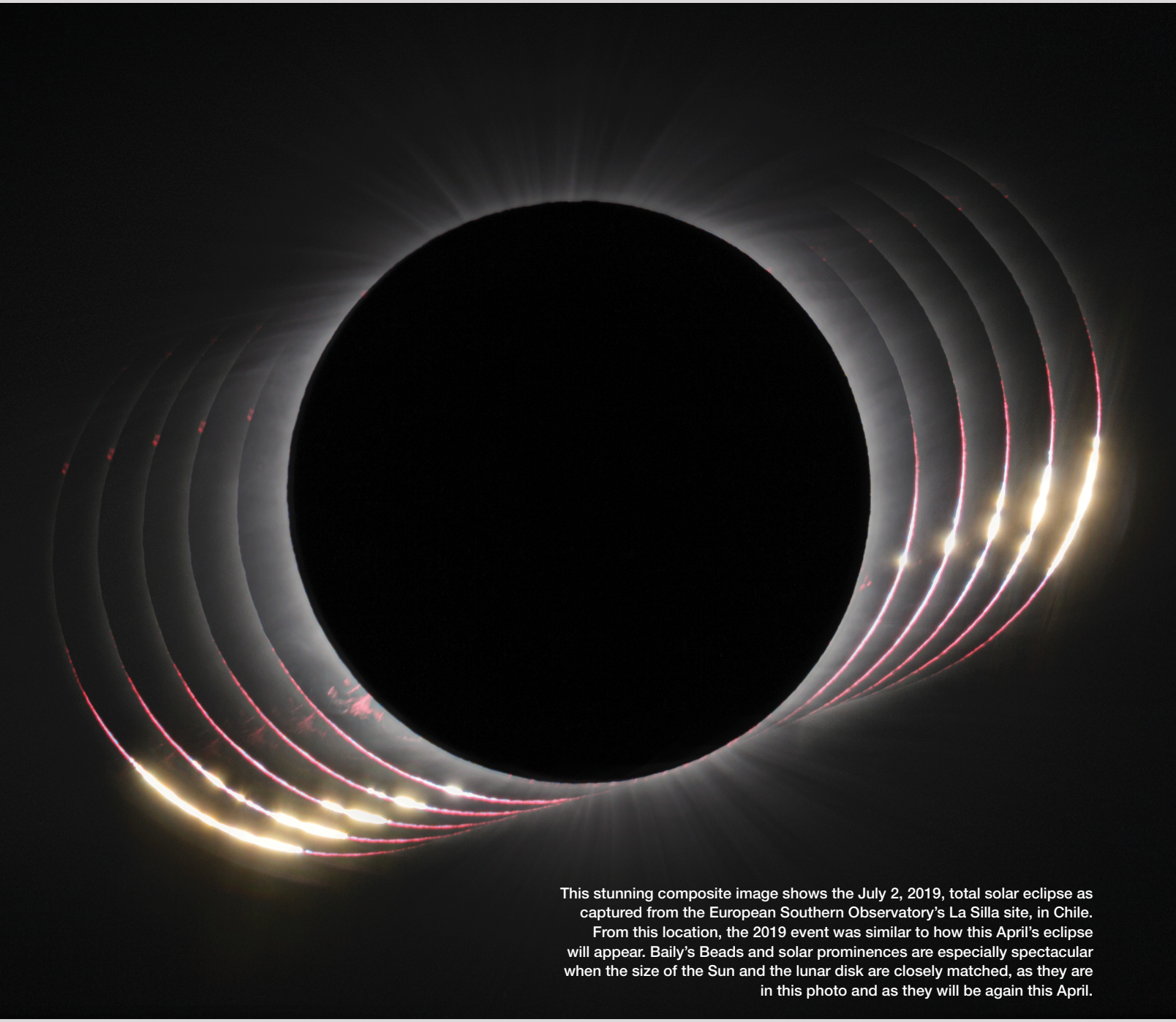
A Touch-and-Go Solar Eclipse

This unusual event will entice eclipse chasers willing to travel.



This stunning composite image shows the July 2, 2019, total solar eclipse as captured from the European Southern Observatory's La Silla site, in Chile. From this location, the 2019 event was similar to how this April's eclipse will appear. Baily's Beads and solar prominences are especially spectacular when the size of the Sun and the lunar disk are closely matched, as they are in this photo and as they will be again this April.

A rare hybrid solar eclipse will brush parts of Australia, Timor-Leste, and Indonesia on Thursday, April 20th. In this type of event, the Moon fits so snugly over the Sun that different places along the central line see either a total or an annular eclipse. Hybrid eclipses occur roughly once a decade.

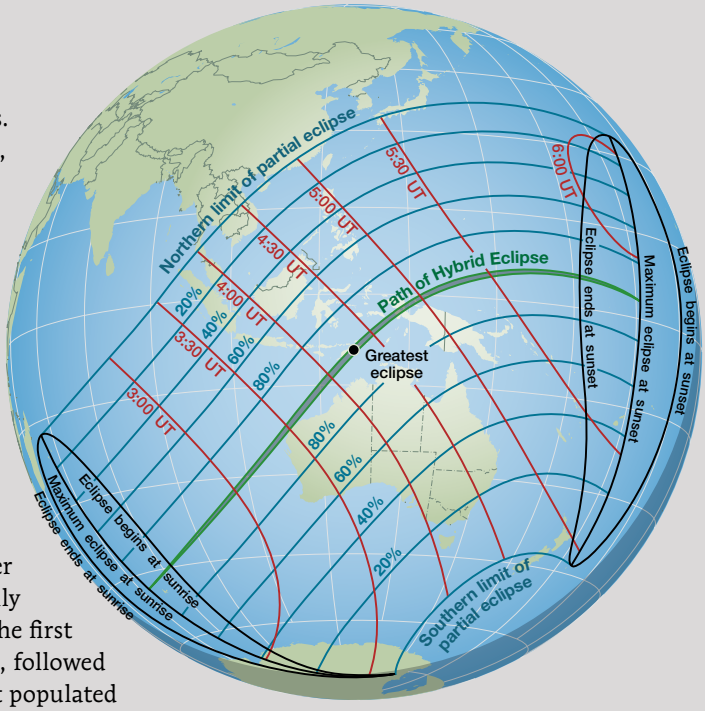
As shown in the diagram at right, the eclipse path first touches down north of the French Southern and Antarctic Lands and continues northeast across the Indian Ocean, making landfall for the first time along the western edge of Australia's North West Cape. Observers along the central line in this narrow peninsula will witness up to $1^m\ 3^s$ of totality at 3:30 UT, with the Sun 54° above the horizon.

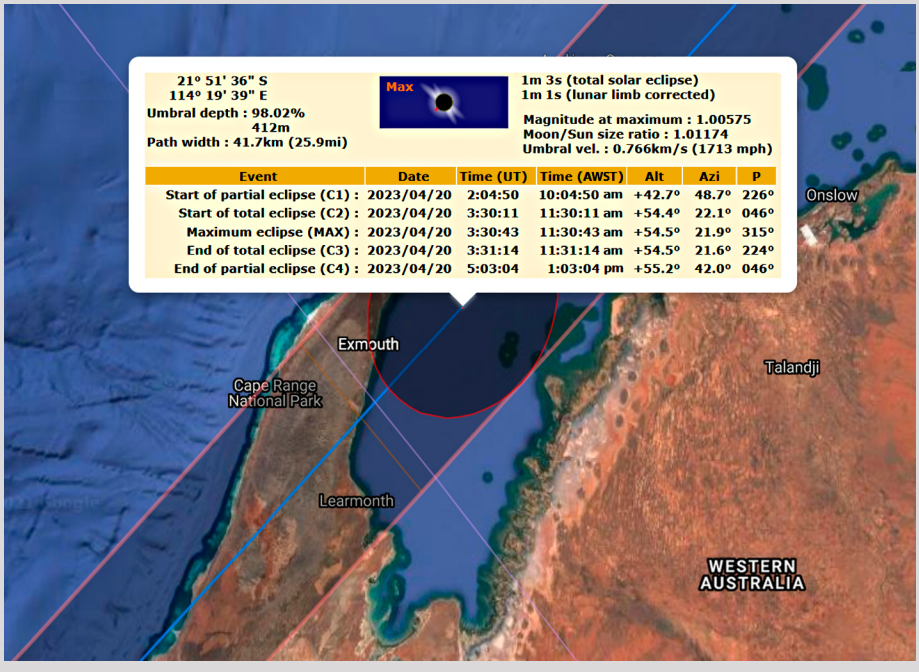
Greatest eclipse occurs at 4:17 UT in Indonesia with $1^m\ 16^s$ of totality. Three minutes later, the Moon's shadow makes landfall over the eastern half of the island of Timor in Timor-Leste, and then proceeds northeast over the Indonesian province of West Papua. As the shadow arcs south of Micronesia and the Marshall Islands, its path narrows and totality decreases to mere seconds before the eclipse transitions to a *broken annularity* phase, with sunlight shining between the mountains dotting the circumference of the lunar disk. Before the event ends at 5:57 UT, some 3,000 kilometers (1,900 miles) southeast of the Hawaiian Islands, the eclipse briefly becomes annular.

So, why does this total, broken annular, and annular sequence occur? During a total solar eclipse, the Moon casts a cone-shaped shadow with its apex below the surface of the Earth. In an annular eclipse, the apex of that cone never quite reaches the ground. Both situations occur in a hybrid eclipse, thanks to our planet's curvature. The Moon's distance from Earth's surface (our satellite's *topographic* distance) varies according to where it appears in the sky. When the Moon shines near the zenith, it hovers directly over Earth's curving surface, where the topocentric distance between the two bodies is at its minimum. Far from the zenith, Earth's surface curves away from the Moon, and the distance increases. When tolerances are tight, the curvature of our planet affects whether or not the shadow cone will kiss or miss Earth's surface.

Because the Moon's apparent size nearly matches the Sun's on eclipse day, the topocentric Earth-Moon distance varies enough to force a hybrid scenario. Solar-eclipse mapper Michael Zeiler predicts only beaded annularity along the first section of the eclipse path, followed by totality across the most populated zone, then a transition back to broken annularity. Observers at the far eastern end of the central path will experience just 4 seconds of annularity before the Moon's shadow departs Earth and zooms off into space.

Even at maximum, totality is very brief this time, and you will have to travel great distances to witness it. Thankfully, a much longer and more convenient total eclipse occurs less than a year later when the Moon's shadow crosses Mexico, central U.S., and Canada's Maritime Provinces. There's also an annular eclipse due later this year (October 14th) for observers across the Americas, including a wide swath of the continental U.S. Our October issue will feature complete information.





▲ Eclipse-chasers from around the world will converge on the westernmost corner of Australia for the solar eclipse on April 20, 2023. Although the Moon and Sun will converge to create an annular eclipse (or nearly so) at the beginning and end of the track, in this stretch they'll see up to 1 minute of totality. The table gives details for one likely location of P&O's *Pacific Explorer*. *Alt.* and *Azi.* are the Sun's altitude and azimuth; *P* is the position angle of the Moon's contact (north = 0°).

TOTAL ECLIPSE SEQUENCE (FACING PAGE): PETR HORÁLEK; ECLIPSE GLOBE MAP: LEAH TISCIONE / *S&T*; AUSTRALIA MAP: XAVIER JUBIER