ARECIBO OBSERVATORY

PUERTO RICO

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Arecibo Observatory
Planetary Radar Program
Jan-Jun 2018

Dr. Anne Virkki
(The yet-unofficial) Group Lead
of the planetary radar group at AO

Challenges

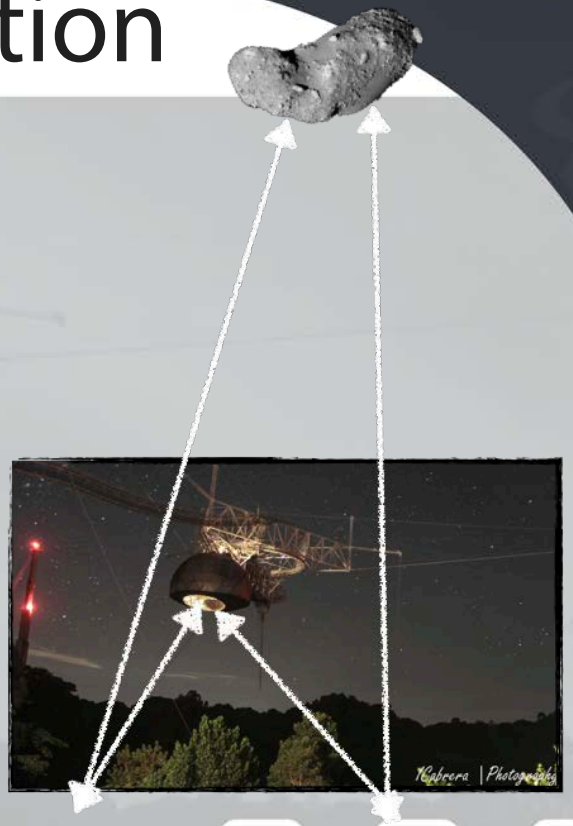
- Half of the team left to LPI; search for new staff underway; current team 1 staff scientist + 2 postdocs
- Generators broke in early-April to the point of no observing in 1.5 months (FEMA provided a spare one!)
- Only one working klystron until August
- Gain of the dish ~30 % below pre-hurricane levels, dish alignment will likely take 1-1.5 years (funding settled)

Scientific results – overview

- 23 detected NEAs in 2018 – 11 recently discovered
- The most interesting (read: pretty) targets:
  - (3752) Camillo
  - (66391) 1999 KW_4
  - (68347) 2001 KB_{67}
  - 2015 DP_{155}
  - 2017 VR_{12}

Planetary radar – introduction

- Post-discovery characterization of small bodies:
  - ~100 NEAs, 2-5 MBAs, 1-2 comets per year
- Transmitted signal:
  - 2380 MHz (12.6 cm)
  - Transmit power up to 1 MW
- Received signal:
  - Delay: Distance resolution ~10-600 m
  - Doppler shift: Radial velocity res as fine as a few mm/s
  - Same Circular (SC) and Opposite Circular (OC) polarization: cm-to-dm-scale particles on the surface



Scientific results

(3752) Camillo (Feb 20-22)

- First time in radar (3 nights)
- Contact binary
- P ~ 38 h with B_{CW} = 2.6 Hz

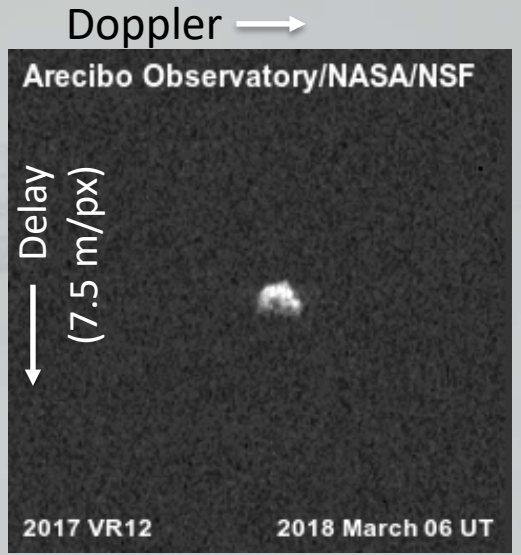
  -> D ~ 3.5 km
- SC/OC = 0.26

Scientific results

2017 VR_{12} (Mar 6-7)

- First time in radar (2 nights)
- Spheroidal
- D ~ 100 m with B_{CW} = 2.4 Hz

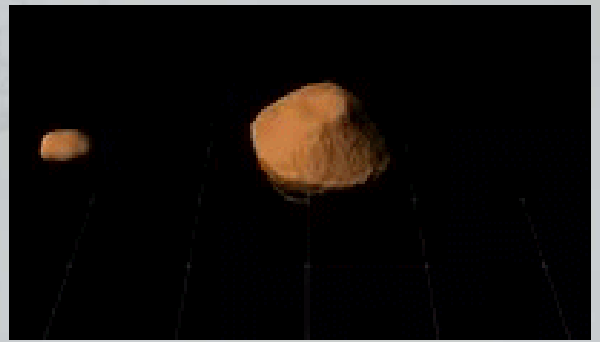
  -> P ~ 1.15 h
- SC/OC = 0.25



Scientific results

66391 1999 KW_4 (May 25- Jun 1)

- The "text book binary" (D~1.5 km + moon 360 m)
- The 4th time in radar; 5-6 semi-successful nights
- Bad signal-to-noise ratio (secondary not visible, primary barely)



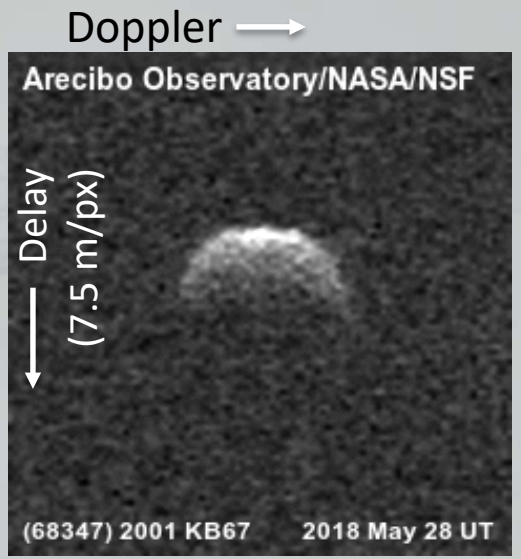
Ostro et al. (2006)

Scientific results

2001 KB_{67} (May 25- Jun 1)

- First time in radar; 5-6 successful nights
- Spheroidal
- D~270 m with B_{CW} = 1.2 Hz

  -> P ~ 6 h
- SC/OC = 0.21

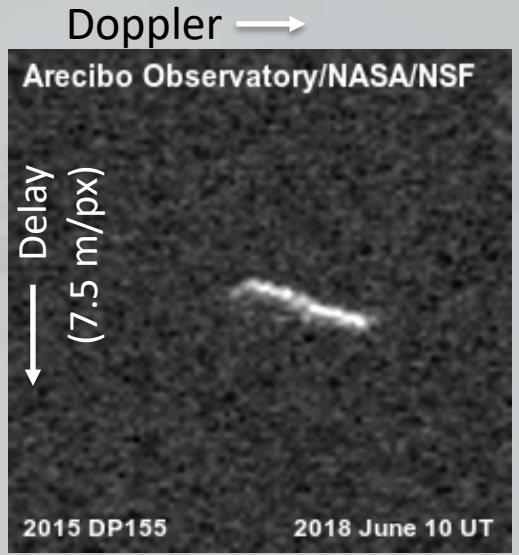


Scientific results

2015 DP_{155} (Jun 10-11)

- 3 nights; first-time in radar
- (Tri)angular shape
- D ~200 m with B_{CW} = 1.2 Hz

  -> P ~ 4.5 h
- SC/OC = 0.16



Future plans

- Upcoming high-priority targets: 2010 NY_{65}, Ivar, Agni, 2015 FP_{118}, 2004 DV_{24}, 2002 VE_{68}, 2003 SD_{220}, 2016 AZ_{8}, 2004 XP_{14}
- Funding proposal for 2019-2023 got submitted on Jun 7th (ROSES SSO); If funded:
  - After the dish alignment project is accomplished (by 2020 or -21), the annual radar observation hours likely to increase from ~600 up to ~800; before then ~600 h/yr
  - The team grows (AO+LPI+LPL+SwRI+Maine+NMT)
  - More active effort on timely data analysis