

Editorial: A Tribute to the Arecibo Observatory

In this issue, we present a special series of three Colloquia dedicated to the Arecibo Telescope, whose sudden collapse, on December 1, 2020, marked the passing of a unique multipurpose observatory that helped shape our view of the cosmos, even reaching out to the stars with the famous “Arecibo Message” sent in 1974 toward the M13 globular cluster.

Conceived in 1963 by Cornell University Professor William Gordon as a tool for ionospheric modification and radar studies, the facility evolved into a masterpiece of 20th-century electrical engineering, featuring a 305-meter spherical reflector built into a natural karst sinkhole close to the city of Arecibo, Puerto Rico. Its unique design—complemented by major upgrades in the 1970s and 1990s—allowed it to operate across a broad frequency spectrum (from 50 MHz to 10 GHz) and to become the most sensitive radio telescope and most powerful radar system in the world. The Arecibo Observatory was singular in its ability to bridge disparate scales of physics, ranging from the scattering of free electrons in our own Earth’s upper atmosphere, to the imaging of neighboring planets and asteroids, to the detection of powerful radio bursts originating in distant galaxies.

To honor the Arecibo legacy, this set of Colloquia features three articles written by scientists with a career-long commitment to the Observatory. The focus of the first Colloquium is on the Arecibo planetary radar system, which allowed for the observation of hundreds of near-Earth objects, revealing a staggering heterogeneity in the asteroid population and providing the subsurface imaging of Mercury, Venus, and Mars that paved the way for modern *in situ* space missions. The second Colloquium charts Arecibo’s revolutionary impact on radio astronomy, including the Nobel Prize-winning discovery of the first pulsar in a binary system—which led to the confirmation of the existence of gravitational waves—and the discovery of the first exoplanets. The third Colloquium describes how the unique combination of Arecibo’s highly sensitive incoherent scatter radar and accompanying ground- and space-based instrumentation allowed for transformative discoveries in geospace science, ranging from ionospheric plasma physics to ionosphere-magnetosphere coupling and space weather.

Beyond its instrumentation, Arecibo stood as a salient example of scientific community building and public outreach. As a multipurpose observatory, it drew an interdisciplinary cohort of students, engineers, scientists, and visitors, embedding the facility deeply into the local Puerto Rican community and turning it into a global scientific icon. As we look toward a future without this sentinel, these articles serve as a reminder that Arecibo’s legacy—much like the message aimed at the M13 cluster—will continue to propagate through the annals of physics forever.

Véronique Van Elewyck
Associate Editor

Dietrich Belitz
Colloquium Editor



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