

Near-Earth Asteroid Observations with the Arecibo Planetary Radar

A photograph of the Arecibo Planetary Radar structure, showing the complex metal framework and the large, spherical radar dish. The structure is set against a clear blue sky with some light clouds. The radar dish is a large, spherical structure composed of many smaller, triangular panels, and it is suspended from a massive metal framework that extends across the sky.

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Observatory and Radar Group Status

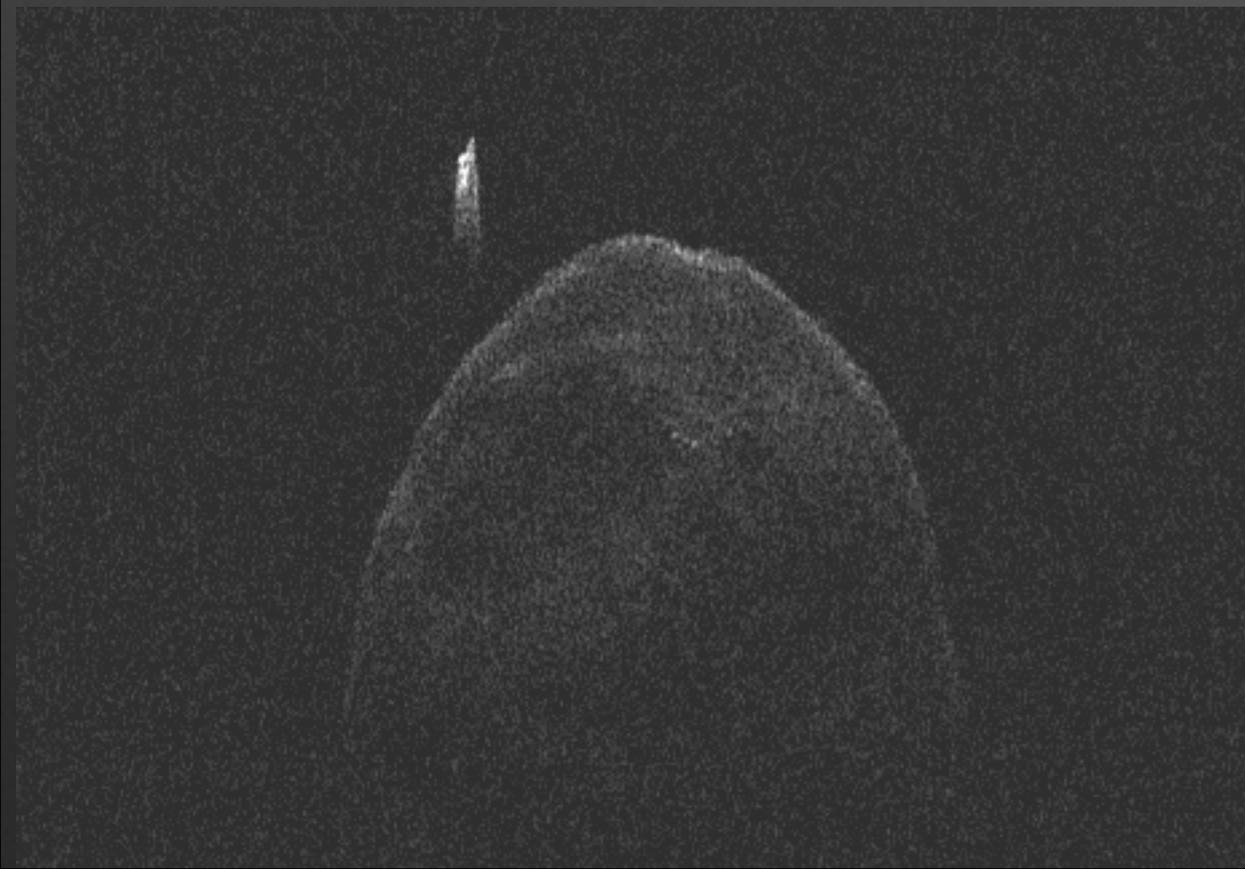
- Arecibo Observatory is a facility of the NSF currently managed by SRI, USRA, and UMet
- Reduced NSF funding for the observatory requires the radar program to rely entirely on outside support
- NASA NEOO funding supports the radar program:
 - \$2M/year through September 2016 intended to fund basic telescope 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

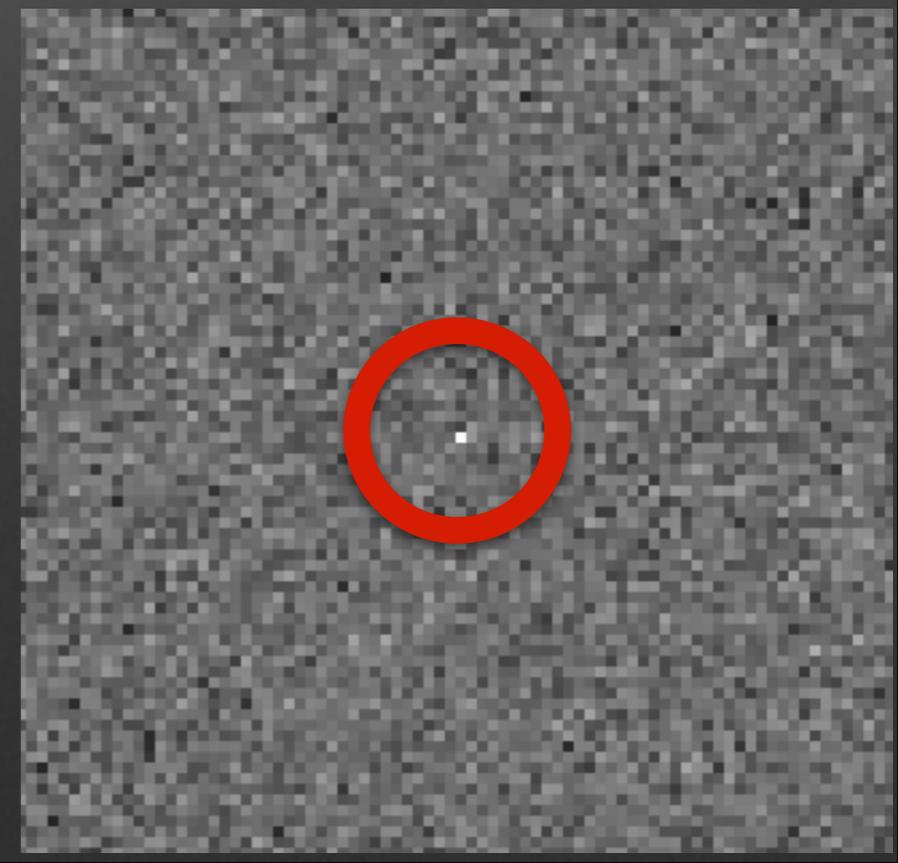
What Do We Measure with Radar?

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

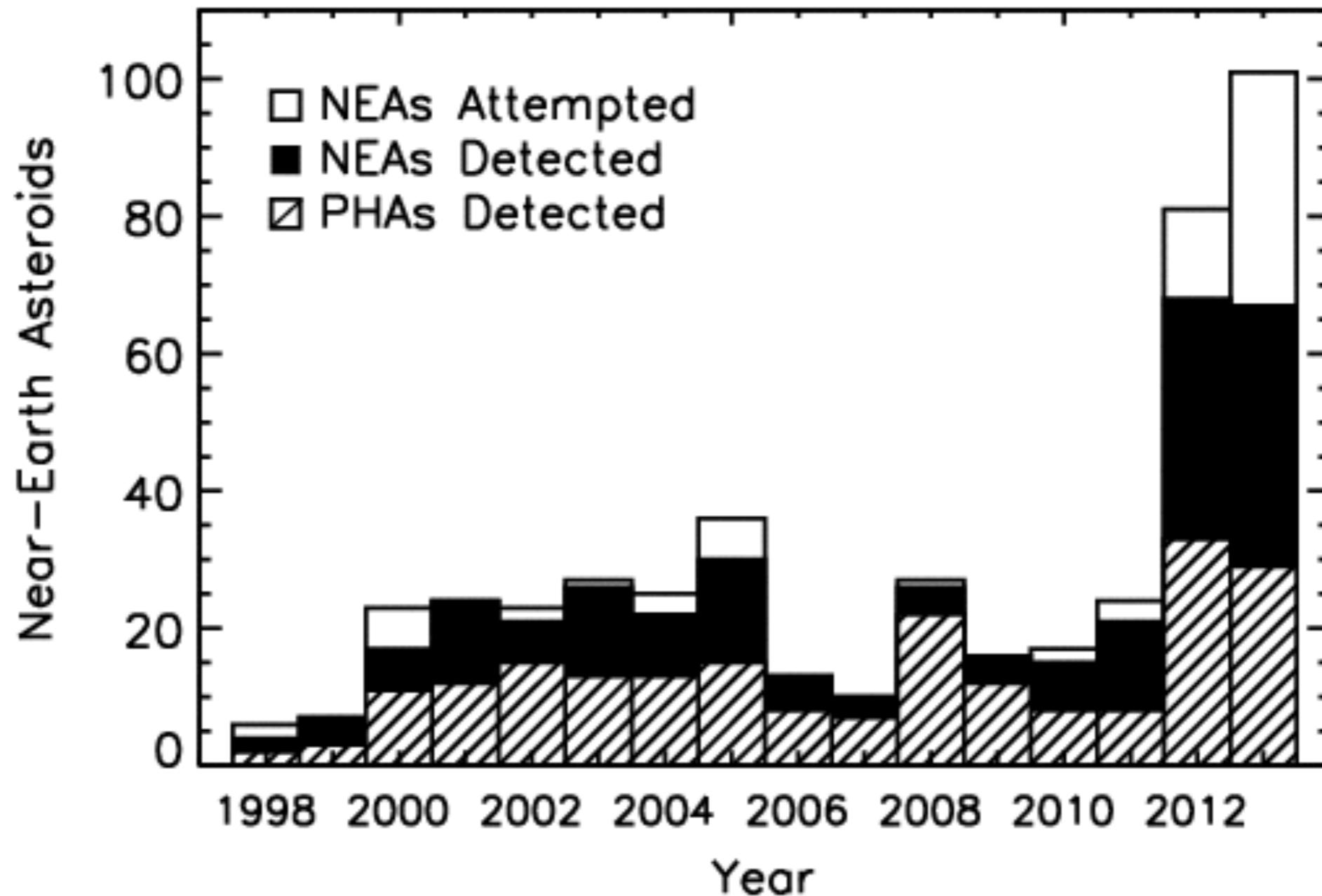


Left: 1998 QE2

Right: 2002 GT



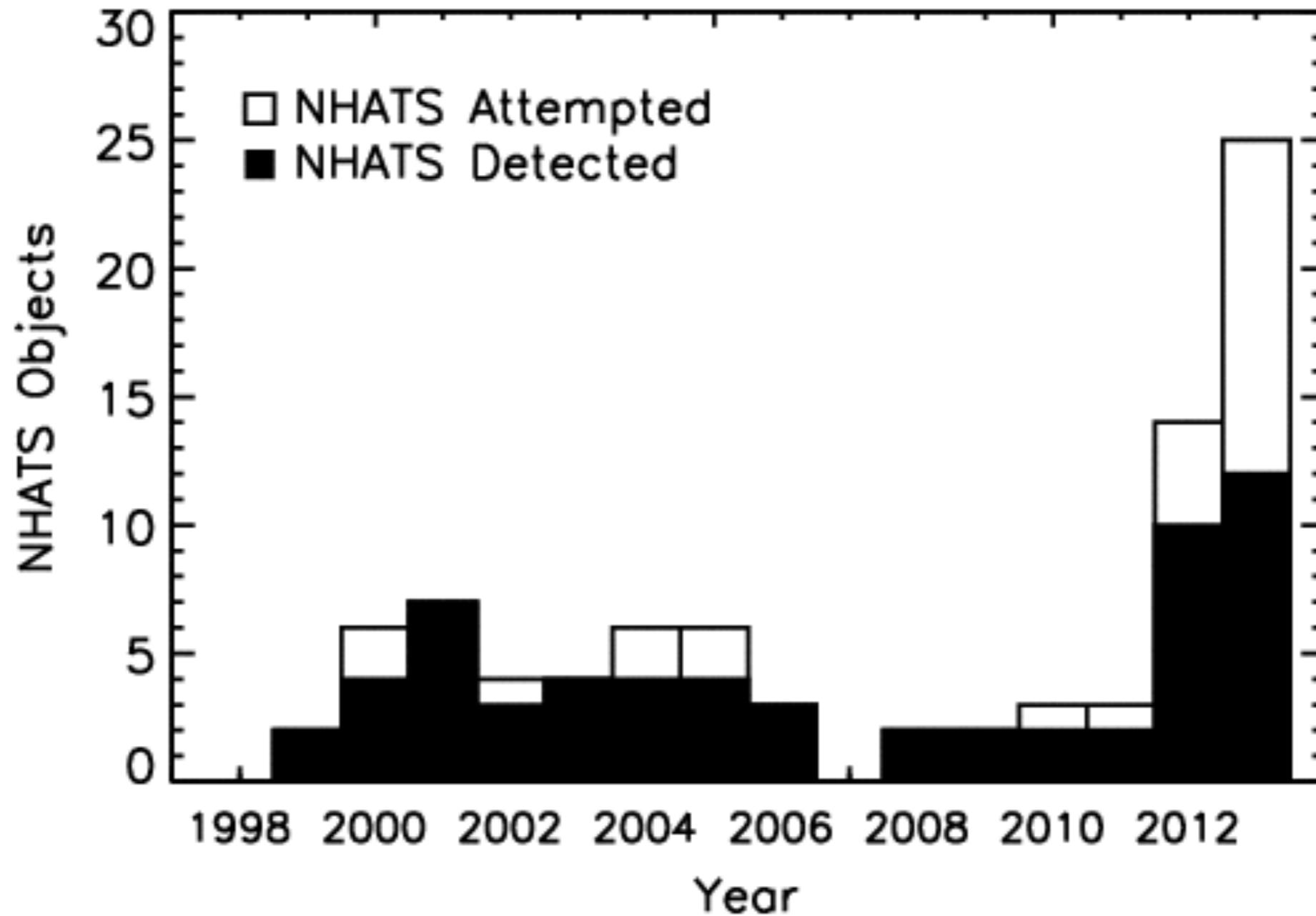
NEA Detections with Arecibo



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.

NHATS Detections with Arecibo



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