



Splendid Geminids!

December hosts yet another Moon-free meteor shower.

When it comes to meteor showers, 2026 has dealt us a pair of aces. The August Perseids peaked at new Moon. Now it's the Geminids' turn. When Earth passes through the densest part of the debris trail on **Sunday night, December 13–14**, the Moon is a 20%-illuminated crescent that sets around 9 p.m. local time, well before the shower kicks into gear. The Geminids are easily the year's richest annual meteor shower. For observers far from city lights, up to 150 meteors per hour

▲ In this composite image of the 2021 Geminids each meteor points back to the radiant in Gemini located to the right of Castor (top center). Orion appears at middle left near the horizon. If you'd like to create your own composite, see page 53 of our August issue.

rip across the sky. If you live closer to town (like I do) you'll see half to a third as many. My record is one meteor per minute during the 2023 peak. After the Perseids, the Geminids rank highest in *fireballs*, meteors equal to or brighter than Venus. If you're lucky you

might catch sight of your shadow racing across the snow as a fireball blazes at your back. If you're luckier, you'll be facing the scintillating sight.

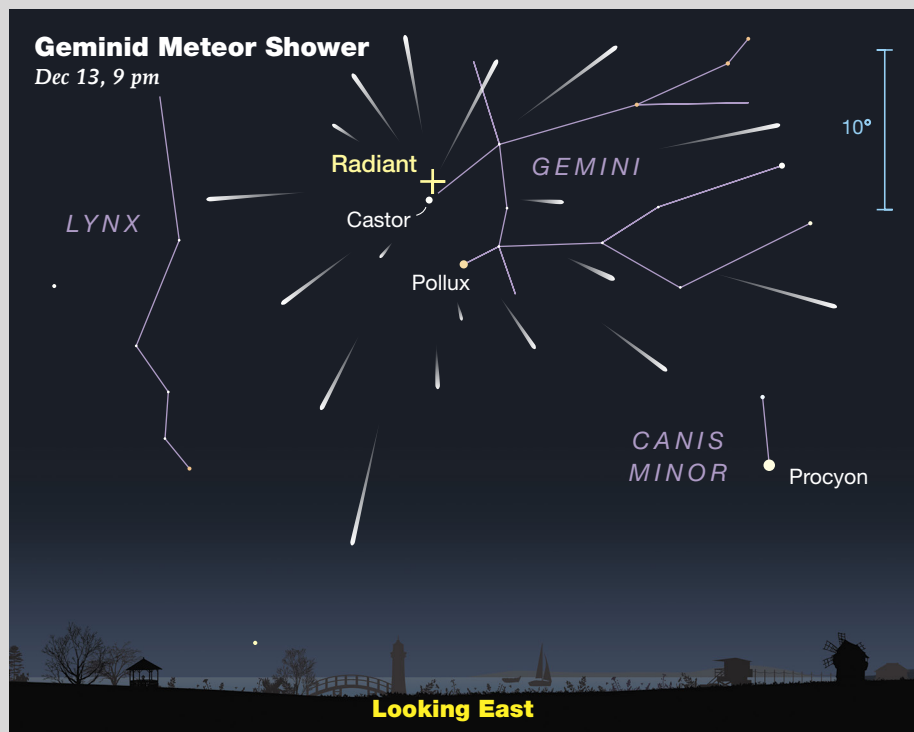
Meteors stream from a *radiant* in Gemini about 2° northwest of 2nd-magnitude Castor, the fainter of the two Gemini twins. The radiant is a convincing illusion. The same way parallel railroad tracks appear to meet in the distance, distant meteors on parallel paths meet at the radiant point. As they enter the atmosphere, the slender streaks appear to fan across the entire sky. In truth, they follow straight paths. With some showers you have to wait until after midnight for the action to start. Not with the Geminids. The radiant is high enough to get a taste as early as 10 p.m. But if you stay up late, the rate ticks up as the hours pass. In the wee hours, with the whole sky as their canvas, the plasma paintbrushes create a real-time masterpiece.

After midnight, your location on Earth turns head-on into the direction of incoming meteoroids. Instead of looking out the back window waiting for them to catch up to us, we're pressed up against the front window. As we plow face-on in their direction, the material strikes the atmosphere with greater speed. Not only does that increase the number of meteors, but also their impact velocity, which brightens them up. The shower peaks around 14:00 UT (9 a.m. EST) on December 14th, so rates should con-

tinue to increase as dawn approaches. Observers on the West Coast and in the Hawaiian Islands are best placed to see the peak. For Southern Hemisphere skywatchers, where Gemini rides low in the northern sky, the best viewing time is around 2 a.m., when the radiant crosses the meridian.

The Geminids have a broad maximum, with strong activity for 10 to 12 hours. Moreover, **the shower is active from December 4–20**, so even if the peak night is clouded out, you'll at least see a modest showing the night before and after. Brighter, more massive Geminids are typically observed toward the end of the maximum period.

Most meteor showers occur when Earth crosses the orbit of a comet. But sometimes an asteroid gets into the act. The Apollo-class **near-Earth asteroid 3200 Phaethon** is a contributor to this annual cosmic spitballing. Research shows that the Geminid stream likely originated in the disruption (possibly through impact) of an asteroid or comet 1,200 to 2,400 years ago. Phaethon appears to be one of its surviving remnants. The 5.8-kilometer (3.6-mile) rocky body gets so close to the Sun at perihelion that solar heating releases sodium gas from its interior, creating a temporary tail and likely wafting dust and rocks along its orbit. Every December, Earth crosses Phaethon's path, and particles ranging in size from sand grains to pebbles strike our atmospheric windshield at 35 km/s



▲ Bundle up for the annual Geminid meteor shower, the year's richest. The December 13-14 peak coincides with a nearly moonless sky, ideal conditions for staying up late to take in the full experience. Shower members strike the atmosphere at 35 km per second (78,000 mph), about 40% slower than the Perseids. The shower is active from December 4th to the 20th.

(22 miles per second, or 78,000 mph). Plowing through the air heats and vaporizes the fragments, transforming them into oohs and aahs.

As long as you're warmly dressed in a lounge chair under a warm blanket, watching the Geminids is a true thrill. Meteor rates can reach more than one-a-minute, then suddenly drop to zero. These meteor-free intervals make it feel like the show's over, but it's only a

cosmic ruse. Stick around for two more minutes. Feel the anticipation. Believe. Soon enough, another arrow of light arrives, and you're an optimist again.

If you'd like to contribute your Geminid observations to further meteor science, visit the American Meteor Society ([tinyurl.com/AMS-observing](https://www.tinyurl.com/AMS-observing)) where you'll find information and observing forms. Next year's shower occurs at full Moon. Take advantage, and clear skies!