

Arecibo Observatory: Overview

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THE ARECIBO OBSERVATORY
SRI INTERNATIONAL • UMET • USRA

What is the Arecibo Observatory?

- It is a scientific site focused on performing cutting edge research and development
 - Radio Astronomy (pulsars, fast radio bursts)
 - Space and Atmospheric Sciences (Solar flares, ionosphere studies)
 - Planetary Radar (Asteroid detection & characterization)
 - Education and Public Outreach (SVC, REU, AOSA)
- Managed by SRI International, Universities Space Research Association and Universidad Metropolitana
- Currently funded by the National Science Foundation and NASA with an annual budget of about \$12M
- How much does it cost to use the Observatory?
 - Nothing!



Interesting Facts About the Site

- Largest operational single radio telescope in the World
 - Its Primary reflector is 305m
- Built in 1963, the Observatory was built in the middle of the cold war by the Department of Defense of the U.S (ARPA)
 - Construction began in 1960
 - Ballistic Missile defense & understand the ionosphere
- The site has over 40 buildings and expands over 118 acres
- There are currently 128 employees on site supporting the maintenance, operations and research
- Over 150 customers across the World
 - NSF, NRL, NASA, AFRL, JPL, QinetiQ



AO Through the Years

Determines the rotation rate of Mercury, this turned out to be 59 days rather than the previously estimated 88 days.

The first pulsar in a binary system was discovered. Confirming of Einstein's theory of relativity and a Nobel Prize in 1993

First radar ranging to an Earth-crossing asteroid (1862 Apollo)

The discovery of millisecond pulsars.

The first planets outside the solar system were discovered

SOHO spacecraft, suffered communication loss We "found" the satellite on July 28, 1998, using radar technique.

Discovery that 2000 DP107 was the first near-Earth asteroid identified by radar as a binary system.

Discovery of the first triple asteroid system, 2001 SN263

Joins with telescopes around the World & Radio Astron satellite to form the largest telescope 20 times the size of the Earth.

Radar Scientists obtains a record-setting year detecting 95 near-Earth asteroids

1965

1974

1980

1982

1991

1998

2000

2008

2012

2015

We've had a few upgrades....

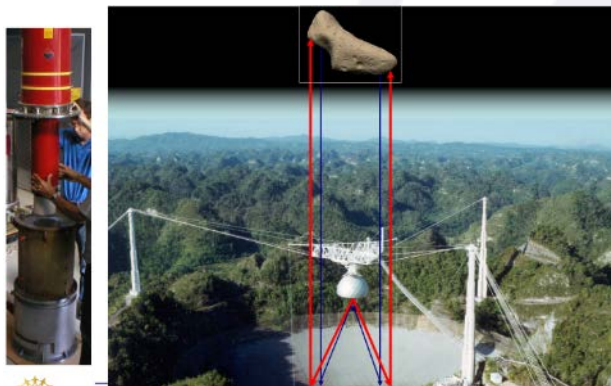
- Passive optical instruments for study of the upper atmosphere began to be added in 1960's
- Surface upgrade completed allowed frequency response to 2 GHz S-band 2380 MHz (13 cm) transmitter added in permits radar studies of planet surfaces 1970's
- Major upgrade converted line focus of the spherical reflector to a point focus, using Gregorian optics 1990's
- High power lasers (LIDAR) added for studies of the middle and upper atmosphere 1990's
- Ground-screen added, lowers edge spillover losses, and reduces RFI reflection from the surrounding mountains 1990's
- S-band transmitter upgraded to a 1 MW system. 1990's
- Visitor Center outreach and education facility added 1990's
- A radio camera permitting broad sky coverage and imaging completed 2000's
- A new 12 M dish 2000's
- The Science and Visitor Center was re engineered in 2016 2000's
- A new Ionosphere heating facility and secondary reflector mesh installation was completed in 2016 2000's
- Culebra remote observing facility completed in 2016 2000's



AO Capabilities and Equipment

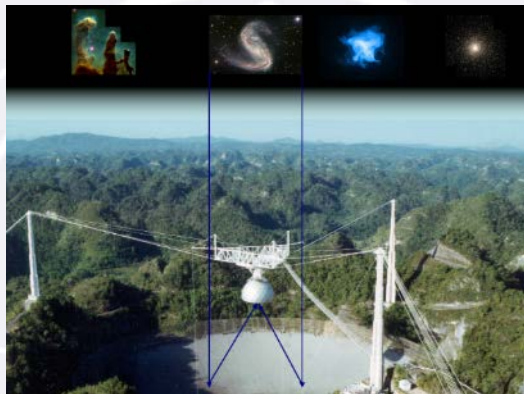
- Transmitters

- 430MHz
- S Band Radar



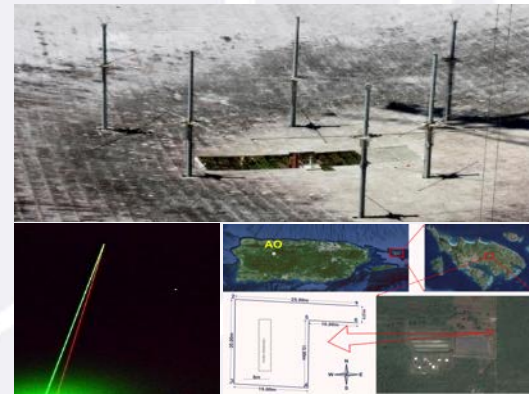
- Receivers

- Alfa, L band, C band, X band, S band



- SAS

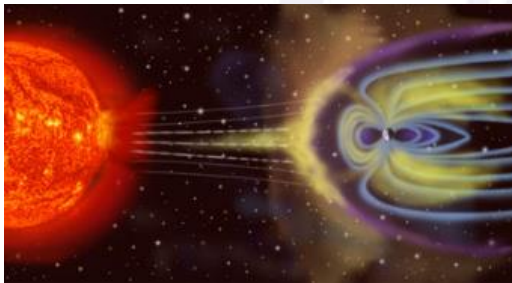
- Ionosphere Heating
- Lidar
- Optics



Arecibo Science Today

Space & Atmospheric Sciences

- Space Weather
- Ionospheric modification
- Dynamics and coupling of the ionized and neutral atmosphere
- Plasma physics (natural or modified, HF)
- Long-term changes (natural or not)=



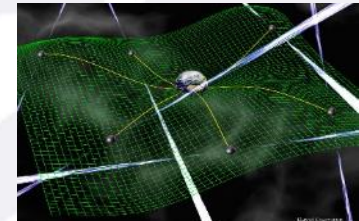
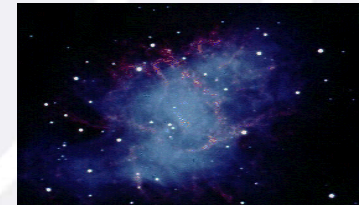
Asteroid Detection

- Detect and characterize potentially hazardous Near Earth Objects (NEO's).
 - Orbit
 - Raw material
 - Origins
 - Characterization (size, weight, speed)



Discovery

- What else is out there?
 - New galaxies, planets, stars, pulsars
 - Gravitational Waves
 - Pulsars
 - FRB's



A typical day at AO is not typical

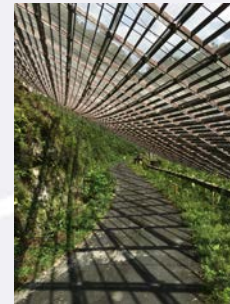
- World Class research facility
- Hotel
- Restaurants
- Museum

Other facts

- We host over 25 film crews every year



- Both the platform and the primary reflector are suspended...
 - The reflector is supported by a network of steel cables
 - The area underneath the dish has its own habitat
 - Suspended 450 feet above the reflector is the 900 ton platform



More stuff

- Its primary reflector had never been cleaned....until 2 weeks ago
 - The current primary reflector mesh was replaced in 1974 from the original design
 - The surface is made of 38,778 perforated aluminum panels, each measuring about 3 feet by 6 feet
- We have housing on site!
- The Science and Visitor Center hosts over 90,000 visitors each year
- Millions pumped every year into the local economy



Questions?

