Arecibo Science Advocacy Partnership

Board Statement on Arecibo Atmospheric and Related Facilities

25th October 2022

In spite of the collapse of the Arecibo telescope instrument platform on December 1, 2020, many instruments have continued to operate at Arecibo, including the optical lidar facilities and the 12-meter radio telescope.

In addition, the six 100-kW high-frequency (HF) transmitters, the 430-MHz radar transmitter, the power generation plant, and a variety of measurement and test equipment were not damaged in the platform collapse. Resurfacing the missing 30 percent of the 305-meter dish with a mesh that would operate up to 1 GHz, similar to the original mesh dish from the 1960s, would allow renewed Arecibo HF, 430-MHz radar, and radio astronomy observations.

For the Arecibo HF system, the 5-MHz dipoles have already been repaired by Arecibo staff, and are fully functional and can accept power. A 300-foot-diameter HF subreflector (a metal web with 5-foot openings) would be supported from the existing towers, and the transmission line segments at the bottom of the dish would be replaced, all of which is straightforward to do.

For the 430-MHz radar, a design has been proposed that would use a simple horn feed at the bottom of the dish, in combination with a lightweight mesh subreflector, also supported by the existing towers.

For low-frequency planetary radar and radio astronomy, a lightweight, agile receiving system, based on existing technologies, would be constructed.

All of this could be implemented in the immediate future at low cost. Arecibo radar and radio instrumentation could then be used in conjunction with existing complementary instruments, as in the past.

We also support the funding and construction of a new and modern Arecibo radar and radio telescope for all Arecibo science areas. But a new telescope will require many years of design studies, planning, and construction. Until then, we recommend that NSF maintain support for the Arecibo instrumentation that is still operating, and support the incremental funding required to repair the 305-meter dish, restore the HF transmitter facility, and implement 430-MHz radar and low-frequency planetary radar and radio astronomy systems.

Continued operations at Arecibo, as described above, would support science and technology goals that include research into atmospheric structure, waves, and turbulence; studies of ionospheric

densities, temperatures, and structure during high-power HF radio-plasma experiments; space weather research including solar physics and the origins of space weather storms; space weather and climate change research as part of the American latitudinal radar chain; development of a stable ionospheric plasma mirror for HF communications; detection and characterization of space debris and satellite arcing; remote mapping of ocean surface dynamics via satellite reception of HF reflections; subsurface exploration and mapping of the moon, asteroids, and inner planets; searching for exoplanets possessing the magnetic fields required to shield their surfaces from radiation dangerous to life; and studies of the interstellar and interplanetary media.

In regard to HF science, we note that Arecibo's low-latitude location is unique in the world, and would provide an important complement to the U.S. HAARP HF transmitter, located in the auroral ionospheric region in Alaska.

The Aeronomy and Geospace Facilities programs of the NSF Division of Atmospheric and Geospace Sciences (AGS) have traditionally been very supportive of research and education at Arecibo in atmospheric and ionospheric physics and high-frequency (HF) radio-plasma experiments. The NSF Division of Astronomical Sciences (AST) has also long supported Arecibo. We hope that our comments here will in some way assist NSF program managers in their efforts to maintain funding for science and education at Arecibo.

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Resources and further information:

Arecibo Science Advocacy Partnership
http://www.areciboscience.org

NSF Division of Atmospheric and Geospace Sciences (AGS)
https://www.nsf.gov/funding/programs.jsp?org=AGS

NSF AGS Aeronomy Program
https://beta.nsf.gov/funding/opportunities/aeronomy

NSF AGS Geospace Facilities Program
https://beta.nsf.gov/funding/opportunities/geospace-facilities-gf

NSF Division of Astronomical Sciences (AST)
https://www.nsf.gov/funding/programs.jsp?org=AST

NSF AST Arecibo Observatory Program
https://beta.nsf.gov/funding/opportunities/arecibo-observatory