Comet Section

Sunskirting comet C/2024 G3 (ATLAS)

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Director

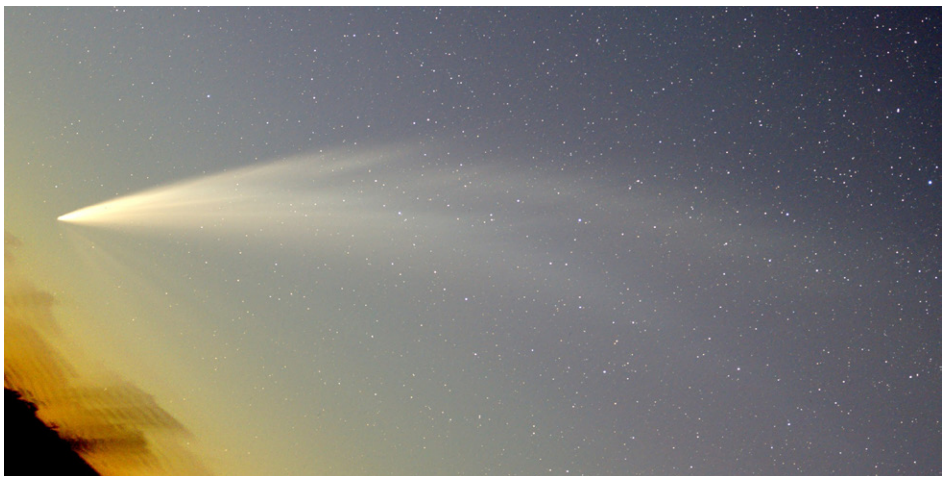

Figure 1. 2025 Jan 22, 11:10 UTC. Canon 6D, 100 mm, *f*/2.8. 15 × 30 s, ISO 1600, field of view 15 deg, N down, Michael Mattiazzo, Victoria, Australia.

Circumstances & predictions

Comet C/2024 G3 was discovered by the ATLAS survey on 2024 Apr 5 using a 0.5-m, *f*/2 Schmidt telescope at Rio Hurtado, Chile.[1] At the time of discovery, it was a 19th-magnitude asteroidal object in the far southern constellation of Octans. Subsequent observations revealed its cometary nature and showed that it would reach a very small perihelion distance of q = 0.093 au on 2025 Jan 13.[2] This low distance implied that the comet could become quite bright – if it survived.

It was to be a southern-hemisphere object throughout its apparition, only rising above –20° declination briefly around perihelion, when at a small elongation and so only visible in a bright sky. Most BAA observations were made using remote telescopes in the southern hemisphere, although a few images were obtained from the UK in daylight around perihelion. The Section received many observations from southern-hemisphere observers.

Nicolas Lefaudeux performed simulations which indicated that the best chance of seeing the comet's dust tail would be after perihelion, between 2025 Jan 19 & 23.[3] He commented that the tail could reach a length of 15–20 degrees in the evening twilight.

As it turned out, the comet brightened rapidly as it approached the Sun, and it put on a spectacular show for southern-hemisphere observers following perihelion.

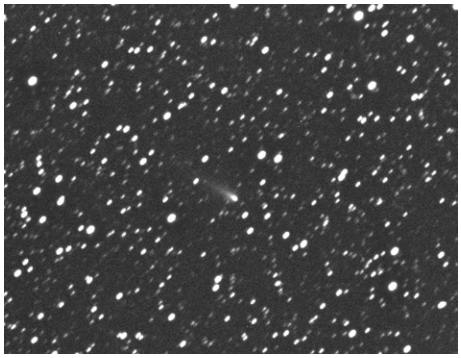

Figure 2. 2024 Sept 1, 09:35 UTC. iTelescope T17 (0.43 m, *f*/6.8). Field of view 10 × 8 arcmin, N right. Michael Mattiazzo, Siding Spring.

Approaching perihelion

Through the summer and autumn of 2024, it brightened at a faster-than-expected rate as it tracked through the constellations of the deep south. Images and measurements showed a very dusty comet with very low levels of volatiles. By the end of October, when the comet disappeared into the solar glare, its magnitude had risen to 12.

The comet went through solar conjunction in November, and it emerged into the morning sky in early December. Obtaining magnitude estimates at this time was challenging, as it was only observable low in the morning twilight from the southern hemisphere. Most remote telescopes could not reach low enough to image it. However, with time donated to the BAA Comet Section by Jas Madhavan, I was able to use iTelescope T70 – a 135-mm Samyang lens attached to an ASI 2600MM camera at Rio Hurtado, Chile. This system can reach down to the local mountain ridge horizon, which lies at around 4° altitude at the comet's azimuth. The skies over the Atacama are incredibly transparent, even at this altitude, and I managed to capture a sequence of images throughout December that showed the comet's rapid brightening was continuing.

At the beginning of December, the comet was around 10th magnitude and displayed a short tail approximately 0.2 degrees in length. It was possible to follow the comet in a ►

▼ **Figure 3.** 2025 Jan 4, 00:49 UTC. iTelescope T70 (135-mm FL, *f*/2, ASI 2600MM). Zenith up. Nick James, Chile.

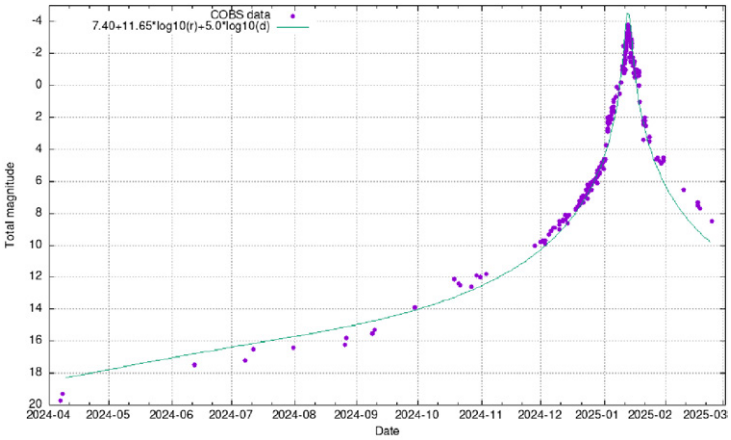

Figure 4. Visual and electronic estimates of the comet's total magnitude, taken from the COBS database and plotted with the fitted light curve.

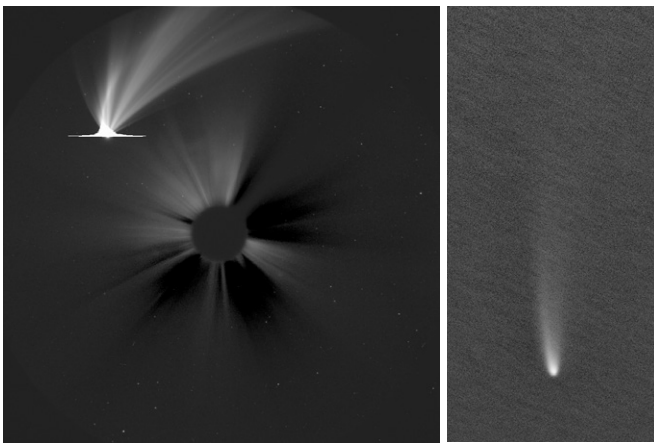

Figure 5 (left). 2025 Jan 14. 00:37 UTC. LASCO C3 SOHO image. *(ESA; processed by Nick James)* **Figure 6 (right).** 2025 Jan 13, 17:15 UTC. 140 TEC $f/7$ AP ×0.72 Quad Telecompressor, $f = 5$, ASI 6200MM. Michael Buechner, Spain.

▶ reasonably dark sky through to the end of the month, by which time it was around 5th magnitude. After that, it was only visible in twilight.

In mid-December, images began to show a narrow dust spine in the tail, indicating that dust was being released at a very low velocity. This suggested the onset of significant disruption of the nucleus, as the dust was being ejected due to fragmentation rather than in gas jets. At this time, evidence from astrometry and photometry implied that the comet remained mostly intact.

On 2025 Jan 2.76, Terry Lovejoy in Brisbane reported that the comet appeared to have brightened significantly and was approaching magnitude 3. I imaged it from Chile on Jan 3.36, and the image was saturated, with an indicated magnitude of 2.9. It appeared that the comet was in outburst, with Michael Mattiazzo reporting 2nd magnitude on Jan 3.7.

This outburst was temporary, and the comet subsequently appeared to be following the predicted light curve (Figure 4) quite closely. The light curve indicated that the comet's absolute magnitude was around 7.4 – above the Bortle survival limit for all possible perihelion distances – so it seemed probable that the comet would survive its close approach to the Sun.

At perihelion

The comet had been moving north as it approached perihelion, and it should theoretically have been visible from the UK in bright morning twilight for a few days from Jan 10. Unfortunately, I was thwarted by freezing fog on those mornings, and I am not aware of any successful UK observations during the morning twilight.

However, several UK observers managed to image the comet in daylight around the time of perihelion. On 2025 Jan 11, I successfully imaged it from Chelmsford using a 90-mm refractor and an ASI 1600 camera when the elongation was 7.9°. I estimated a total magnitude of –0.8 using Venus as a reference. As the comet moved through perihelion, it displayed a spectacular tail in the images (Figure 5) from the Large Angle Spectrometric Coronagraph (LASCO) C3 instrument aboard the *Solar and Heliospheric Observatory* (SOHO) satellite.

Using a remote telescope, Michael Buechner imaged the comet only 3 degrees above the horizon in the evening twilight on the day of perihelion, when the elongation was only 5° (Figure 6). The total magnitude probably reached –4 just before perihelion.

Post perihelion

After perihelion, the comet began moving south again as it emerged into the evening twilight. The spectacular dust tail, which had been seen in the LASCO images, became visible from the ground as the elongation increased and the comet moved into darker skies. By Jan 16, the tail displayed a series of distinct striae.

Between Jan 18 & 19, the comet's head became much more diffuse, indicating that the nucleus had fragmented. Images by Lional Majzik in Hungary showed a strong spine feature in the tail, indicative of low-velocity dust emission from large fragments. After this date, the comet's head became much more diffuse, but the tail was still prominent. In fact, much of the dust in the spectacular tail had left the nucleus many weeks earlier, meaning the tail would persist long after the head had faded.

At this time, the comet was primarily a southern-hemisphere object, but there was a possibility that the far end of the tail could be visible above the horizon from low northern latitudes long after the head had set.

Immediately after the BAA January meeting, I flew to Tenerife for a few days with the

Figure 7 (left). 2025 Jan 19, 19:18 UTC. ASI 2600MC, 250-mm FL, $f/4.9$, 100 × 0.1 s. Nick James, Tenerife.

Figure 8 (right). 2025 Jan 19, 20:00 UTC. Sony A7s III, 100 mm, $f/2$, 41 × 5 s. Image height 14 deg. Nick James, Tenerife. The comet's head is 7 degrees below the horizon, and the Helix nebula is visible in the upper reaches of the tail.

Figure 9. 2025 Jan 22, 10:41 UTC. 50 mm, $f/1.4$, ISO 3200. 12 × 10 s. Vello Tabur, New South Wales, Australia.

Figure 10. 2025 Jan 22, approx. 10h UTC, 135-mm FL, 22 s. Terry Lovejoy, Queensland, Australia.

Figure 11. 2025 Jan 26, 10:31 UTC. Canon 6D Mk. II, 85-mm, $f/2.0$, ISO 10,000. 40 × 1s. Rob McNaught, New South Wales, Australia.

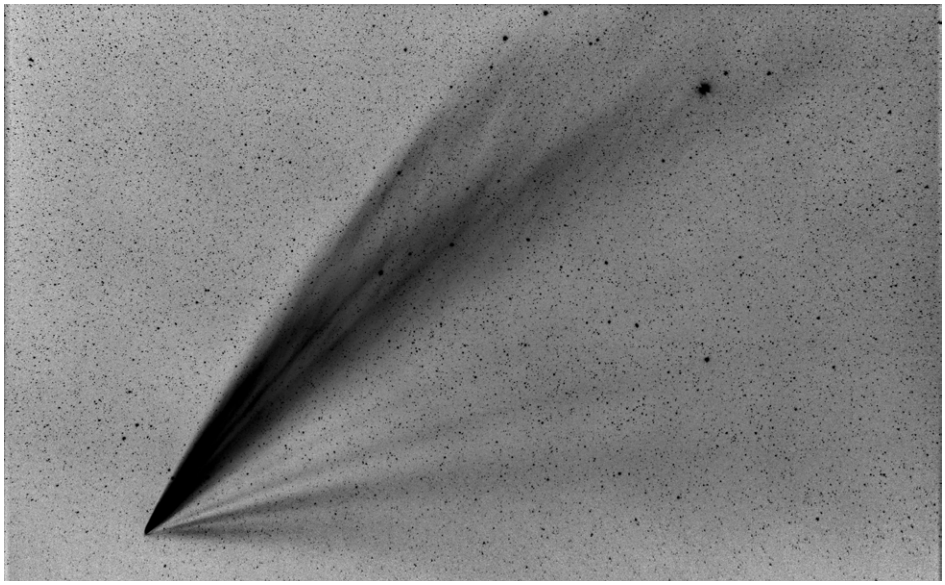

Figure 12. 2025 Jan 27, 10:58 UTC. Canon R6 II, 135-mm FL, $f/2$, ISO 3200. Vello Tabur, New South Wales, Australia.

intention of imaging the comet in bright twilight and capturing the far end of its tail in darker skies. I observed from a location 2,200 m up the southwestern flank of Mount Teide, at a spot with a clear western horizon. I used a 100-mm lens on a Sony A7s III camera.

The 100-mm focal length lens had a 20 × 14 degrees field of view, and I took 5-s exposures at ISO 1600 with the lens open at $f/2$. Figure 8 is the result of a stack of 41 × 5-s exposures taken at 19:57 UTC on Jan 20, with significant processing to remove the background gradient. At the time this image was taken, the comet's head was 7 degrees below the horizon. The main part of the dust tail is aligned almost vertically to the horizon, with the Helix Nebula (NGC 7293) visible in the faint upper reaches of the tail. At least three other streamers are visible to the right of the main tail, stretching to the top of the frame – at least 21 degrees from the comet's head. I convinced myself that I could see the lower part of the dust tail with the naked eye, appearing as faint striations with a surface brightness about the same as the zodiacal light near the horizon. This is only the second time that I have imaged a significant tail when the head of the comet was below the horizon – the first time was C/2006 P1 (McNaught) in 2007 Jan.

Even though the comet's nucleus fragmented around Jan 18, the tail has continued to be visible as a ghostly remnant near the predicted ephemeris position of the comet. Rob Kaufman has been imaging this very faint, headless tail from Australia, and it remains visible almost three months after perihelion. Interestingly, the comet's total magnitude appears to have been substantially unaffected by the fragmentation, with estimates in late February actually running slightly brighter than the best-fit light curve. It remains unclear exactly what observers were recording in these estimates.

1 **www.cbat.eps.harvard.edu/iau/cbet/005300/CBET005384.txt**
2 **minorplanetcenter.net/mpec/K24/K24X74.html**
3 **groups.io/g/comets-ml**