQ XX HAR11 Christian Harder
   2019T4  2022 04 23.84  S 12.3 HS 32.0L 5 144   1    2            ICQ XX PIL01 Uwe Pilz
   2019T4  2022 04 20.37 xM 11.6 AQ 40.0L 4  59   1.2  6            ICQ XX WYA   Christopher Wyatt
   2019T4  2022 04 19.88  S 11.7 TI 29.8L 4 132   1.3  4            ICQ XX HAR11 Christian Harder
   2019T4  2022 04 18.84  S 11.6 TI 29.8L 4 132   1    3/           ICQ XX HAR11 Christian Harder
   2019T4  2022 04 05.45 xM 11.6 AQ 40.0L 4  59   1.2  6            ICQ XX WYA   Christopher Wyatt
   2019T4  2022 04 04.48 xM 11.9 AQ 40.0L 4  59   1.3  6            ICQ XX WYA Christopher Wyatt
   2019T4  2022 04 01.91  S 10.8 TK 20.3T10 100   4    3            ICQ XX GON05 Juan Jose Gonzalez Suarez
```

C/2019 T4 (ATLAS) was discovered on 2019 October 6 at 19th magnitude with the "Asteroid Terrestrial-Impact Last Alert System" 0.5-m reflector at Haleakala. At discovery, T4 ATLAS was 8.6 au from the Sun. Perihelion is in a few months on 2022 June 9 at a still distant 4.24 au. The comet is a dynamically old long-period comet last at perihelion ~64,000 years ago.

A number of visual observations were made in April finding C/2019 T4 between magnitude 10.6 and 12.3 though most estimates were between 11.0 and 12.0. The majority of observations also found a coma diameter between 1’ and 2’. It is interesting that the comet appears to have brightened by about 0.5 to 1.0 magnitudes in April compared to the prediction we ran last month. C/2019 T4 is visible from both hemispheres in the evening sky in the constellation Crater.

Figure 6 - Michael Jager imaged C/2019 T4 (ATLAS) and 10th magnitude galaxy NGC 3887 (lower left) on 2022 April 20, a day before the image on the cover. The galaxy on right side of the image is NGC 3836.

C/2020 V2 (ZTF)

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

Orbit (email communication from Syuichi Nakano)

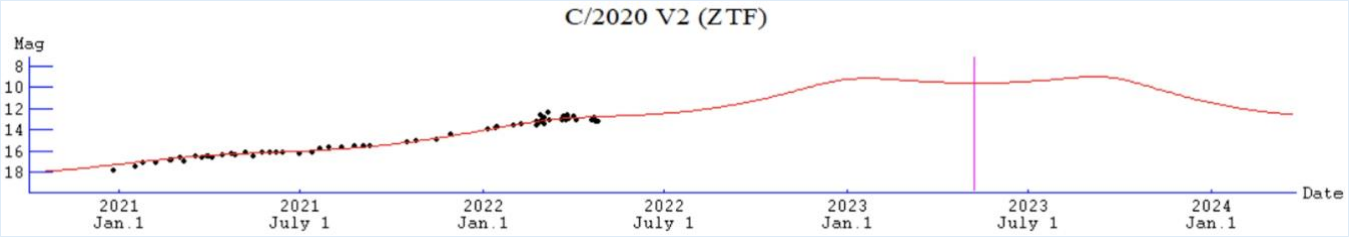
```
   C/2020 V2 (ZTF)
Epoch 2023 May 16.0 TT = JDT 2460080.5
T 2023 May 8.55257 TT                                    Nakano
q   2.2277816           (2000.0)            P              Q
z  -0.0005357      Peri.  162.42872     +0.69784708     +0.59394119
 +/-0.0000013      Node   212.37163     +0.53387710     -0.05876170
e   1.0011934      Incl.  131.61185     +0.47747743     -0.80235960
From 1810 observations 2020 Apr. 18-2022 Apr. 16, mean residual 0".37.
(1/a)org.= +0.000009, (1/a)fut.= -0.000226 (+/-0.000001), Q= 8.
The comet will pass 2.64 AU from Jupiter on 2023 July 12 UT.
```

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 04 29.89  S 13.8 TI 29.8L 4 132   0.5  4    0.8m110 ICQ XX HAR11 Christian Harder
   2020V2  2022 04 28.90  S 13.7 TI 29.8L 4 108   0.75 4    1.0m120 ICQ XX HAR11 Christian Harder
   2020V2  2022 04 27.89  S 13.7 TI 29.8L 4 132   0.6  4            ICQ XX HAR11 Christian Harder
   2020V2  2022 04 26.89  S 13.6 TI 29.8L 4 132   0.55 4            ICQ XX HAR11 Christian Harder
   2020V2  2022 04 25.90  S 13.7 TI 29.8L 4 132   0.8  4            ICQ XX HAR11 Christian Harder
   2020V2  2022 04 23.91  S 14.1 TI 53.1L   155   0.45 4    0.5m110 ICQ XX HAR11 Christian Harder
   2020V2  2022 04 23.85  S 13.8 HS 32.0L 5  80   1.2  4            ICQ XX PIL01 Uwe Pilz
   2020V2  2022 04 22.98  S 13.3 TI 29.8L 4 132   0.9  4            ICQ XX HAR11 Christian Harder
   2020V2  2022 04 19.90  S 13.5 TI 29.8L 4 132   0.6  4    1.0m100 ICQ XX HAR11 Christian Harder
   2020V2  2022 04 03.85  S 13.5 TI 29.8L   132   0.55 5            ICQ XX HAR11 Christian Harder
   2020V2  2022 04 02.46  Z 13.7 AQ 10.6R 5a180   1.2       1.0m150 ICQ XX RAMaa Raymond Ramlow
```

The Zwicky Transient Facility (ZTF) used the 1.2-m Schmidt on Mount Palomar to discover C/2020 V2 (ZTF) on 2020 November 2 at 19th magnitude. At discovery, the comet was approximately 2.5 years from perihelion and over 8 au from the Sun. The comet is still a year from its 2023 May 8 perihelion at 2.23 au. Christian Harder, Uwe Pilz, and Raymond Ramlow observed C/2020 V2 on 10 separate nights in April. They reported the

comet between magnitude 13.3 and 14.1 (aperture corrected to 12.8 to 13.4). Since the comet is still over 4 au from the Sun, its coma is still small at 0.5' to 1.2'.

C/2020 V2 is currently in Ursa Major and only visible to northern observers. V2 should continue to slowly brighten at 12th magnitude. 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. We may be hearing about this comet for many months and years to come.

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)

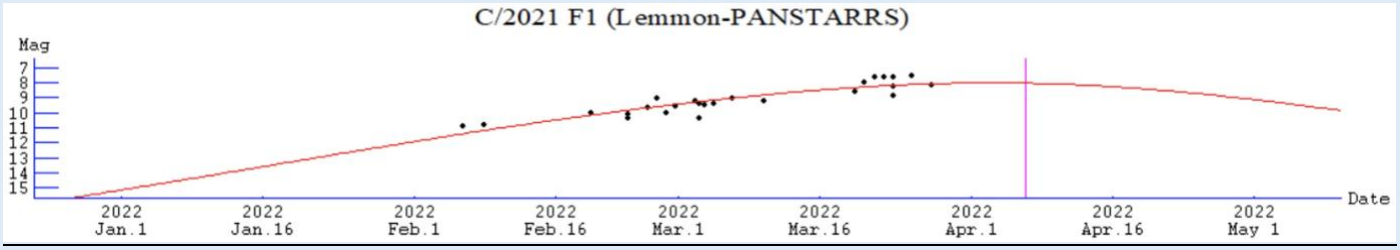
```
    C/2021 F1 (Lemmon-PANSTARRS)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 Apr. 6.87358 TT                                  Rudenko
q   0.9954849            (2000.0)            P              Q
z  +0.0042386      Peri.  146.82258     +0.70299125     +0.60122058
 +/-0.0000013      Node   203.45145     +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     Naut Twil
                                                                    40N  40S
2022-May-01  01 57  +12 37   1.077   2.063     8M   Ari   9.1      0    0
2022-May-06  02 06  +10 17   1.112   2.077    12M   Cet   9.5      0    0
2022-May-11  02 15  +07 57   1.152   2.083    16M   Cet   9.9      0    0
2022-May-16  02 24  +05 36   1.195   2.084    20M   Cet  10.4      0    3
2022-May-21  02 32  +03 14   1.242   2.080    25M   Cet  10.8      0    8
2022-May-26  02 40  +00 49   1.292   2.071    29M   Cet  11.2      0   12
2022-May-31  02 49  -01 39   1.344   2.058    34M   Eri  11.7      0   16
2022-Jun-05  02 57  -04 13   1.399   2.043    38M   Eri  12.1      0   21
```

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

```
m1 = 14.6, G = 0.15 [through T-180 days]
m1 =  6.7 + 5 log d + 26.6 log r [T-180 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
None.
```

C/2021 F1 (Lemmon-PANSTARRS) reached 8th magnitude in late March before passing too close to the Sun for observation. 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. A quick analysis of photometry submitted to the Minor Planet Center at that time finds an absolute magnitude of 14.6 and diameter of 8 km assuming an albedo of 0.04. It is a dynamically old long-period comet with an original semi-major axis of ~200 au and orbital period of ~2800 years.

Due to its low solar elongation, it is not surprising that no observations of C/2021 F1 were reported to the ALPO or COBS in April. Though still not visible to northern observers in May, southern observers should be able to observe F1 during the 2nd half of the month as it moves through the morning constellations of Aries (May 1-5), Cetus (5-30), and Eridanus (30-31). Now a month past its 2022 April 6 perihelion at 1.00 au, the comet may already be fading fast by then and no brighter than 10-11th magnitude.

C/2021 P4 (ATLAS)

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

Orbit (from MPEC 2022-H30)

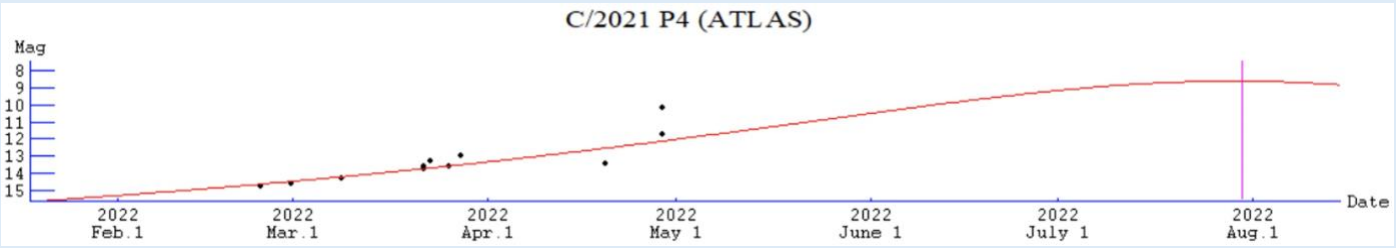
```
    C/2021 P4 (ATLAS)
Epoch 2022 Jan. 21.0 TT = JDT 2459600.5
T 2022 July 30.37835 TT                                  Rudenko
q   1.0804764            (2000.0)            P               Q
z  +0.0031939      Peri.  175.82255     -0.96755546     -0.18540209
 +/-0.0000017      Node   348.09490     +0.20093071     -0.15276505
e   0.9965491      Incl.   56.31076     +0.15317731     -0.97071567
From 647 observations 2021 Aug. 10-2022 Apr. 20, mean residual 0".6.
1/a(orig) = +0.003532 AU**-1, 1/a(fut) = +0.003270 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-May-01  03 29  +59 23   1.779   2.329    45E   Cam  12.0    23    0
2022-May-06  03 56  +59 24   1.722   2.287    44E   Cam  11.8    23    0
2022-May-11  04 24  +59 09   1.666   2.245    43E   Cam  11.5    23    0
2022-May-16  04 52  +58 36   1.611   2.205    42E   Cam  11.3    23    0
2022-May-21  05 21  +57 42   1.556   2.167    41E   Cam  11.0    22    0
2022-May-26  05 49  +56 27   1.503   2.132    39E   Cam  10.8    22    0
2022-May-31  06 17  +54 49   1.451   2.099    38E   Lyn  10.6    21    0
2022-Jun-05  06 43  +52 49   1.401   2.068    37E   Lyn  10.3    20    0
```

Comet Magnitude Formula (from ALPO and COBS data)

```
m1 = 6.7 + 5 log d + 13.9 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
   2021P4  2022 04 28.89  S 12.1 TI 29.8L 4 108   2.4  3           ICQ XX HAR11 Christian Harder
   2021P4  2022 04 28.88  S 10.5 TK 20.3T10 100   4    3           ICQ XX GON05 Juan Jose Gonzalez Suarez
   2021P4  2022 04 19.89  S 13.8:TI 29.8L 4 132   0.4  4           ICQ XX HAR11 Christian Harder
```

The "Asteroid Terrestrial-Impact Last Alert System" (ATLAS) search program found this 19th magnitude comet on 2021 August 10 with their 0.5-m f/2 Schmidt on Haleakala, Hawaii. Perihelion occurs on 2022 July 30 at 1.08 au, though unfortunately, the comet will be located on the other side of the Sun at a geocentric range of ~2 au and low solar elongation. Too bad perihelion wasn't in early March when a close approach to within 0.1 au of Earth would have occurred resulting in a 4-5th magnitude comet racing through opposition.

J. J. Gonzalez and Christian Harder both visually observed C/2021 P4 on April 28. Christian estimated a magnitude of 12.1 while J. J. found the comet at 10.5. Other visual observations submitted to COBS suggest it is closer to 12th rather than 10th magnitude. This month, the comet should continue to brighten up to ~10.5 as it moves through Camelopardalis (May 1-27), Auriga (27-30), and Lynx (30-31) in the northern sky.

New Discoveries, Recoveries and Other Comets News

New Periodic Comet Numberings

441P/2017 R1 = P/2022 B2 (PANSTARRS) [MPC 138400, WGSBN Bull. 2 #5]

New Comet Discoveries

P/2022 G1 = P/2011 Q3 (McNaught) - Hidetaka Sato of Bunkyo-ku, Tokyo, Japan, recovered P/2011 Q3 (McNaught) on 2022 April 5, 10, and 11 at 20th magnitude with an iTelescopes 0.51-m f/6.8 at Siding Spring, Australia. Perihelion is expected on 2022 August 19 at 2.32 au when the comet should be near opposition at around 17th magnitude. P/McNaught was discovered on 2011 August 29 at 18th magnitude. It peaked during that apparition at 17th magnitude. [MPEC 2022- H01, CBET 5115]

C/2022 F2 (NEOWISE) – The Near-Earth Object Wide-field Infrared Survey Explorer (NEOWISE) spacecraft discovered C/2022 F2 on 2022 March 30 at 16-17th magnitude. The comet was only a week passed perihelion at discovery (T = 2022 March 24 @ 1.60 au). It should have brightened a few tenths of a magnitude to around magnitude 16.5 when closest to Earth in mid-April at 1.15 au. [MPEC 2022-G83, CBET 5113]

C/2022 F1 (ATLAS) – The "Asteroid Terrestrial-Impact Last Alert System" (ATLAS) program first observed this comet on 2022 March 30 with their new 0.5-m f/2 Wright-Schmidt reflector at Rio Hurtado in Chile. C/2022 F1 is a high-q comet with perihelion on 2022 September 4 at 5.95 au. Due to the large q, the comet is already as bright as it will get at 18th magnitude. With a declination in the -80s, telescopes will need to be located in the southern hemisphere to observe this ATLAS comet. [MPEC 2022-G82, CBET 5112]

P/2022 E1 = P/2005 N11 = P/2015 PO210 (PANSTARRS-Christensen) – This comet was announced as P/2022 E1 (Christensen) on 2022 March 11. Syuichi Nakano found pre-discovery observations from the most prior return in 2005 and 2006. A request to the Pan-STARRS team to search for pre-discovery observations within their data found that they had discovered the object back in 2015 when it was assumed to be asteroidal and was designated 2015 PO210. The recognition of the 2015 discovery resulted in adding 'PANSTARRS' to the official name of this comet. [MPEC 2022-H49, CBET 5117]

P/2020 WJ5 (Lemmon) – The Catalina Sky Survey discovered this comet at 20th magnitude back on 2020 November 18. Though numerous reports of cometary activity were reported in the weeks and months following discovery, the object was only recently announced as a comet. It is a low-eccentricity object (0.17) with a perihelion at 5.02 au back on 2021 July 3. Its orbital period is 14.8 years. Though its distance to the Sun has not

changed by much since discovery, the object has rapidly brightened and is currently around 18th magnitude. [CBET 5118, MPEC 2022-H121]

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 >.

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

Clear skies!
- Carl Hergenrother

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/2021 P4 (ATLAS)													
2021P4	2022 04 28.89	S 12.1	TI	29.8L	4	108		2.4	3			ICQ XX HAR11	Christian Harder
2021P4	2022 04 28.88	S 10.5	TK	20.3T10		100		4	3			ICQ XX GON05	Juan Jose Gonzalez Suarez
2021P4	2022 04 19.89	S 13.8:	TI	29.8L	4	132		0.4	4			ICQ XX HAR11	Christian Harder
C/2021 O3 (PANSTARRS)													
2021O3	2022 04 19.36	xI[7.6	AQ	25.0L	5	74						ICQ XX WYA	Christopher Wyatt
C/2021 E3 (ZTF)													
2021E3	2022 04 01.78	Z 11.3	AQ	10.6R	5a	180		5.5				ICQ XX RAMaa	Raymond Ramlow
C/2021 A1 (Leonard)													
2021A1	2022 04 01.78	Z 12.4	AQ	10.6R	5a	180		4.5		35.0m	123	ICQ XX RAMaa	Raymond Ramlow
C/2020 Y2 (ATLAS)													
2020Y2	2022 04 20.37	xS 15.0	AQ	40.0L	4	182		0.5	3			ICQ XX WYA	Christopher Wyatt
2020Y2	2022 04 05.44	xM 14.4	AQ	40.0L	4	261		0.6	5/			ICQ XX WYA	Christopher Wyatt
2020Y2	2022 04 04.47	xM 14.6	AQ	40.0L	4	182		0.7	5/			ICQ XX WYA	Christopher Wyatt
C/2020 V2 (ZTF)													
2020V2	2022 04 29.89	S 13.8	TI	29.8L	4	132		0.5	4	0.8m	110	ICQ XX HAR11	Christian Harder
2020V2	2022 04 28.90	S 13.7	TI	29.8L	4	108		0.75	4	1.0m	120	ICQ XX HAR11	Christian Harder
2020V2	2022 04 27.89	S 13.7	TI	29.8L	4	132		0.6	4			ICQ XX HAR11	Christian Harder
2020V2	2022 04 26.89	S 13.6	TI	29.8L	4	132		0.55	4			ICQ XX HAR11	Christian Harder
2020V2	2022 04 25.90	S 13.7	TI	29.8L	4	132		0.8	4			ICQ XX HAR11	Christian Harder
2020V2	2022 04 23.91	S 14.1	TI	53.1L		155		0.45	4	0.5m	110	ICQ XX HAR11	Christian Harder
2020V2	2022 04 23.85	S 13.8	HS	32.0L	5	80		1.2	4			ICQ XX PIL01	Uwe Pilz
2020V2	2022 04 22.98	S 13.3	TI	29.8L	4	132		0.9	4			ICQ XX HAR11	Christian Harder
2020V2	2022 04 19.90	S 13.5	TI	29.8L	4	132		0.6	4	1.0m	100	ICQ XX HAR11	Christian Harder
2020V2	2022 04 03.85	S 13.5	TI	29.8L		132		0.55	5			ICQ XX HAR11	Christian Harder
2020V2	2022 04 02.46	Z 13.7	AQ	10.6R	5a	180		1.2		1.0m	150	ICQ XX RAMaa	Raymond Ramlow
C/2020 M5 (ATLAS)													
2020M5	2022 04 05.44	xM 15.1	AQ	40.0L	4	261		0.5	4			ICQ XX WYA	Christopher Wyatt
2020M5	2022 04 04.50	xM 15.2	AQ	40.0L	4	261		0.5	4/			ICQ XX WYA	Christopher Wyatt
C/2020 K1 (PANSTARRS)													
2020K1	2022 04 02.47	Z 15.1:	AQ	10.6R	5a	300		0.6				ICQ XX RAMaa	Raymond Ramlow
C/2020 J1 (SONEAR)													
2020J1	2022 04 05.45	xS 14.9	AQ	40.0L	4	182		0.5	3			ICQ XX WYA	Christopher Wyatt
C/2019 T4 (ATLAS)													
2019T4	2022 04 29.88	S 12.0	TI	29.8L	4	132		1.2	3/			ICQ XX HAR11	Christian Harder
2019T4	2022 04 28.92	S 10.6	TK	20.3T10		77		4	3			ICQ XX GON05	Juan Jose Gonzalez Suarez
2019T4	2022 04 28.88	S 11.9	TI	29.8L	4	108		1.8	3/			ICQ XX HAR11	Christian Harder
2019T4	2022 04 27.88	S 11.1	TI	29.8L	4	132		1.5	3/			ICQ XX HAR11	Christian Harder
2019T4	2022 04 26.88	S 11.0:	TI	29.8L	4	132		1.7	3/			ICQ XX HAR11	Christian Harder
2019T4	2022 04 23.87	S 11.9	TI	53.1L		155		1.8	4			ICQ XX HAR11	Christian Harder
2019T4	2022 04 23.84	S 12.3	HS	32.0L	5	144		1	2			ICQ XX PIL01	Uwe Pilz
2019T4	2022 04 20.37	xM 11.6	AQ	40.0L	4	59		1.2	6			ICQ XX WYA	Christopher Wyatt
2019T4	2022 04 19.88	S 11.7	TI	29.8L	4	132		1.3	4			ICQ XX HAR11	Christian Harder
2019T4	2022 04 18.84	S 11.6	TI	29.8L	4	132		1	3/			ICQ XX HAR11	Christian Harder
2019T4	2022 04 05.45	xM 11.6	AQ	40.0L	4	59		1.2	6			ICQ XX WYA	Christopher Wyatt
2019T4	2022 04 04.48	xM 11.9	AQ	40.0L	4	59		1.3	6			ICQ XX WYA	Christopher Wyatt
2019T4	2022 04 01.91	S 10.8	TK	20.3T10		100		4	3			ICQ XX GON05	Juan Jose Gonzalez Suarez
C/2019 L3 (ATLAS)													
2019L3	2022 04 29.87	S 10.0	TI	29.8L	4	108		2.4	3			ICQ XX HAR11	Christian Harder
2019L3	2022 04 28.90	S 9.8	TK	20.3T10		77		2.5	5			ICQ XX GON05	Juan Jose Gonzalez Suarez
2019L3	2022 04 28.86	S 10.3	TI	29.8L	4	108		2.2	3			ICQ XX HAR11	Christian Harder
2019L3	2022 04 27.86	S 10.0	TI	29.8L	4	108		2.6	3/			ICQ XX HAR11	Christian Harder
2019L3	2022 04 26.86	S 10.0	TI	29.8L	4	108		2.5	3/			ICQ XX HAR11	Christian Harder
2019L3	2022 04 25.86	S 9.8	TI	29.8L	4	108		2.5	3/			ICQ XX HAR11	Christian Harder
2019L3	2022 04 23.88	S 9.8	TI	53.1L		139		2.2	4/			ICQ XX HAR11	Christian Harder
2019L3	2022 04 23.83	S 10.6	TK	32.0L	5	80		0.5	6	1.6	59	ICQ XX PIL01	Uwe Pilz
2019L3	2022 04 22.15	Z 9.8	AQ	10.6R	5a	180		7.1		8.0m	29	ICQ XX RAMaa	Raymond Ramlow
2019L3	2022 04 20.36	xM 10.5	AQ	40.0L	4	108		1.3	6	4.0m	132	ICQ XX WYA	Christopher Wyatt
2019L3	2022 04 19.85	S 10.0	TI	29.8L	4	108		2.5	4			ICQ XX HAR11	Christian Harder
2019L3	2022 04 18.85	S 10.4	TI	29.8L	4	108		1.5	4			ICQ XX HAR11	Christian Harder
2019L3	2022 04 10.84	S 9.7	TI	25.2L	4	92		2.5	4			ICQ XX HAR11	Christian Harder
2019L3	2022 04 05.41	xM 10.2	AQ	40.0L	4	59		2.3	6			ICQ XX WYA	Christopher Wyatt
2019L3	2022 04 04.44	xM 10.2	AQ	40.0L	4	59		3.5	6	8.7m	93	ICQ XX WYA	Christopher Wyatt
2019L3	2022 04 03.84	S 9.7	TI	29.8L		92		2.6	4			ICQ XX HAR11	Christian Harder
2019L3	2022 04 03.13	Z 9.6	AQ	10.6R	5a	180		7.7		7.0m	28	ICQ XX RAMaa	Raymond Ramlow
2019L3	2022 04 01.85	S 9.7	TK	20.3T10		77		2.5	6			ICQ XX GON05	Juan Jose Gonzalez Suarez
C/2017 K2 (PANSTARRS)													

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   2017K2  2022 04 30.48  S 10.0 TK 12.5B    30   2.0  4            ICQ xx HER02 Carl Hergenrother
   2017K2  2022 04 29.02  S 10.3 TK 20.3T10  77   3    3/           ICQ XX GON05 Juan Jose Gonzalez Suarez
   2017K2  2022 04 24.05  S 10.3 TI 53.1L   139   2    4            ICQ XX HAR11 Christian Harder
   2017K2  2022 04 23.02  S 10.3 TI 29.8L 4 108   2    3/           ICQ XX HAR11 Christian Harder
   2017K2  2022 04 08.48  S 10.5:TK 12.5B    30   1.5  3            ICQ xx HER02 Carl Hergenrother
   2017K2  2022 04 02.48  Z 11.1 AQ 10.6R 5a180   2.6       5.5m343 ICQ XX RAMaa Raymond Ramlow
116P/Wild
116        2022 04 23.90  S 13.5:TI 53.1L   215   0.8  3            ICQ XX HAR11 Christian Harder
116        2022 04 20.39 xS 13.6 AQ 40.0L 4 108   1.4  3/           ICQ XX WYA   Christopher Wyatt
116        2022 04 05.43 xM 14.0 AQ 40.0L 4 182   1.4  4            ICQ XX WYA   Christopher Wyatt
104P/Kowal
104        2022 04 22.15  Z 12.5 AQ 10.6R 5a300   4.6              ICQ XX RAMaa Raymond Ramlow
104        2022 04 05.42 xS 12.6 AQ 40.0L 4 108   1.4  2/           ICQ XX WYA   Christopher Wyatt
104        2022 04 04.45 xS 12.9 AQ 40.0L 4 182   1.5  2/           ICQ XX WYA   Christopher Wyatt
104        2022 04 03.12  Z 11.1 AQ 10.6R 5a180   6.6              ICQ XX RAMaa Raymond Ramlow
104        2022 04 01.84  S 10.5 TK 20.3T10 100   4    2            ICQ XX GON05 Juan Jose Gonzalez Suarez
73P/Schwassmann-Wachmann
 73        2022 04 22.17  Z 16.6 AQ 10.6R 5a540   0.8       0.5m123 ICQ XX RAMaa Raymond Ramlow
 73        2022 04 03.14  Z 16.9 AQ 10.6R 5a540   0.7              ICQ XX RAMaa Raymond Ramlow
67P/Churyumov-Gerasimenko
 67        2022 04 05.42 xS 13.7 AQ 40.0L 4 182   1.1  2/           ICQ XX WYA   Christopher Wyatt
 67        2022 04 04.45 xM 13.5 AQ 40.0L 4 108   1    3            ICQ XX WYA Christopher Wyatt
 67        2022 04 03.13  Z 13.3 AQ 10.6R 5a300   3.2      15.5m284 ICQ XX RAMaa Raymond Ramlow
 67        2022 04 01.87  S 11.5 TK 20.3T10 100   2    3            ICQ XX GON05 Juan Jose Gonzalez Suarez
29P/Schwassmann-Wachmann
 29        2022 04 01.89  S 11.2 TK 20.3T10 100   5    1            ICQ XX GON05 Juan Jose Gonzalez Suarez
22P/Kopff
 22        2022 04 01.79  Z 12.2:AQ 10.6R 5a180   4.2              ICQ XX RAMaa Raymond Ramlow
19P/Borrelly
 19        2022 04 28.91  S 10.3 TK 20.3T10  77   3.5  4            ICQ XX GON05 Juan Jose Gonzalez Suarez
 19        2022 04 28.90  S 11.1 TI 29.8L 4 108   2.9  2            ICQ XX HAR11 Christian Harder
 19        2022 04 27.87  S 11.1 TI 29.8L 4 108   1.8  2            ICQ XX HAR11 Christian Harder
 19        2022 04 26.87  S 11.0:TI 29.8L 4 108   2    2            ICQ XX HAR11 Christian Harder
 19        2022 04 25.91  S 11.4 TI 29.8L 4 108   2    2            ICQ XX HAR11 Christian Harder
 19        2022 04 23.89  S 10.6 TI 53.1L   139   2    2            ICQ XX HAR11 Christian Harder
 19        2022 04 19.87  S 10.8 TI 29.8L 4  92   2.5  2            ICQ XX HAR11 Christian Harder
 19        2022 04 10.84  S 10.6 TI 25.2L 4  92   1.5  2/           ICQ XX HAR11 Christian Harder
 19        2022 04 03.83  S  9.9 TI 29.8L    92   2.4  3            ICQ XX HAR11 Christian Harder
 19        2022 04 03.12  Z 10.2 AQ 10.6R 5a180   8.3       5.5m 75 ICQ XX RAMaa Raymond Ramlow
 19        2022 04 01.86  S  9.9 TK 20.3T10  77   3.5  5            ICQ XX GON05 Juan Jose Gonzalez Suarez
9P/Tempel
  9        2022 04 01.77  Z 13.9 AQ 10.6R 5a300   2.1       2.7m259 ICQ XX RAMaa Raymond Ramlow
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