Near-Earth Asteroid Observations with the Arecibo Planetary Radar

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Observatory and Radar Group Status

- Arecibo Observatory is a facility of the NSF currently managed by SRI, USRA, and UMet

- Reduced NSF funding for the observatory requires the radar program to rely entirely on outside support

- NASA NEOO funding supports the radar program:
  - $2M/year through September 2016 intended to fund basic telescope operations to observe at the traditional level of 20-30 objects per year
Observatory and Radar Group Status

• October 2013: Additional NASA NEOO funds will allow for substantial increase in telescope time and objects observed
  
  • Implementation delayed due to uncertainties of sequestration and government shutdown
  
  • Currently advertising for additional staff to assist with observations and analysis and expect to hire soon
  
• December 2013: “Dear Colleague Letter” NSF 14-022 suggests continued decline in support for Arecibo from NSF Astronomy, but no concrete news
  
• NASA NEOO support of the radar program cannot support the observatory as a whole
What Do We Measure with Radar?

- Line-of-sight distance and velocity —> Astrometry
- Object depth —> Size and shape
- Velocity dispersion —> Spin state
- Scattering properties —> Surface roughness, composition

Left: 1998 QE2
Right: 2002 GT
1998-2011: ~20 detections per year, mostly larger targets and PHAs.
2012-2013: increase by a factor of 3+ in attempts and detections of NEAs.
The increase in usage included a push to smaller objects.
Rapid Radar Response

• In 2013, we responded to three requests to observe potential NASA mission targets, but did not detect them
  
  • One may have been detectable with a clearer request procedure, which has since been established
  
  • The other two were too small, too far away, or both
  
  • Rapid response to targets of opportunity are attempted on a best-effort basis and are contingent upon:
    
    • re-scheduling the telescope
    
    • having an available transmitter operator and observer
    
    • having an available observing ephemeris
Summary of Arecibo Radar Status

• The radar program at Arecibo is strong and growing: funding increased, telescope usage and detections up and increasing, personnel expanding

• We are sampling the small end of the population, though inherent faintness and (often) rapid rotation makes observations difficult

• We need to work closely with survey/discovery programs and the JPL NEO program office to have telescope time available to rapidly follow up on new, desirable targets while “brightest,” i.e., close to Earth