



**ARECIBO OBSERVATORY**  
P U E R T O   R I C O

# The Arecibo Observatory

- It is a **multidisciplinary research facility** focused on performing cutting edge research
  - Radio Astronomy
  - SAS
  - Planetary Sciences
- AO is the largest fully operational single dish radio telescope in the World
  - A Facility of the National Science Foundation
  - Site expands over 118 acres and has more than 40 buildings
  - Built in 1963, upgraded 3 times



UNIVERSITY OF  
CENTRAL FLORIDA



# Research and Capabilities

AO is one of the most sensitive and complete instrument in the World for Radio astronomy, SAS and PRS

305m primary reflector

Most sensitive ISR in the World

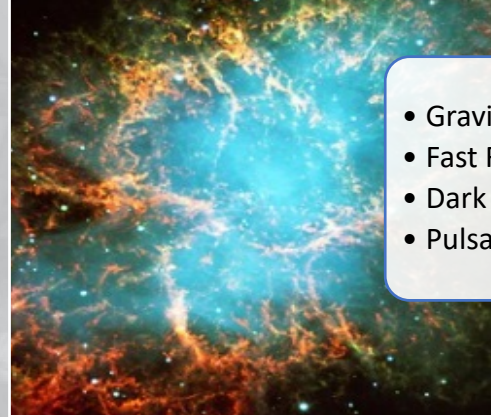
Ionospheric Heating Facility

Most powerful planetary radar in the World (S Band)

Over 12 different receivers for passive measurements (327MHz – 10GHz)

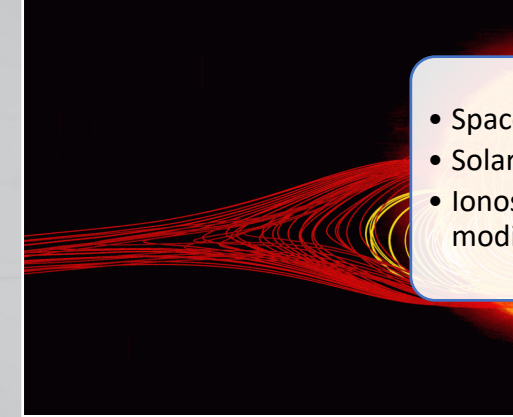
Lidar & Optics

## Radioastronomy



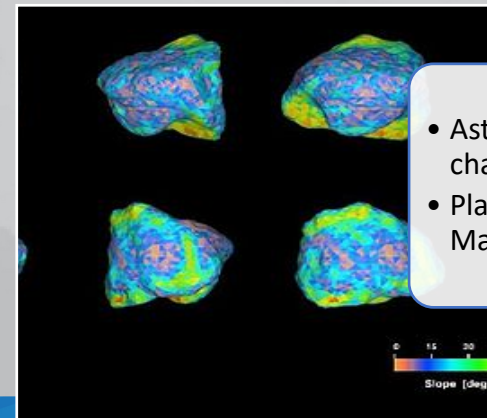
- Gravitational Waves
- Fast Radio Bursts
- Dark Matter
- Pulsars

## Space and Atmospheric Sciences



- Space Weather
- Solar Wind
- Ionospheric modification (HF)

## Planetary Sciences

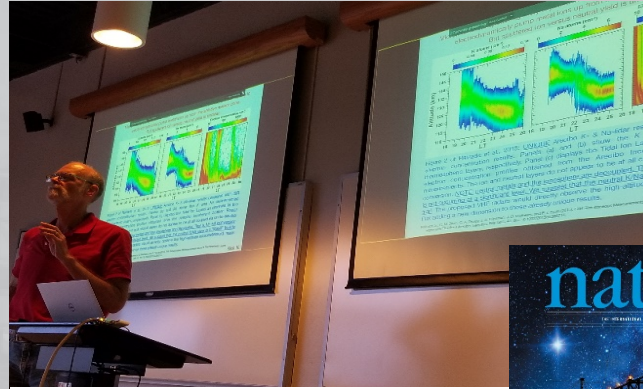


- Asteroid characterization
- Planet Surface Mapping



# AO by the numbers

- **AO**
  - Science Operations (500+ users/year)
  - Science and Visitors Center
  - On Site Accommodations
  - Cafeteria
- **13M operational budget**
  - 80% Local suppliers
- **Over 130 full time employees**
  - +10 countries (PR, USA, Brazil, Spain, Finland, Germany, Sri Lanka, India, Italy, Taiwan)
- **Host over 85,000 visitors per year**
  - 30% local schools
  - + 400 scientists use AO
- **Informal Education Programs**
  - REU/STAR/Observation Nights



Dr. Michael Sulzer presenting



Students at the Visitor Center on January 2019.



Arecibo Observatory Futures workshop



REU Students





# Historic Accomplishments

1963-1989

- Determined the rotation rate of Mercury (59 days)
- **Discovered the first pulsar in a binary system (Nobel Prize in 1993)**
- First radar ranging to an Earth-crossing asteroid
- The discovery of millisecond pulsars

13 October 1993

The Royal Swedish Academy of Sciences has decided to award the Nobel Prize Physics for 1993 jointly to Russell A. Hulse and Joseph H. Taylor, Jr, both of Princeton University, New Jersey, USA for the discovery of a new type of pulsar, a discovery that has opened up new possibilities for the study of gravitation

1990-1999

- Found SOHO spacecraft when it suffered communication loss
- **Discovered the first planets outside the solar system**
- Detected nuclear blast with ionosphere measurements

2000-2010

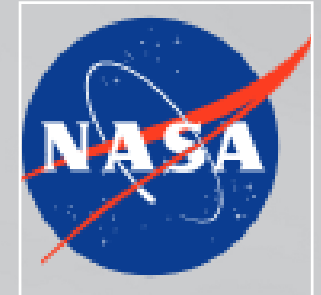
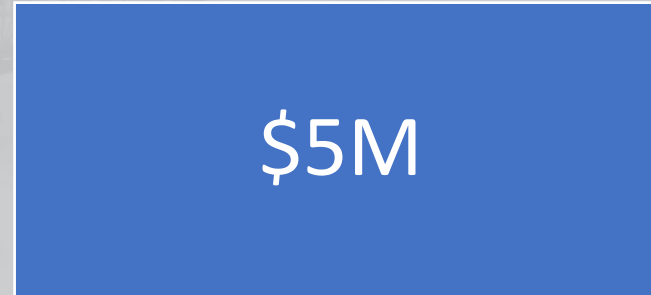
- Discovered the first triple asteroid system, 2001 SN263
- **Detected the first repeating fast radio burst**
- Discovered the first near-Earth asteroid identified by radar as a binary system

# AO Recent Projects /Collaborations

- \$20M award from NASA for Near Earth Object Observations
- \$6M from NSF to build ALPACA
- \$12.3M award for restoration
  - New motion and control system
  - New S Band Control System
  - New 430Mhz line feed and modulator
  - Adaptive Alignment Technology
- Collaborations with Industry
  - Lockheed Martin – RFI
  - Microsoft – Cloud Data Storage



\$7M

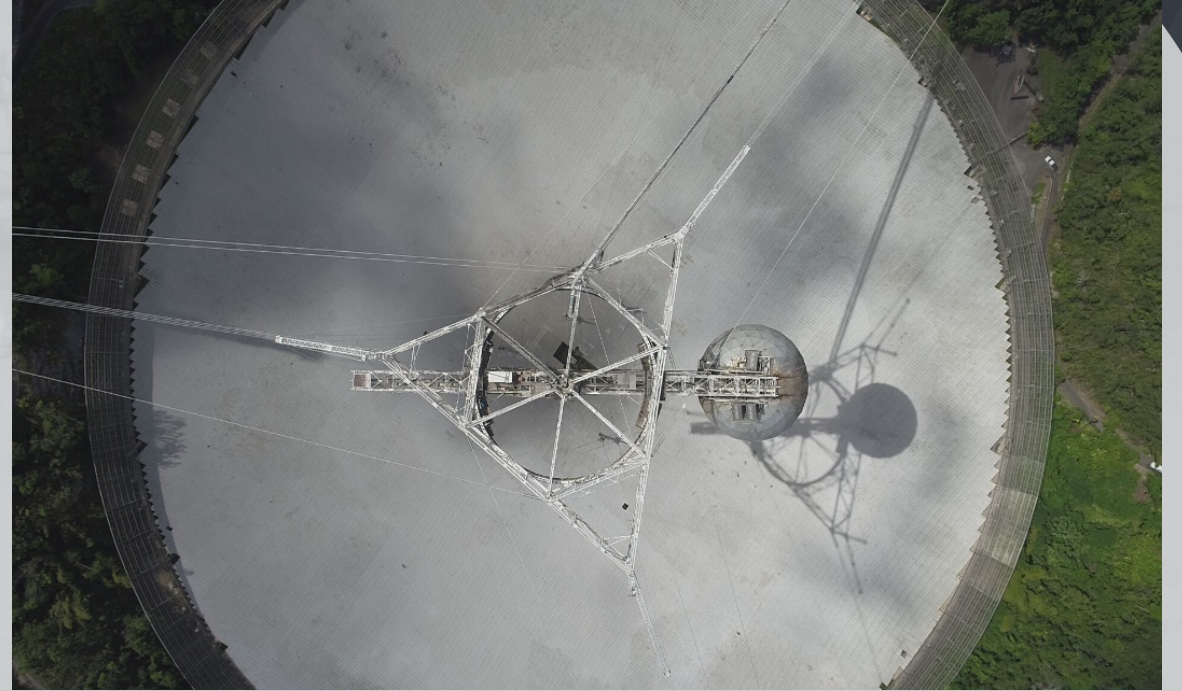


Self Funded  
SciVi Operations



# Closing Thoughts

- GBT/AO Single Dish radio astronomy school
  - Unique Opportunity to learn from World experts
  - Ask Questions!
- Multidisciplinary collaboration is critical for innovation
- Thanks to the GBT Team!





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