

DPS 2020



# Detection of Yarkovsky Acceleration of (99942) Apophis

David J. Tholen

University of Hawaii

[tholen@ifa.hawaii.edu](mailto:tholen@ifa.hawaii.edu)

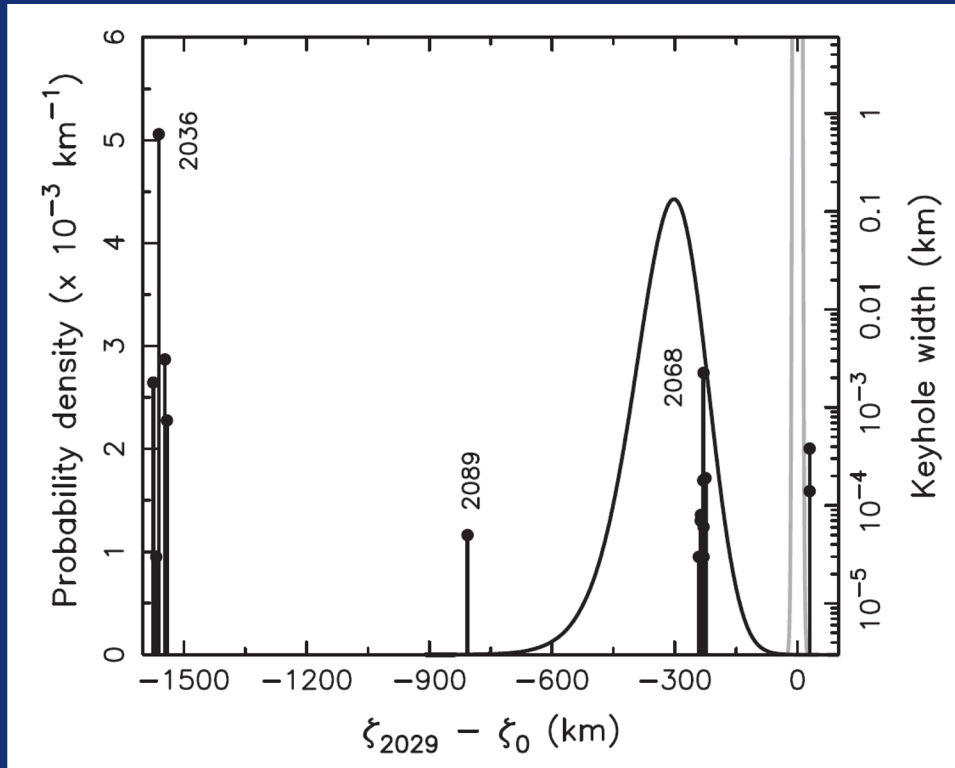
Davide Farnocchia

Jet Propulsion Laboratory

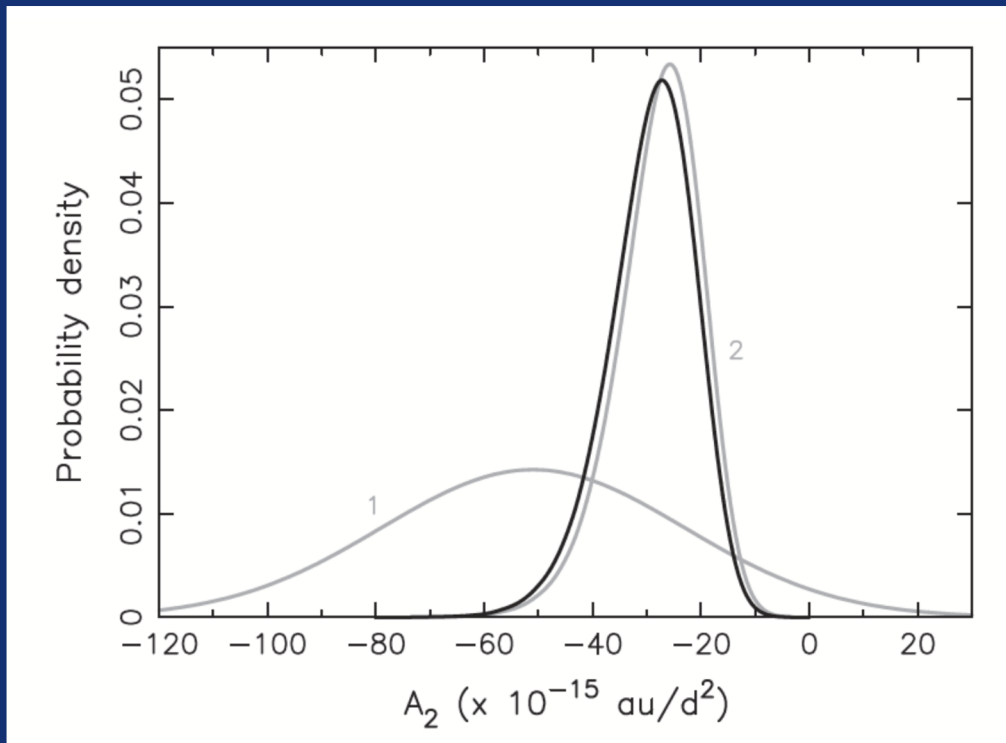
- In a nutshell, as the title suggests, the news is that we've detected Yarkovsky acceleration on the near-Earth asteroid (99942) Apophis
- What made this possible is a superb set of data acquired with the Subaru telescope in January and March of this year
- 18 observations better than 10 milliarcseconds, equivalent to a single position good to about 2 milliarcseconds (that corresponds to about twice the size of the asteroid at its distance in January)

- What is Yarkovsky acceleration?
- Arises from non-isotropic thermal radiation; basically the heat radiated from an asteroid gives that object a exceedingly tiny push, and the warmer hemisphere pushes slightly more than the cooler hemisphere, which causes the asteroid to drift away from what a purely gravitational orbit would predict

- Why is Yarkovsky important for (99942) Apophis?
- Apophis is a fairly large (~300 meter diameter) asteroid with numerous Earth impact scenarios for the second half of this century
- Yarkovsky acceleration needs to be taken into account to accurately compute the impact risk



- From Vokrouhlicky et al. 2015
- Gray bars represent gravity-only solution, which rules out the 2068 impact scenario
- Black curve includes the predicted Yarkovsky acceleration based on observed rotational state and thermal emission, which allows a 2068 impact



- From Vokrouhlicky et al. 2015
- Gray curve labelled 2 is their predicted value for the  $A_2$  parameter, peaks at  $-26 \text{ E-15 AU/d}^2$
- We measured  $-27 \text{ E-15 AU/d}^2$  plus or minus  $2 \text{ E-15}$ , in excellent agreement with the prediction

DPS 2020



## Contact Information

Dr. David J. Tholen  
Institute for Astronomy  
University of Hawaii  
[tholen@ifa.hawaii.edu](mailto:tholen@ifa.hawaii.edu)