Space & Astronomy | Feb 15, 2026 | 9 min read | By Bryan White

Upcoming Polar Antumbra: A Scientific Prospectus of the February 17 Annular Eclipse

Space * Astronomy * Solar System

Introduction: The Geometry of the Polar Antumbra

On February 17, 2026, the southern polar region of Earth will experience an annular solar eclipse belonging to Saros Series 121. While the corridor of annularity -- within which the Moon's antumbral shadow strikes the surface -- is largely confined to the uninhabited expanses of the East Antarctic Ice Sheet and the Southern Ocean, the alignment offers a premier natural laboratory for high-latitude aeronomy and atmospheric physics. By abruptly interrupting solar radiation over the polar cap, the eclipse enables researchers at Antarctic stations such as Concordia and Mirny to probe ionospheric recombination rates, atmospheric gravity wave generation, and magnetosphere-ionosphere coupling.

Within the solar system, an annular eclipse occurs when the Moon passes directly between the Sun and Earth while near the apogee of its elliptical orbit, rendering its apparent angular diameter smaller than the solar photosphere.[1] On February 17, 2026, the Moon lies 6.8 days past apogee (February 10) and 7.5 days prior to perigee (February 24), while Earth remains relatively close to its early-January perihelion.[3] This orbital geometry yields an eclipse magnitude (ratio of apparent diameters) of 0.9630 and a solar disk obscuration of 92.81%, leaving a brilliant "ring of fire" (annulus) surrounding the lunar silhouette.[3]

Because the shadow strikes Earth's high southern latitudes at a grazing, oblique incidence (= -0.9743), the antumbral footprint is stretched into an exceptionally wide oval -- measuring 616 kilometers (383 miles) across -- and traces a 4,282-kilometer (2,661-mile) arc across Wilkes Land, the polar plateau, and the Davis Sea.[2][3]

Orbital Dynamics and the Evolution of Saros Series 121

The February 17, 2026 event is the 61st of 71 eclipses in Saros Series 121.[3][5][6] The Saros periodicity of 6,585.32 days (18 years, 11 days, 8 hours) arises from a near-commensurable three-body orbital resonance harmonizing three lunar periods:[7]

* Synodic Month (29.53 days): 223 lunar phase cycles from New Moon to New Moon.

* Draconic Month (27.21 days): 242 passages through the ecliptic orbital nodes.

* Anomalistic Month (27.55 days): 239 returns to perigee, governing Earth-Moon distance.

Because the Saros interval includes an extra one-third of a day (8 hours), Earth rotates an additional 120 deg between consecutive events, shifting each successive eclipse path westward and returning to the same longitude every three Saros cycles (the 54-year, 34-day Exeligmos).[7]

Saros 121 commenced near the North Pole with a partial eclipse on April 25, 944 CE, matured into a run of long total eclipses peaking on June 21, 1629 (6 minutes 20 seconds of totality), transitioned through two 19th-century hybrid eclipses (1827 and 1845), and has produced exclusively annular eclipses since 1863.[6][8] Following its predecessor on February 7, 2008, the 2026 event precedes the series' longest annularity on February 28, 2044 (2 minutes 27 seconds), before Saros 121 degrades into southern partial eclipses and terminates on June 7, 2206.[6][9] Furthermore, the February 2026 event inaugurates a remarkable 30-month "Golden Age" of six central eclipses (2026-2028), including the total solar eclipses of August 12, 2026 (Arctic/Spain), August 2, 2027 (North Africa/Luxor), and July 22, 2028 (Australia).[3][28]

Geographic Trajectory, Station Circumstances, and Polar Climatology

Globally, the penumbral partial phase spans 09:56 to 14:27 UTC, while the antumbral annular phase lasts 59 minutes from 11:42 to 12:41 UTC, reaching greatest eclipse at 12:13:06 UTC (64 deg 43'S, 86 deg 45'E).[2][3][10] The track directly intersects two permanently staffed research stations while casting a partial shadow across Antarctica, the Kerguelen and Heard Islands (~88% obscuration), southeastern Africa (13%-20% in Maputo, Durban, and Antananarivo), and Ushuaia, Argentina (~3%).[2][4][11][12]

| Location / Parameter | | Coordinates | | Eclipse Phase | | Annular Duration | | Max Time (UTC) | | Solar Altitude | | Obscuration & Mean Cloud Cover |

| Greatest Eclipse Point | | 64 deg 43'S, 86 deg 45'E | | Annular (Max) | | 02m 20s | | 12:13:06 | | 12 deg | | 92.81% area (Magnitude 0.9630)[3] |

| Concordia Station (Dome C) | | 75 deg 06'S, 123 deg 20'E | | Annular | | 02m 01s | | 11:46 | | 5 deg | | ~92% area; ~35% cloud cover (Best)[2][16] |

| Mirny Station (Davis Sea) | | 66 deg 33'S, 93 deg 00'E | | Annular | | 01m 52s | | 12:07 | | 10 deg | | ~93% area; ~65% cloud cover (Coastal)[2][16] |

| Casey Station | | 66 deg 17'S, 110 deg 31'E | | Partial | | N/A | | ~12:00 | | 9 deg | | ~91% area; high coastal cyclonic cloudiness[16] |

| Amundsen-Scott South Pole | | 90 deg 00'S, 0 deg 00'E | | Partial | | N/A | | ~11:30 | | 11 deg | | ~90% area (Mag 0.902); low interior cloudiness[11] |

| McMurdo Station | | 77 deg 51'S, 166 deg 40'E | | Partial | | N/A | | ~11:50 | | 14 deg | | ~86% area; moderate Ross Sea cloud cover[2][11] |

Viewing conditions bifurcate sharply between the interior plateau and the coastal margin:

* High Plateau (Concordia Station, 3,233 m): Governed by an anticyclonic dome with millimeter-scale precipitable water vapor, Dome C offers a mean February cloud cover of ~35%, but ambient temperatures near -40 deg C and a 5 deg solar altitude introduce strong horizon refraction and inversion turbulence.[2][16]

* Coastal Margin (Mirny Station): At 10 deg solar altitude along the Davis Sea, Mirny lies inside the subpolar cyclonic storm track (~65% mean cloud cover and frequent blowing snow).[16][17]

* Lunar Limb Profile and Eclipse Meteorology: Lunar Reconnaissance Orbiter (LRO) topography predicts prolonged Baily's Beads and a "broken annulus" at contact points.[13][14][15] Meanwhile, the 93% drop in insolation will induce localized eclipse meteorology anomalies: a 3 deg C to 5 deg C surface temperature drop, boundary-layer stabilization, and "eclipse wind" shifts.[18][19][20]

High-Latitude Aeronomy: Ionospheric and Gravity Wave Experiments

At high geomagnetic latitudes, Earth's magnetic field lines funnel directly into the magnetospheric cusp. In summer, the polar ionosphere (60-1,000 km) is ionized both by solar Extreme Ultraviolet (EUV) / X-ray flux and by magnetospheric particle precipitation.[21][22] As the supersonic antumbra sweeps across Antarctica, it abruptly shuts off photoionization while leaving auroral particle precipitation intact, enabling three core experiments:

* Ionospheric Recombination and Cusp Isolation: GNSS receivers and ionosondes will track Total Electron Content (TEC) decay across the D, E, and F layers, isolating magnetosphere-driven ionization from solar EUV photoionization.[21][22][23]

* SuperDARN Radar Convection Mapping: The Super Dual Auroral Radar Network (SuperDARN) across McMurdo, South Pole, and Dome C will measure coherent-scatter Doppler shifts to map how the sudden conductivity cavity alters polar plasma convection.[24][25]

* Atmospheric Gravity Waves (AGWs): Supersonic radiative cooling generates a bow wave of buoyancy oscillations that propagate upward as Traveling Ionospheric Disturbances (TIDs), which physicists will filter from background katabatic terrain waves.[26]

For personnel on the ice or passengers aboard charter flights from Australia, strict safety protocols apply: ISO 12312-2 solar filters must be worn at all times, and goggles must seal against reflected UV glare from the high-albedo (0.8-0.9) snow surface.[16][27]

Conclusion: A Calibration Point at the Bottom of the World

Although few human observers will witness the February 17, 2026 "ring of fire" over East Antarctica, the alignment serves as a vital benchmark for atmospheric and space physics. By pairing LRO limb astrometry with SuperDARN and GNSS diagnostics, scientists will record how the polar upper atmosphere responds to an abrupt radiative shutoff -- inaugurating the 2026-2028 eclipse triad at the bottom of the world.[14][24][28]

Post-Event Verification (Nov 20, 2026): Published on February 15, 2026 as a pre-eclipse scientific prospectus, the orbital and geometric predictions above unfolded as forecast on February 17, 2026, with greatest annular eclipse at 12:13:06 UTC over East Antarctica, followed six months later by the August 12, 2026 total solar eclipse across the Arctic, Greenland, Iceland, and Spain.[1][28]

Updates... (Nov 23, 2026): Replaced the HTTP 404 Eclipsophile URL in Reference 16 with Palchetti et al. (Sep 1, 2015, Bulletin of the American Meteorological Society, DOI 10.1175/BAMS-D-13-00286.1) on Antarctic water vapor and cloud properties; upgraded exact publication dates across References 18, 19, and 20; normalized the

References heading and consolidated prior post-event verification notes.

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