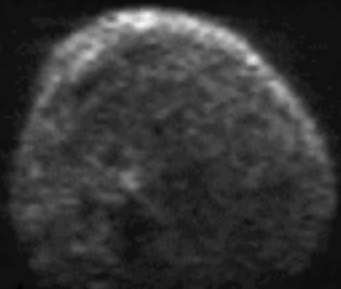


Real-time Characterization of Hazardous Asteroids: Lessons from Recent Flybys

Vishnu Reddy

Planetary Science Institute

Tucson, Arizona

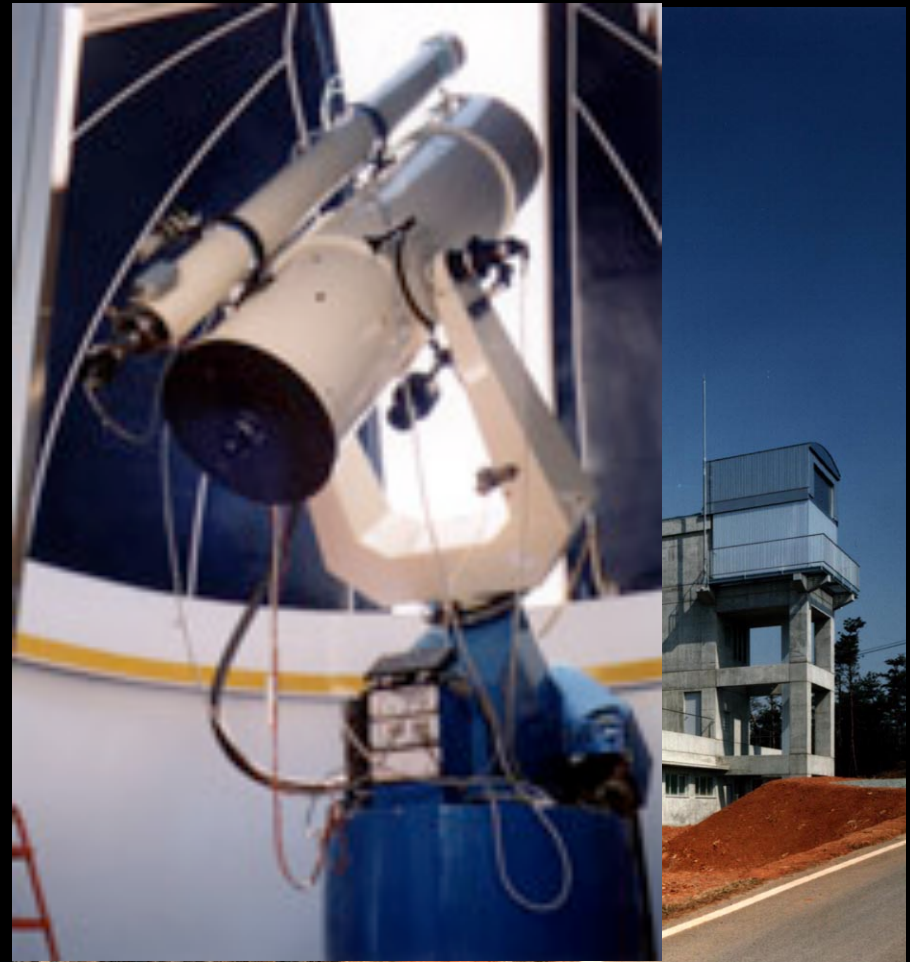


Contributors

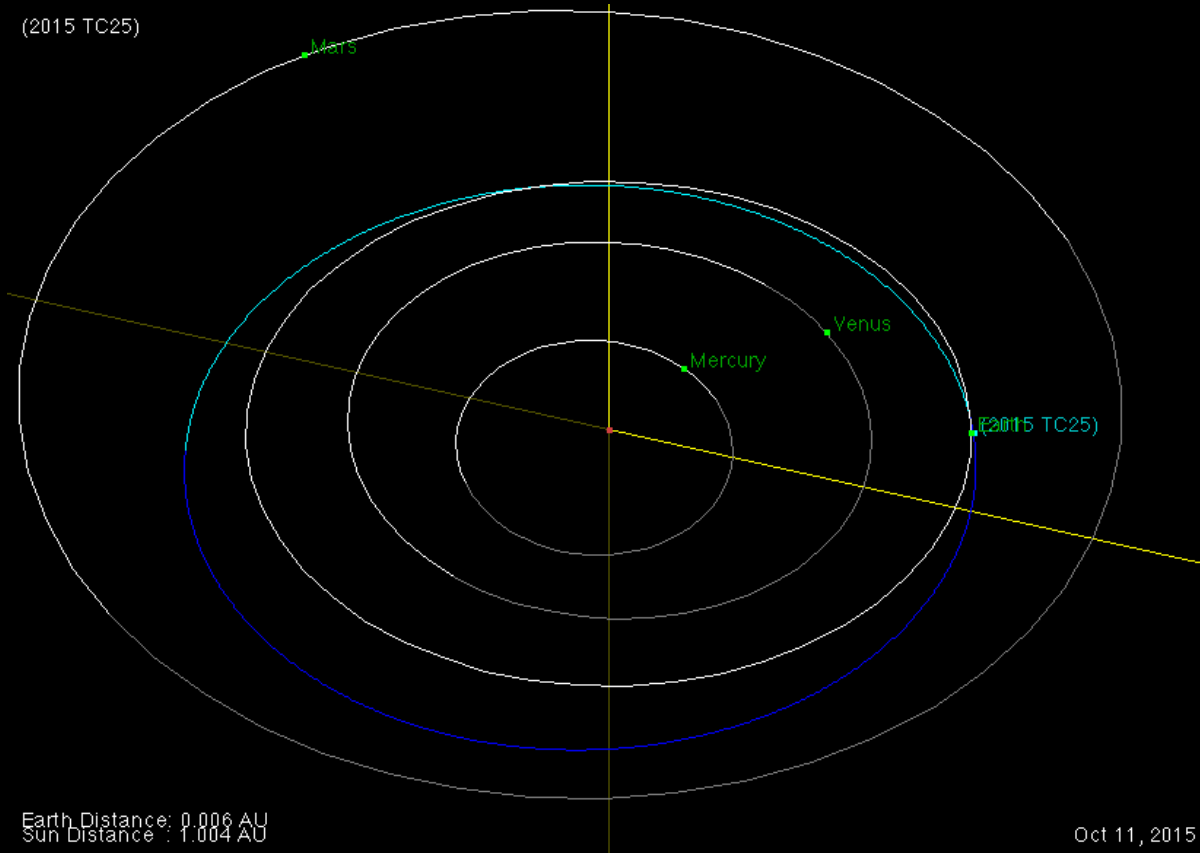
- Juan Sanchez, Matt Izawa (PSI)
- Audrey Thirouin, Nick Moskovitz (Lowell)
 - Eileen and Bill Ryan (MRO)
- Ed Rivera-Valentin, Patrick Taylor, Jim Richardson (Arecibo)
 - Stephen Teglar (NAU)
- Ed Cloutis (University of Winnipeg)

2015 TC25

- Oct. 11th 2015 06:56 UTC object (WT19969) discovered by Catalina Sky Survey, Tucson (703)
- Oct. 11th 2015 08:09 UTC object followed up by Magdalena Ridge Observatory, New Mexico (H01)
- Oct. 11th 2015 15:01 UTC object followed up by Bisei Spaceguard Center, Japan (300)
- Oct. 11th 2015 21:12 UTC object followed up by Italian amateurs from Farra d'Isonzo (595)
- Oct. 11th 2015 21:52 UTC object (WT19969) is designated 2015 TC25 and MPEC-T61 is issued



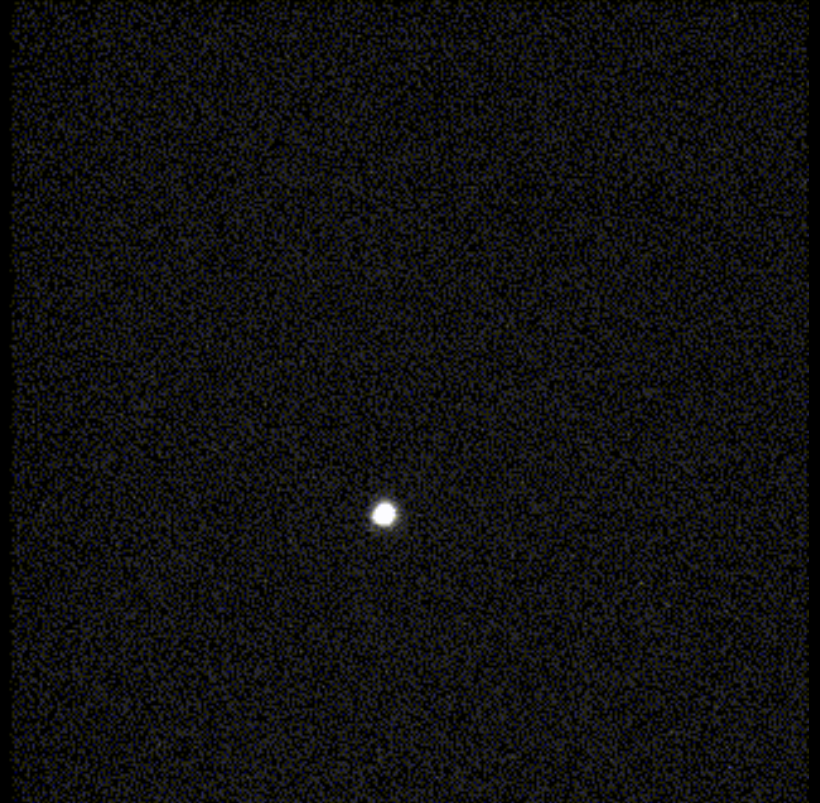
2015 TC25



- Absolute Magnitude (H) :29.5; Size: 2-7 meters
- Closest approach: Oct. 13, 2015 07:26 UTC
- Distance: 111,000 km

2015 TC25

- Characterization
- Photometry
- Spectroscopy
- Radar
- Science Questions:
 - What is the spin rate of the object?
 - What is the composition of the object?



2015 TC25



NASA IRTF (3 meter)
Observer: Reddy/Sanchez

10.1 hours

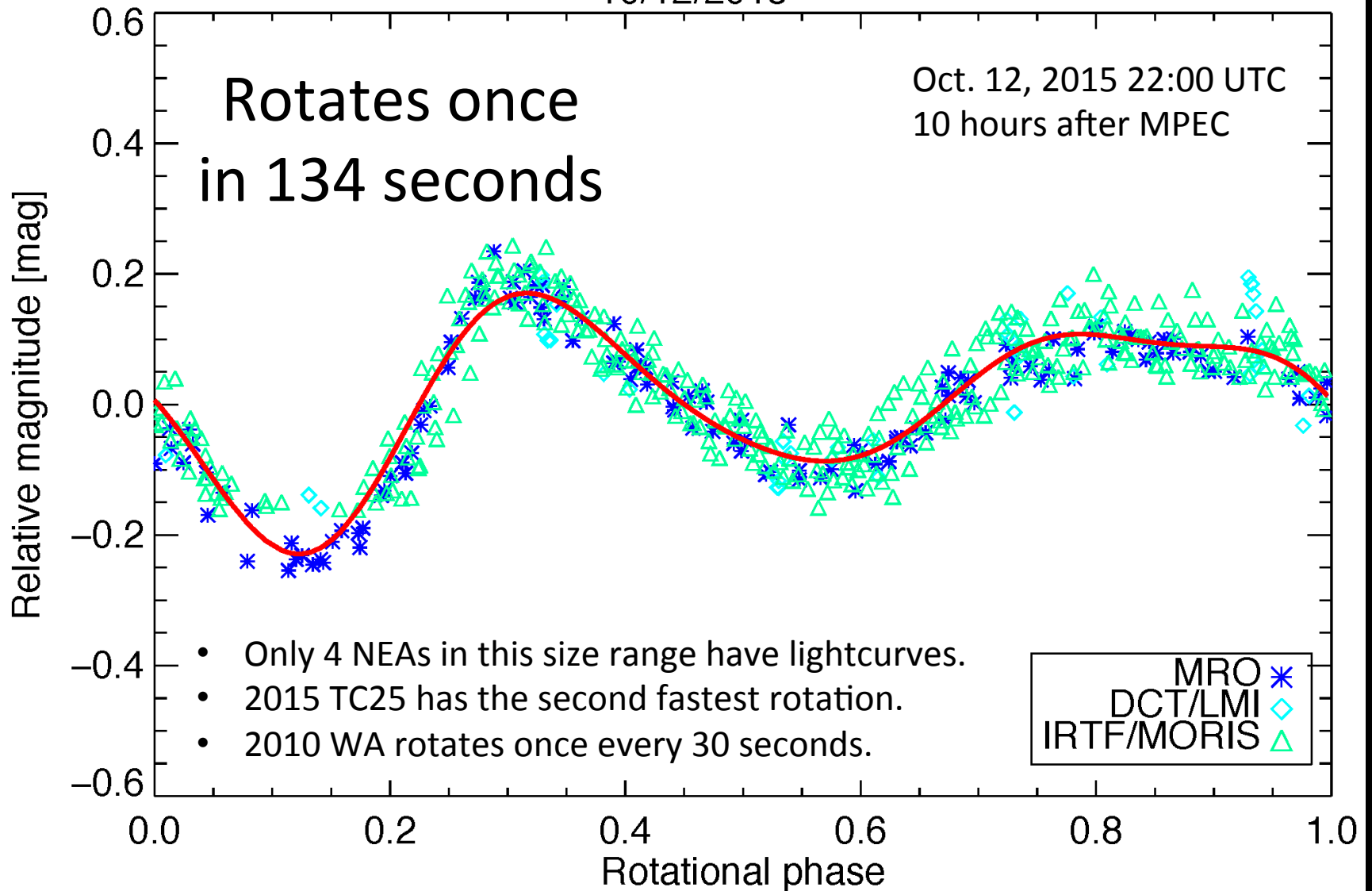


Discovery Channel Telescope
(4.2 meter) Observer: S. Teglar



MRO, (2 meter) Observer: B. Ryan/E. Ryan

2015 TC25



2015 TC25

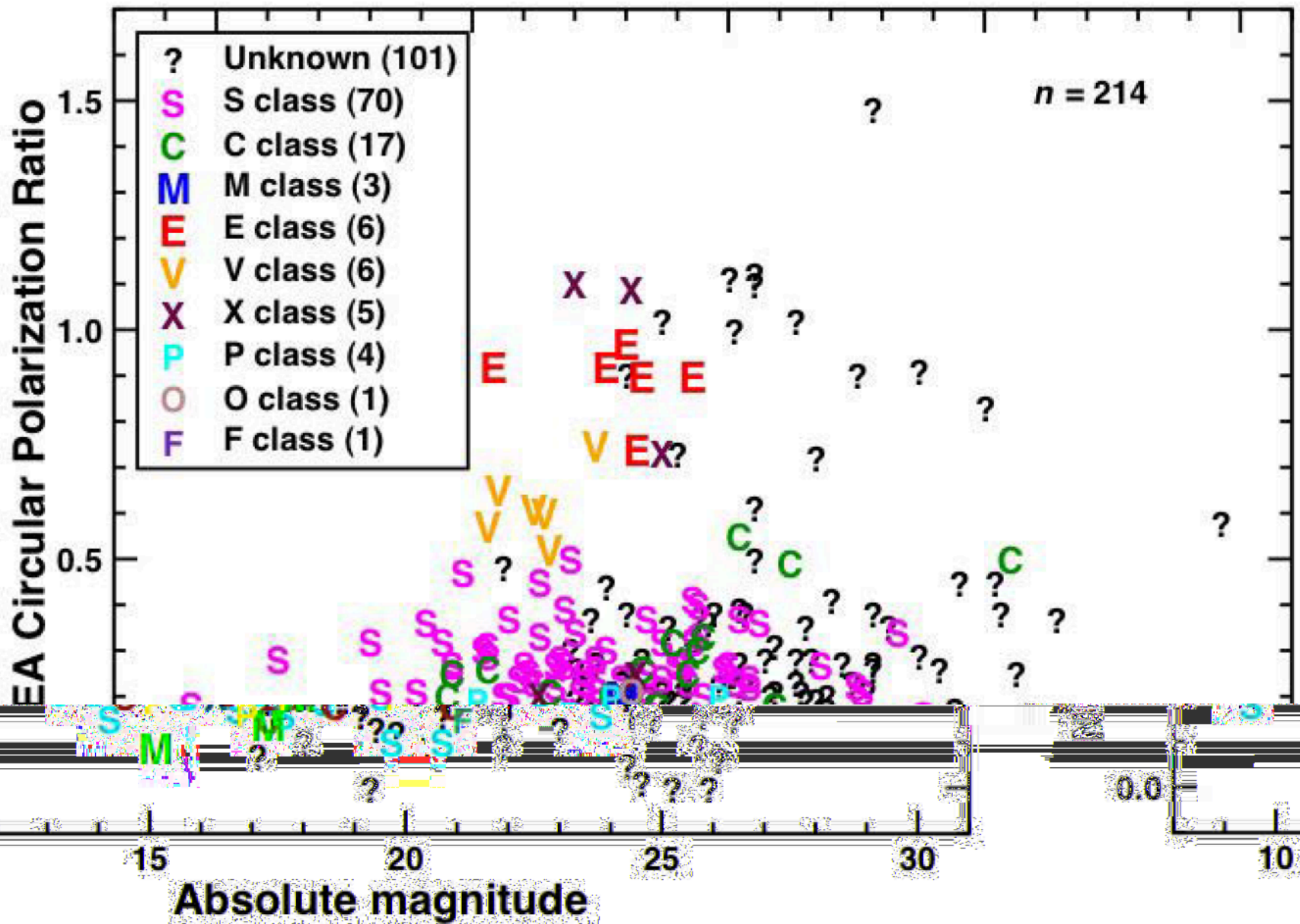


Gemini North (8 meter)
Observer: Mokovitz

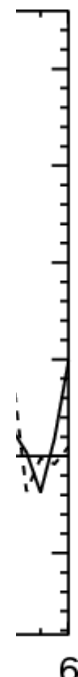
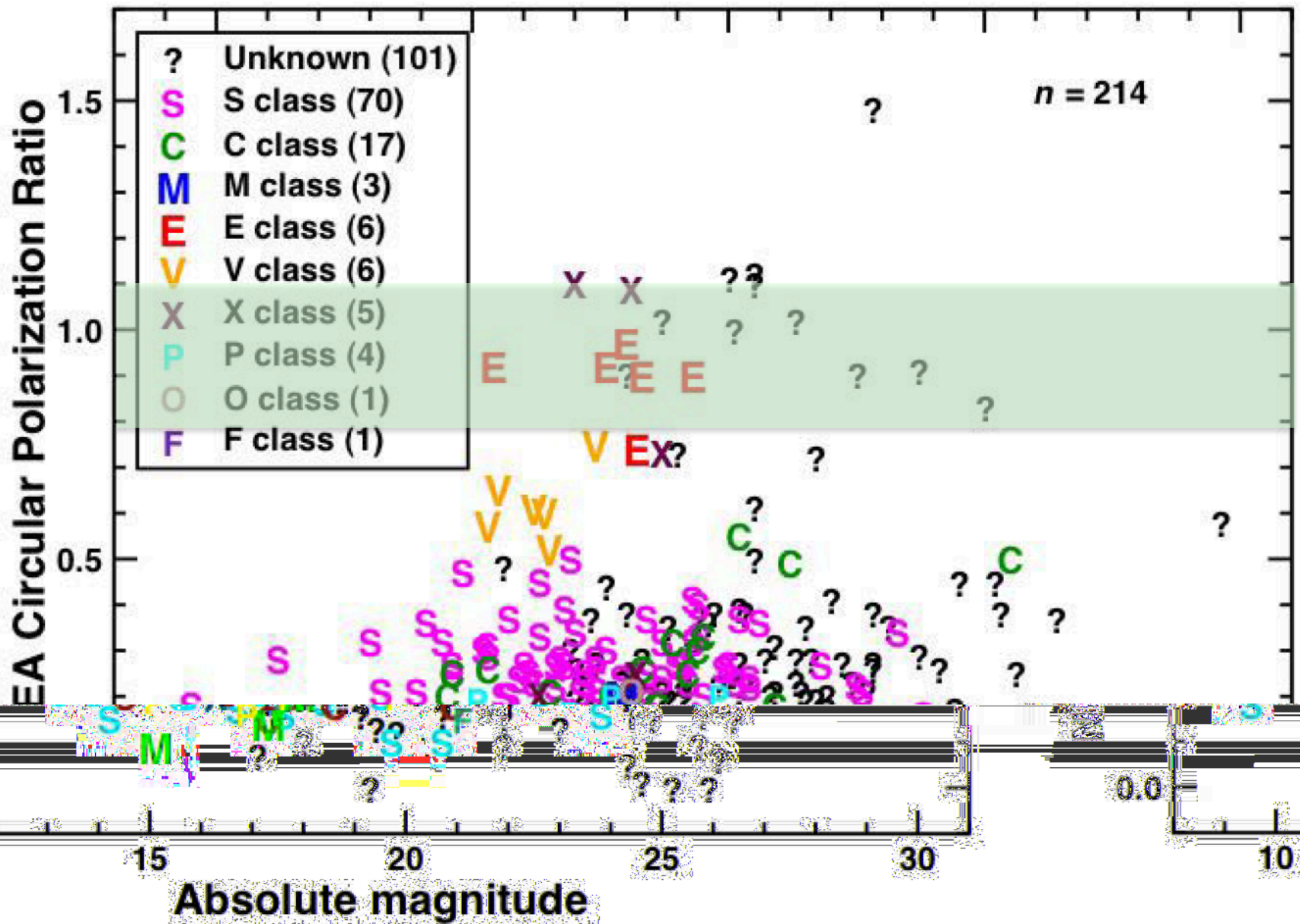


NASA IRTF (3 meter)
Observer: Reddy/Sanchez

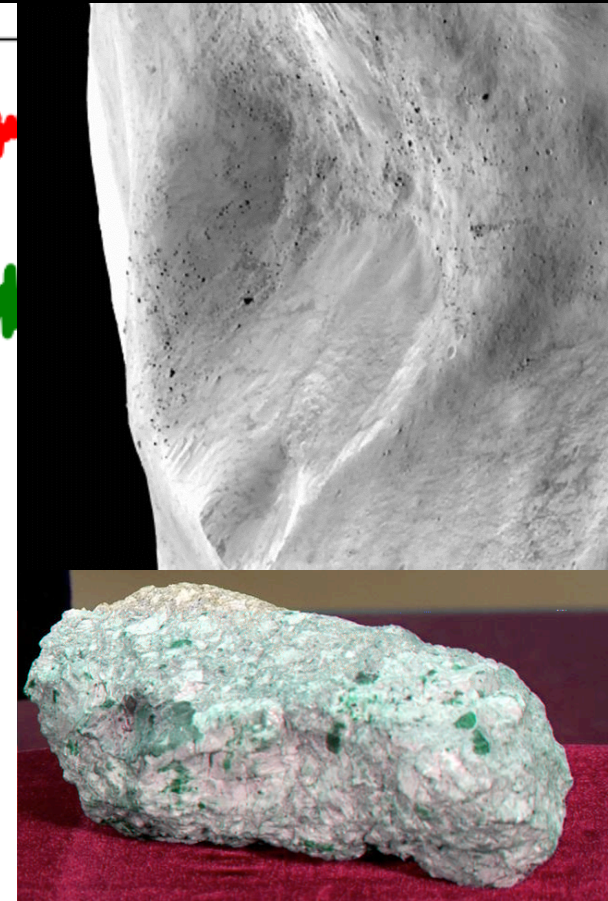
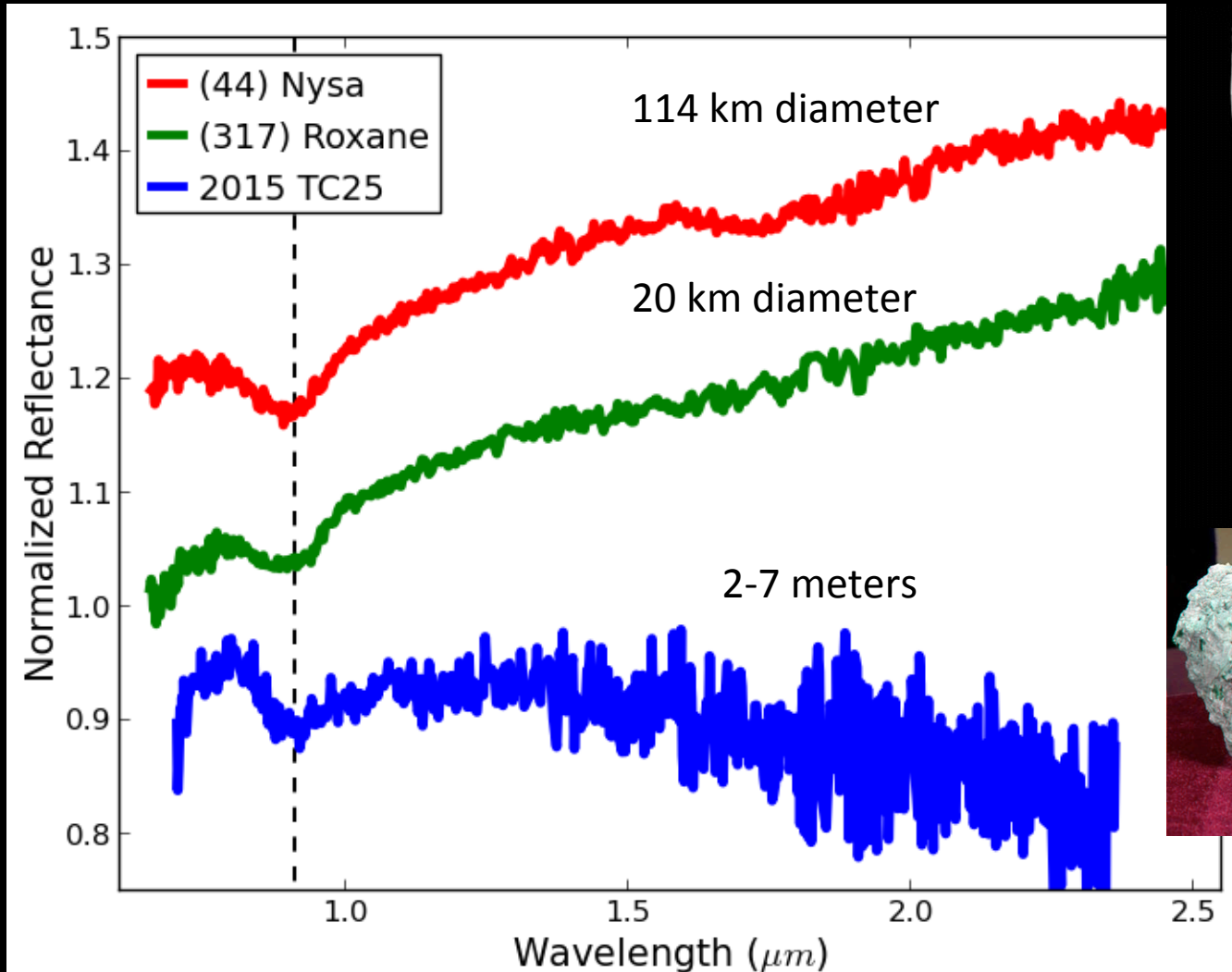
10.1 hours



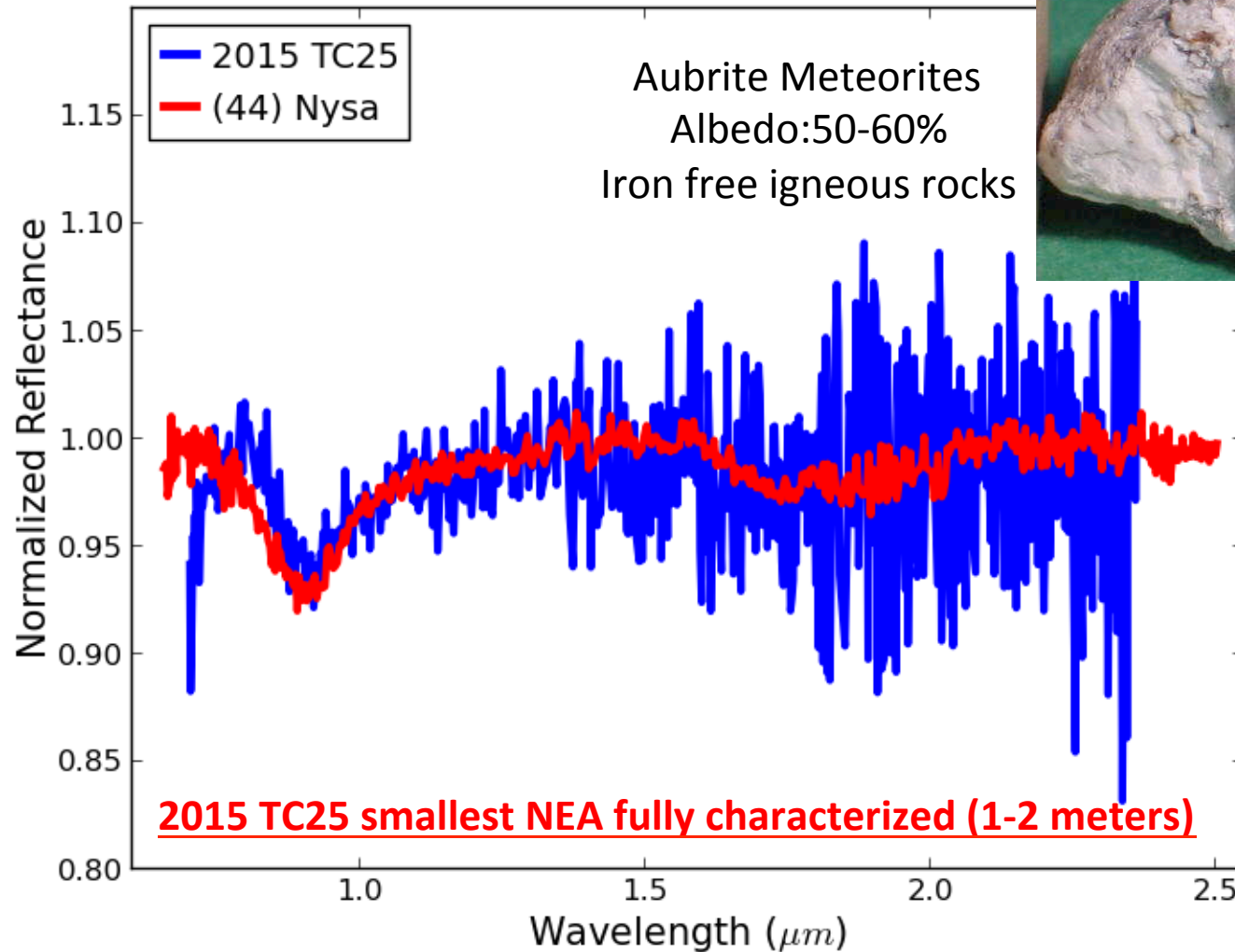
Echo power (std. dev.)



Rock vs. Regolith



2015 TC25



2015 TC25: Lessons Learned

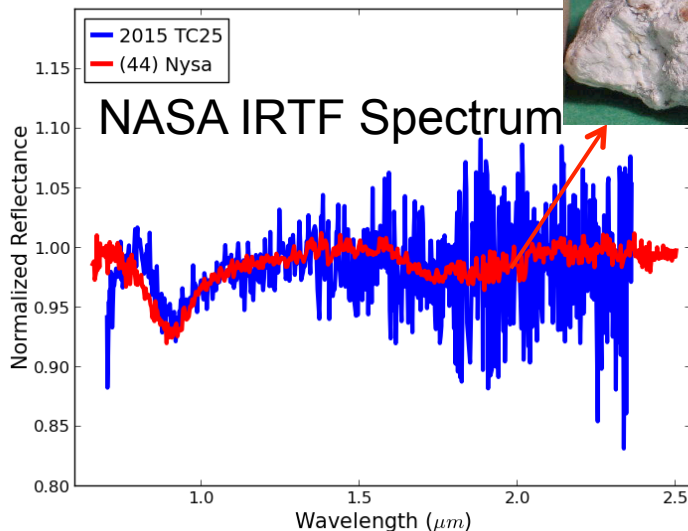
- We need spectra of rocks rather than regolith as we characterize smaller NEAs.
- Multi-wavelength observations of NEAs vital for physical characterization
- Every technique has strengths and weaknesses. Important for experts to acknowledge this to have a credible mitigation strategy. (self-critical)
- Are results from different techniques (radar vs. spectroscopy) converging on a unique answer?
- Traditional lines of communication (telephone, email) might not be ideal for coordinating observations. Important to explore social media options.

Smallest Near-Earth Asteroid

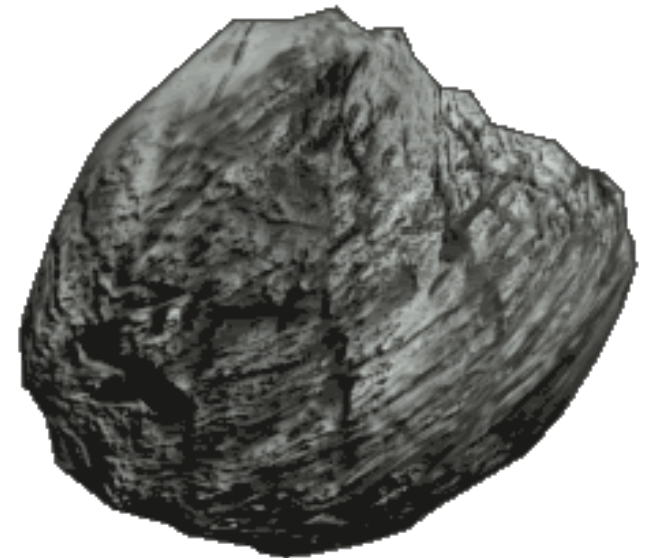
NASA IRTF Animation

Just two days after its discovery on October 11, 2015, asteroid 2015 TC25 made a very close pass by the Earth at a distance of about 69,300 miles (111,000 kilometers), or 29% of the distance to the Moon. Using data obtained at NASA's Infrared Telescope Facility, scientists supported by the Near Earth Objects Observation Program determined that 2015 TC25 is very similar to a rare class of iron-poor stony meteorites, called Aubrites, found on Earth. *2015 TC25, which rotates once every 133 seconds, is only about 6 feet (2 meters) in diameter, making it the smallest asteroid ever mineralogically characterized with a ground-based telescope.*

Aubrite

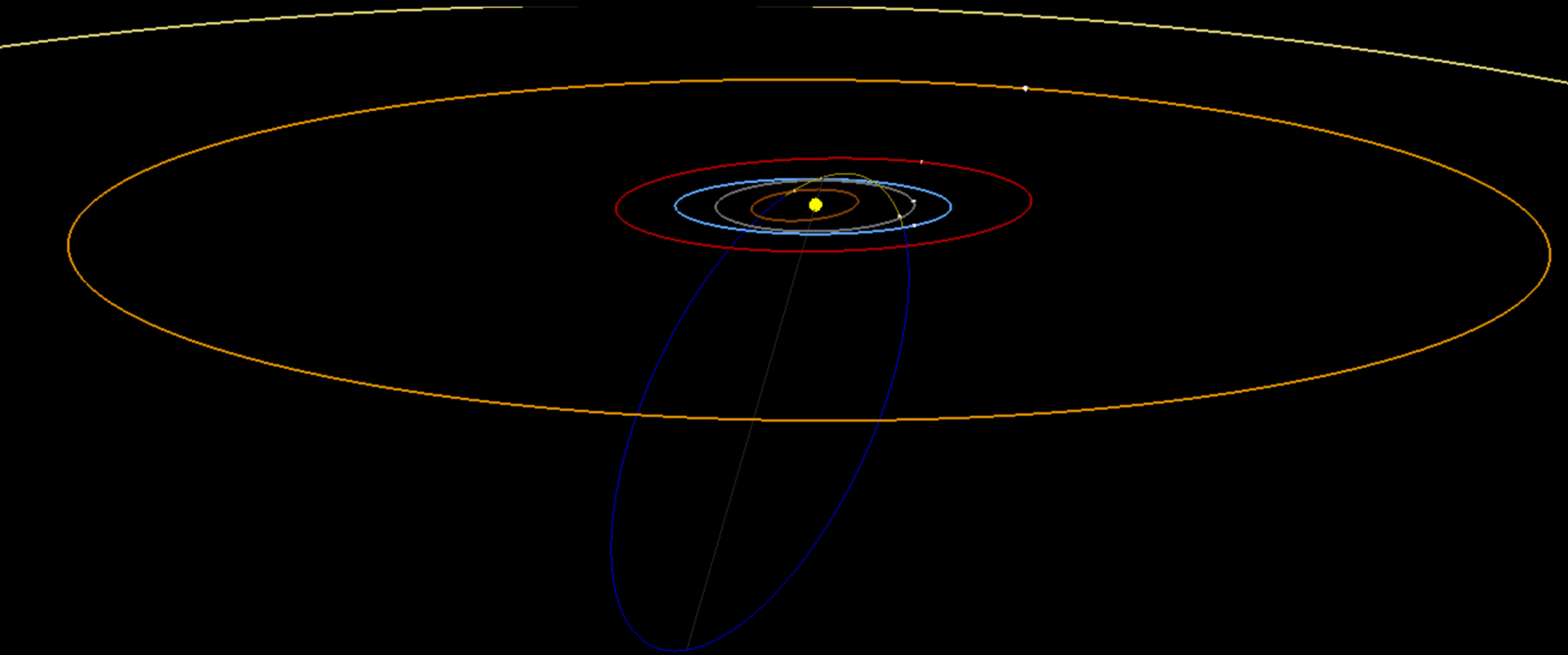


President Obama for scale



2015 TC25 animation (artist's concept)

Update on Halloween Asteroid



- Absolute Magnitude (H) :20; Size: 200-600 meters
- Closest approach: Oct. 31, 2015 17:00 UTC
- Distance: 480,000 km

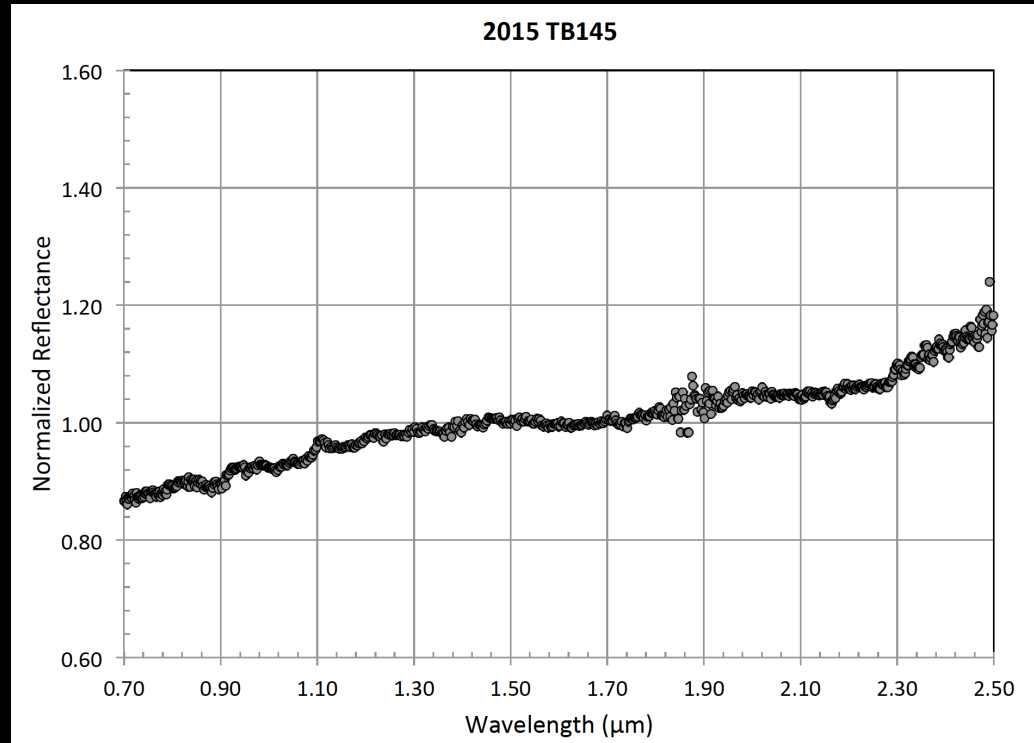
Update on Halloween Asteroid



Arecibo

Oct. 29, 2015

Data processed within hours



- NASA IRTF observations Oct. 29, 2015. Data processed in 2 hrs
- Featureless spectrum with thermal tail. Albedo <10%
- Radar diameter 600 meter (albedo 6%)
- Press release generated 360 news articles.

Thank you

- This research work was supported by the NASA Near-Earth Object Observations Program grant NNX14AL06G (PI:Reddy).
- NASA IRTF is operated by the University of Hawaii under contract NNH14CK55B with the National Aeronautics and Space Administration.