

# World view



By Abel Méndez

## Arecibo Observatory: another great lost in 2020

**Amid all the year's losses, I grieve what was once the world's biggest radio telescope, where I got my scientific start.**

**T**he 305-metre radio telescope at the Arecibo Observatory in Puerto Rico survived decades of hurricanes, including Hurricane Maria in 2017, and earthquakes, including unusually strong ones in early January 2020. It also survived attempts by its owner, the US National Science Foundation, to reduce its funding. But in the early morning of 1 December 2020, its 900-tonne suspended instrument platform collapsed, destroying the 57-year-old telescope.

Arecibo contributed to many significant discoveries, including observations of pulsars that captured a Nobel prize, and the first confirmed exoplanets. Closer to home, the observatory's radar equipment emitted radio signals to identify the shape, spin and speed of potentially hazardous asteroids for NASA. The telescope also monitored dwarf stars, planets in our Solar System and disturbances in Earth's atmosphere.

Arecibo's collapse was a hard blow in what was already a year of loss. The pandemic has forced my interactions with students and colleagues online, and I worry about the health of my family: my octogenarian parents as well as my wife, a health-care worker who has lost a friend and colleague to COVID-19. In such times, it can be a comfort to remember beginnings.

I was 12 years old when I visited the Arecibo Observatory for the first time. Back in 1981, visits were by appointment, and I called from a payphone to try to make a reservation. Garred 'Gerry' Giles, the observatory's head of scientific services, answered the phone in broken Spanish and assigned me a day and time. My parents agreed to make the two-hour drive. We all knew my enthusiasm for astronomy, but I don't think anyone predicted that I'd grow up to be a physicist and astrobiologist at the University of Puerto Rico at Arecibo.

Gerry showed us the observatory control room, where a big window looked out at the massive suspended platform, a rotating structure that held the receivers in which radio signals reflected from the dish below came into focus. That year, the observatory's measurements had been used to create the first radar maps of the surface of Venus: the planet's thick clouds had hindered optical observations, but Arecibo's strong radio signals could pass through and bounce back. I still have the printed pictures of Venus that Gerry gave me that day.

My parents and I went below the dish, riding in a Jeep down a dirt road. From afar, the dish looked like a solid shell, but it was made of many mesh-like plates through which light reached the ground below. The area was humid,

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calm and lush with vegetation. The dish was far above us, and the suspended platform visible even further up, through the mesh.

Decades later, I presented my first scientific lecture at the observatory as a visiting scientist. My research is about habitability of planets, understanding the conditions necessary for any life, from microbial to intelligent. A week before my arrival, I looked Gerry up in an old phone directory, unsure whether he was still in Puerto Rico. I told him that more than 25 years ago, he had given a kid a wonderful experience, and told him the date and time of my presentation. He'd retired by then, but he came – and I was delighted.

More telescopes mean more observations, confirmations and discoveries. Most radio telescopes, such as the world's current largest, the Five-hundred-meter Aperture Spherical Telescope (FAST) in China, were designed only to receive signals, but Arecibo's 305-metre dish was capable of both receiving and transmitting. Our best tool for listening and talking to the Universe is now silent.

The last time that Arecibo was used for a targeted search for signs of extraterrestrial technology, called technosignatures, was from 1998 to 2004, as part of the privately funded Project Phoenix, run by the SETI Institute in Mountain View, California. The project observed 800 nearby stars, but picked up no transmissions. In 2019, NASA restored funding for exoplanet and exobiology research to look for technosignatures.

No such project was running at the observatory when it collapsed, but I was aiming to change that. My research students had planned to observe stellar systems with potentially habitable planets for longer than anybody else has done, and so increase sensitivity to weak signals. We did our last observations of one red-dwarf star in early August 2020, just four days before the first of two cable failures closed the observatory. Soon afterwards, I became one of the dozens of scientists – cosmologists, stellar physicists, atmospheric scientists – who met weekly to brainstorm ideas about how to save and improve the telescope. We did not give up after the December collapse; we plan to find support to rebuild Arecibo with a new, better telescope.

As a child, I learnt from Gerry how one telescope, one moment, one person, can impact your life. It took me years of hard work to learn to use the Arecibo Observatory, and it was tough for me to see it go in less than one minute. Generations of scientists across Puerto Rico are also grieving.

Although I log most of my observations electronically, I like to keep a written notebook when I'm physically with the instruments. January 2020 was the time to start a new one, but with the earthquakes, pandemic and remote work, I didn't make a single entry. I plan to start writing again in 2021 – although I'll never regain that missing year, one in which we all lost so much.