Spectacular Spectacles in the Night Sky

By Greg Sykes (greg@grsykes.com)

Last autumn, the night sky indulged us to several glorious spectacles. On October 10, 2024, auroral storms filled the skies at much lower latitudes than normal with glows reaching Mexico and the Bahamas! This rare display treated Northern Virginia residents to quite a show. Though often mistaken for an aurora borealis, the first marvel seen was a SAR arc: Stable Auroral Red (Figure 1). This phenomenon was discovered in the 1950s. Simply stated, true auroras form when solar flares send charged particles into space, which hit and ionize the earth's atmosphere that results in a colorful display. Auroras usually occur around Earth's magnetic poles because that is where the charged particles are attracted, much like iron filings are drawn to a magnet's poles.

Figure 1. Seen directly overheard, the SAR arc stretched across the entire sky albeit scarcely visible to the naked eye (inset represents what was seen). All images in this article were photographed with a medium to wide aperture and a 1-20 second exposure; the only post-processing adjusted brightness and contrast. The easiest way to know that the observed is a SAR arc or aurora is by finding stars shining through the bright colors (magnified area): starlight passes through upper atmospheric events but water vapor clouds lit by light pollution block stars.

Instead of charged particles, SARs form when Earth's atmosphere heats up. Earth has a ring made of electrical current as opposed to chunks of matter like Saturn's rings. When that current ring heats and releases energy into the upper atmosphere, SARs occur as red, east-west bands across the sky at lower latitudes than auroras. SARs' name is confusing because 1) they move slightly but are slower than a true aurora and 2) the word, "auroral," is used as an adjective meaning aurora-like. However, their deep red wavelength caused by excited atomic oxygen* in the upper atmosphere approaches the human eye's

detection limit and faintness makes them hard to see. Last October, the massive solar storm caused Earth's current ring to roast the atmosphere, which formed the conspicuous SARs. As the SARs faded, the solar particles ionized the atmosphere, lighting the sky red and green with the true aurora borealis (Figure 2). We saw two shows for the price of one solar storm!

*At ground level, oxygen occurs as two atoms bound together in an oxygen molecule. In the thermosphere, the highest level of the atmosphere, cosmic rays hit the diatomic oxygen, which splits the molecule into single atoms.

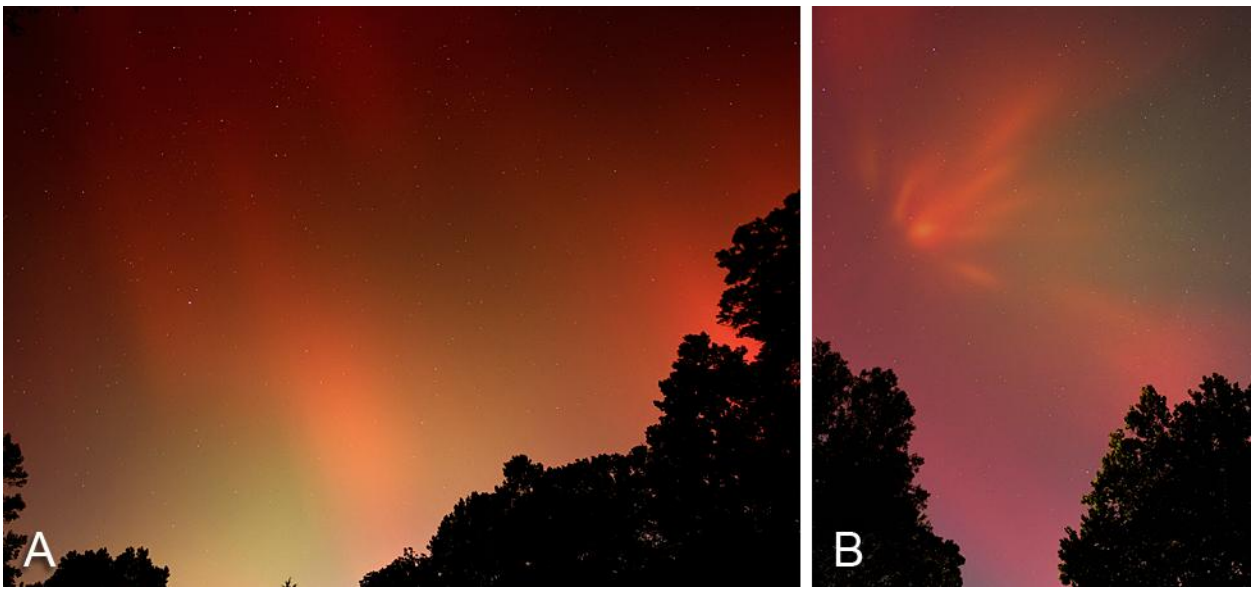

Figure 2. Unlike ARCs, auroras appear as curtains of light in the northern sky (A) that shift within minutes. Colors are determined by the atmospheric gasses that are excited and the solar storm's energy. Southern latitudes are typically rich in red, so Northern Virginia got a rare treat with the extensive greens. The oranges and magentas present are from the red and green mixing—much like TVs and monitors use red-green-blue to display all colors—since there are no atmospheric gasses that would glow orange when excited. Past auroras here appeared in the northern sky. The October 2024 event filled the sky with the brightest parts easily seen overhead with the naked eye (B).

Later in October, Comet C/2023 A3 (Tsuchinshan–ATLAS) passed through the evening sky. Like many comets, it was a challenge to view because when it was closest to the sun and at its brightest, the sun's glare was overwhelming. As the comet moved further from the sun, it lost brilliance but had better contrast against a night sky. While Tsuchinshan–ATLAS was hard to spot with a naked eye, it was an easy target for binoculars. What made this comet especially distinguishing was the length of its long tail! Whereas most astronomical targets need a telescope to see, Tsuchinshan–ATLAS's tail filled the frame when photographed with only an 80 mm lens (Figure 3).

Figure 3. Tsuchinshan–ATLAS is seen here in the twilight sky, which was brightened in post-processing. The parallel arrow serves as a guide to the comet tail's length.

Great ways to see such celestial wonders is to have a clear, moonless sky without light pollution. Mother Nature is in charge of the former but we control the latter—it's as easy as flipping a switch! In addition to gaining darker skies, turning off outdoor lights or changing to a better security, motion-activated system improves human health, saves electric bills, reduces greenhouse gasses, helps the wildlife, and makes for being good neighbors. To better

observe subtleties in the night sky, abstain from substances that interfere with night vision, such as nicotine, several hours beforehand. Allow the eyes up to 30 minutes to adjust to darkness and a red filter on flashlights helps maintain night vision. Stay current with astronomic events by following websites like the ones in this article's resource section.

Be sure to read the follow-up Eco-Article, What's Missing from Tonight's Sky? (March 2026).

Additional resources…

…on space and weather:

- https://www.spaceweather.com/ (sign up here for aurora alerts)
- https://www.space.com/
- https://www.swpc.noaa.gov/communities/aurora-dashboard-experimental
- https://www.astronomy.com/

…on light pollution and its impacts:

- Chepesiuk, Ron. January 2009. Missing the dark: health effects of light pollution. *Environmental Health Perspectives*. 117(1):A20–A27. doi: 10.1289/ehp.117-a20
- Dark Skies video by the Defend Them All Foundation: https://www.youtube.com/shorts/21lutHIRsIA
- https://darksky.org/resources/what-is-light-pollution/effects/human-health/
- https://education.nationalgeographic.org/resource/light-pollution/
- https://www.audubon.org/news/lights-out-across-country
- https://www.birdscaribbean.org/2022/09/get-ready-to-celebrate-world-migratory-bird-day-2022-dim-the-lights-for-birds-at-night/

* * * * *