NEW NEA AND OTHER ASTEROID RESULTS FROM OCCULTATIONS RECORDED BY IOTA OBSERVERS. D. Dunham[1], J. Dunham[1], F. Yoshida[2], T. Hayamizu[3], D. Herald[4], D. Farnocchia[5], R. Venable[1], J. Irwin[1], R. Nolthenius[6], N. Carlson[1], K. Getrost[1], S. Messner[1], R. Jones[1], R. Anderson[1], S. Preston[1], [1]International Occultation Timing Association (IOTA), Fountain Hills, Ariz., USA, *Email: david.dunham@kinetx.com, [2]Planetary Exploration Research Center, Chiba Inst. of Tech., Japan, [3]Saga Hoshizora Astronomical Center, Japan, [4]Trans Tasman Occultation Alliance-IOTA, Wellington, New Zealand, [5]Jet Propulsion Laboratory, Calif. Inst. of Tech., Pasadena, Calif., USA, [6]Cabrillo College and IOTA, Aptos, Calif., USA.

Introduction: International Occultation Timing Association (IOTA) observers played key roles in the first occultations by NEAs in 2019 (Phaethon) and 2021 (Apophis) [1], and more recently, Didymos and Dimorphos [2,3]. Here we summarize these collaborations with SwRI, PERC, and ACROSS and present new results for Phaethon, (4337) Arecibo, and some other interesting objects.

Phaethon: We thought the first 2 years of Phaethon occultation observations nailed the orbit of this object, and in 2021, observers in Japan obtained the best observations of a Phaethon event that stands as the best by any NEA, see the sky-plane plot of Fig. 1.

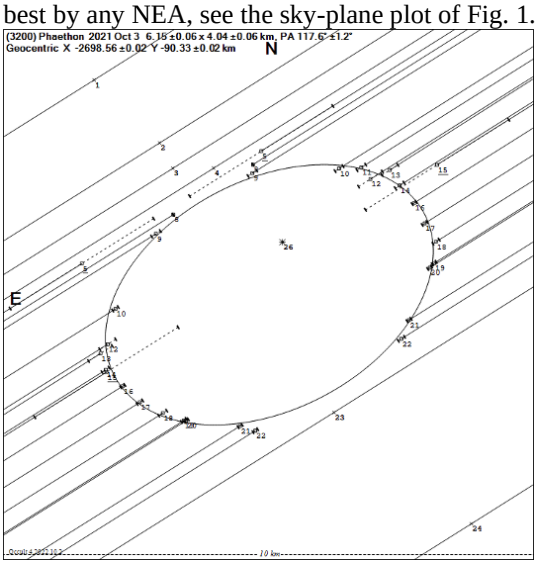

Figure 1 Timings of the occultation of 10.8-mag. TYC 2844-0734-1 by (3200) Phaethon on 2021 Oct. 3 projected on the sky plane. The point 26 above center is the predicted position of the center of Phaethon.

But a year later, the actual path of another occultation by Phaethon was observed to be over 2 km south of the prediction, almost a radius of the object. Perhaps a change in the orbit was caused by the thermal shock to Phaethon by the May 2022 perihelion passage. We will show opportunities to observe more Phaethon occultations during the second half of 2023, to quantify this possible change.

Apophis: IOTA's first observations of Apophis events demonstrated the value of setting up multiple automated stations by one or two observers, and showed the need to use only occultations of stars with good Gaia astrometric solutions for precise orbit determination. We show that same techniques and considerations have been important for Didymos events. We will describe how Fresnel diffraction effects need to be taken into account for the smallest objects, showing how previous theoretical work [4] compares with observations by small NEAs.

(4337) Arecibo: This main-belt asteroid was found to be binary during a May 2021 occultation in Australia, and confirmed with a 2nd event recorded by other IOTA observers a month later in California. The astrometric wobble of this binary object was measured by Gaia, revealing the 1.3-day period [5]. A year later, the same Australian observers found that (172376) 2002 YE25 is also likely binary, and other possible asteroidal moons from IOTA occultations will be noted [6].

Comet 29P/Schwassmann–Wachmann 1: In December 2022, IOTA observers, along with those from SwRI and Unistellar, recorded the first multi-station observation of an occultation by this enigmatic object. IOTA observers recorded one other SW1 occultation, and we will describe how others recorded the first occultation by Comet 28P/Neujmin 1.

References: [1] Dunham D. W. et al. (2021) *Planetary Defense Conf.* [2] Chesley S. et al. (2023) *ACM* submitted. [3] Souami D. et al. (2023) *ACM* submitted. [4] Altwaijry H. A. and Hyland D. (2013) Paper AAS 13-942, Astrodynamics Specialist Conf., Hilton Head, S.C. [5] Tanga P. (2022) https://www.cosmos.esa.int/documents/29201/6953755/EAS2021-S15-Tanga.pdf . [6] Herald D. et al. (2020) *MNRAS 499*, 4570-4590.