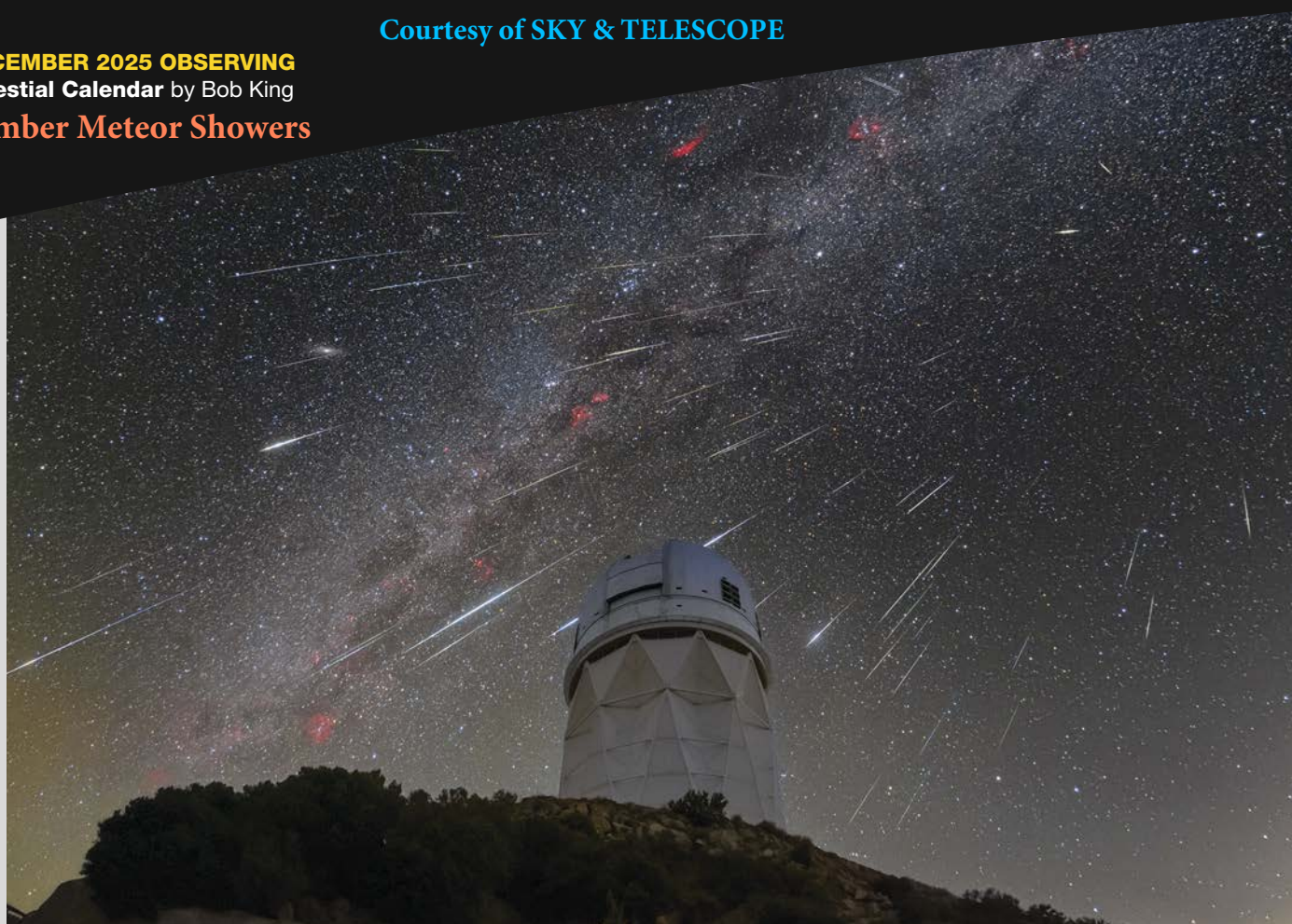




Icy Meteors Streak

Favorable conditions promise fine showings from two December showers.

A nearly full Moon compromised our view of the annual Perseid meteor shower last August. However, we'll do much better with the year's other major display, **the Geminids, which reach maximum on the night of December 13–14**. A 26%-illuminated waning crescent Moon is present but rises in Virgo around 2:30 a.m. local time. Its modest glare has little impact on the year's richest meteor event.

North America could hardly be teed up much better for the Geminids, which are expected to peak around 3 a.m. EST (8:00 UT) on December 14th. The **shower's zenithal hourly rate (ZHR)**,

an idealized number based on pristine skies with the radiant overhead, is 150 meteors per hour. If you live near a city and contend with light pollution, divide that number by three for a more realistic estimate. The International Meteor Organization notes that **the broad Geminid maximum — when the ZHR is 100 or higher — lasts for 10 to 12 hours**, guaranteeing that a large swath of the globe gets a taste of the shower's power.

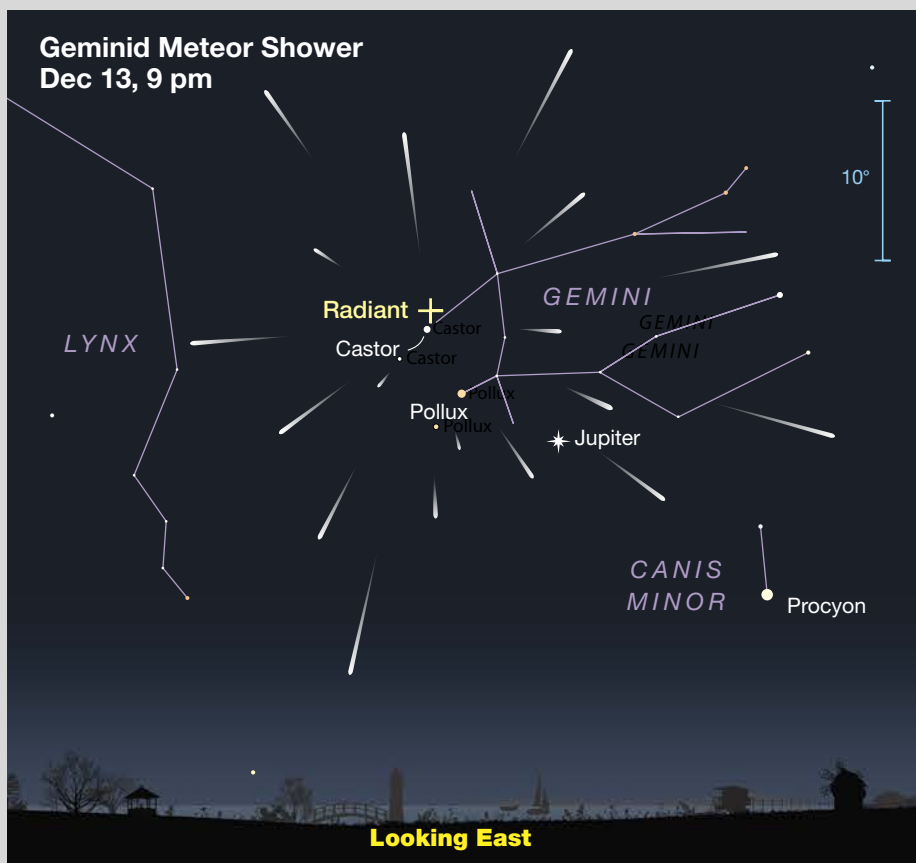
One of the things I've always loved about the Geminids is that you can start meteor gazing as early as 9 p.m. local time. That's when the streaming point (called the *radiant*), located near the star Castor, Alpha (α) Geminorum, begins its climb above the northeastern horizon. A few years back, I listened to the local kids slap a hockey puck around at a nearby outdoor rink as the Geminids ripped across the sky, caught in the net of Earth's atmosphere.

While some observers avoid cold December nights, a little preparation makes Geminid-watching a piece of cake even in subzero temperatures.

▲ Dozens of bright and faint Geminids streak across the sky above the Mayall 4-meter telescope at Kitt Peak National Observatory, in Arizona, during the shower's peak on December 14, 2023. This composite photo was captured over a two-hour period.

A reclining chair is essential for comfort and to avoid a stiff neck. Since you won't be moving around much, insulated boots, long underwear, a wool sweater, heavy down coat, lined gloves, and a scarf are essential. Chemical hand-warmers placed inside your gloves (and boots) give much-needed extra warmth. And don't forget a warm, wool hat. Pull a blanket or sleeping bag over yourself, and you'll be as cozy as a cat on a sunny windowsill. I usually work a split shift during the Geminids — watching for an hour in the evening to take the shower's pulse, then get up at 2 or 3 a.m. to enjoy the peak.

In addition to being rich in fireballs, many meteor watchers describe Geminids as colorful, with hues of green, yellow, and red. These tints are caused by both the excitation of atoms in



Earth's atmosphere along the meteor's path as well as from the composition of the particles themselves. Blue-green is associated with magnesium emission, yellow derives from sodium and iron, and red from the interaction between atmospheric oxygen and nitrogen with material ablated from meteorite fragments as they fall. Excitation of oxygen at the start of the particle's plunge makes meteor trails glow green.

Geminids originate from the asteroid 3200 Phaethon, a hybrid object dubbed a "rock comet." At perihelion, it passes just 21 million kilometers (13 million miles) from the Sun — much closer than the planet Mercury. Astronomers theorize that the intense heat from the Sun bakes and cracks the asteroid's surface, releasing dust and fragments into space along its orbital track. Every December, Earth crosses the object's orbit and sweeps up particles that incandesce as Geminid meteors.

While most everyone looks forward to the Geminids, December features a second meteor shower that I'll wager

few have seen. **The Ursids peak around 5 a.m. EST (10:00 UT) the morning of the 22nd.** This may be one of the best years to try your luck as the Moon is just a very thin, 3%-illuminated waxing crescent that sets in the early evening. The timing is rarely so good.

From a dark, rural location **about 10 Ursids per hour** hasten from a radiant $1\frac{1}{2}^\circ$ northwest of Kochab, Beta (β) Ursae Minoris, the brightest star in the Little Dipper's bowl. That means that for many readers, the shower's radiant is circumpolar.

Ursid meteoroids originate with Comet 8P/Tuttle, which has an orbital period of only 13.6 years. It most recently passed our way in 2021 and reaches perihelion again in April 2035. When Earth crosses the comet's path this month, we'll encounter a denser filament of material that may enhance the shower's typical ZHR. Astronomer Peter Jenniskens, an expert on meteor showers, predicts that run-in occurs at 5:39 UT (12:39 a.m. EST) on December 22nd. Keep your eyes peeled!