

Occultation Observations and Shape Model of DESTINY's Target Asteroid (3200) Phaethon

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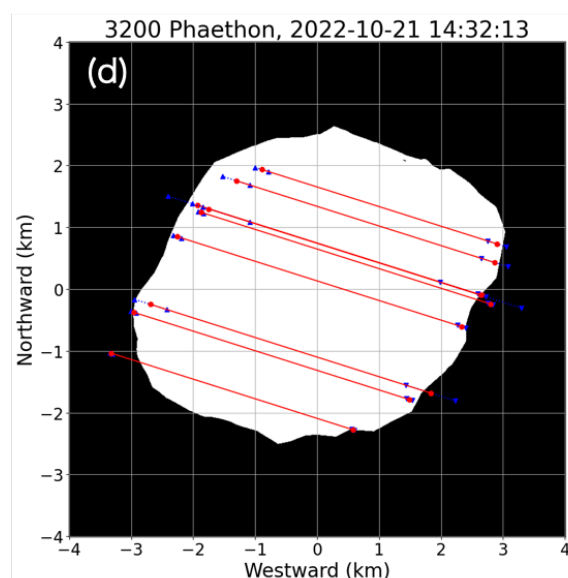
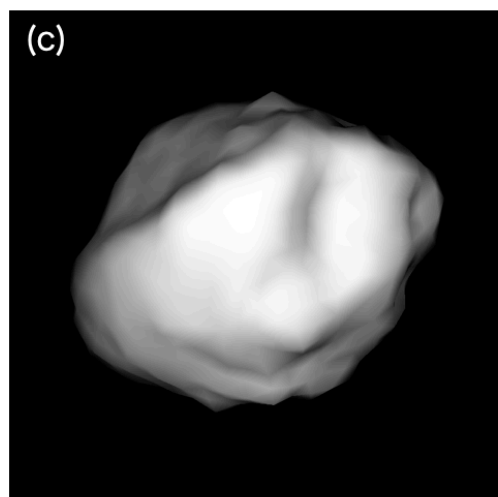
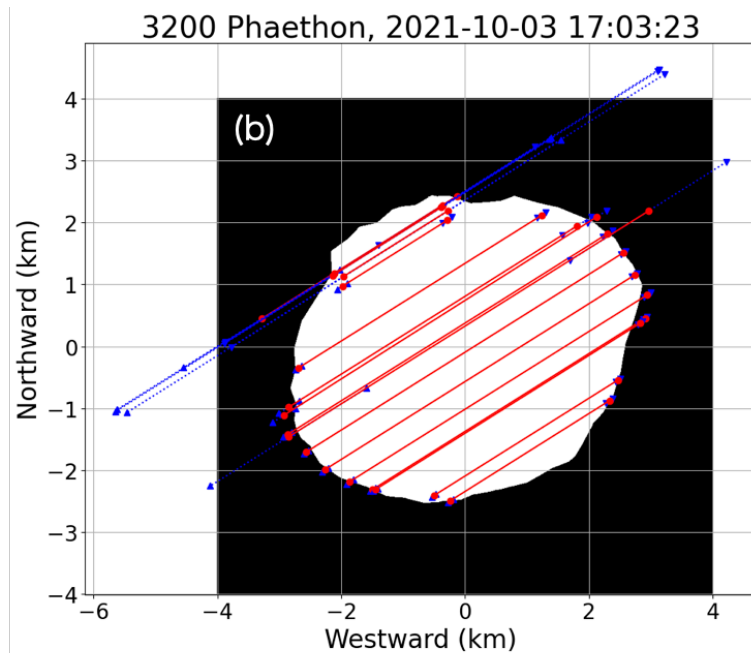
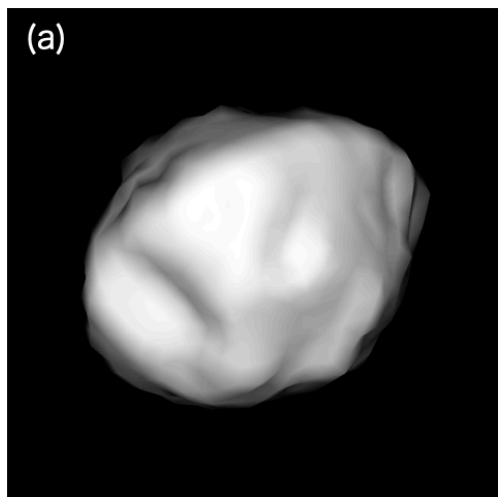
The DESTINY⁺ mission is a flyby mission to the asteroid (3200) Phaethon, the parent body of the Geminids meteor shower. The spacecraft is scheduled for launch in 2024 and the Phaethon flyby in 2028. Due to the orbital configuration between Phaethon and the spacecraft, there's not enough time to observe Phaethon on board prior to the flyby to obtain the necessary information for autonomous flyby imaging. Therefore, the mission's science team is working together to conduct thorough preliminary ground observations to understand the size of the Phaethon, its surface reflectivity, and interesting surface features, in order to optimize imaging during the flyby.

Among the various observations, we have conducted observation campaign for stellar occultation, which provide the most accurate measurements of the size and shape of asteroids. Since 2019, professional and amateur observers have gathered at every opportunity to observe stellar occultation by Phaethon. In Japan, the occultation observations on October 3, 2021 and October 21, 2022 were very successful.

Here we compare the cross sections of the Phaethon obtained from these observations with the shape model of the Phaethon derived from the light curves obtained from previous radar and photometric observations.

The 3D shape model of Phaethon is being refined using the results of occultation observations. There will be many opportunities for occultation observations before the Phaethon flyby, and we plan to continue our observations. We are looking forward to seeing how close we can get to the actual 3D shape of Phaethon through ground-based observations.

Keywords: Asteroids, Flyby mission, (3200) Phaethon



Comparison of Phaethon's 3D shape model and occultation observations. (a) : 3D model of Phaethon as seen from Earth at 17:03:23 UT on October 3, 2021, the time of the stellar occultation by Phaethon. The red line in (b) shows the length of Phaethon's chord based on the time of disappearance and reappearance recorded at each observation site, and the blue line shows the error based on the accuracy of the time measurement. The time accuracy at some stations contains large errors. (c) is a 3D model of Phaethon as seen from Earth at 14:32:13 UT on October 21, 2022, the time of the stellar eclipse by Phaethon. The red and blue lines in (d) mean the same as in (b). As shown in (d), there is a slight discrepancy between the model and the observation. Therefore, further improvement of the model is needed.