

## IOTA Observation Campaigns for Didymos and others, June – September; Titan occ July 9

We've already had successful campaigns, in conjunction with the Southwest Research Institute (SwRI), for occultations by the Lucy mission target Trojan asteroids Polymele on March 27, and (617) Patroclus-Menoetius on June 4, while we had a more widespread campaign for the June 11<sup>th</sup> occultation by Weywot, the approximately 140-km-diameter moon of the large Trans-Neptunian Object (TNO) (50000) Quaoar; for it, the uncertainty range was the whole USA, but the Lucky Star prediction turned out to be much more accurate, with at least one observer, Bob Jones, within the predicted path, recording the occultation. And 4 nights later, two observers in Texas recorded the occultation by another elusive TNO, 2002 TX300, with again the Lucky Star prediction more accurate than expected.

Now, the occultations by (65803) Didymos have the highest priority since NASA's DART mission plans to impact Dimorphos, Didymos' 160m moon that is 1.2 km away, on September 26<sup>th</sup>. To obtain the most science from the mission, the orbit of Dimorphos about Didymos should be determined as well as possible, before and after the impact. We have lots of opportunities after the impact, but only a few before it. We should take advantage of those few chances as best we can. The DART team has arranged extensive ground-based photometric observations of the system, and these have already determined the period of Dimorphos' orbit to an accuracy of 0.06s. They estimate that the 6.6-km/sec impact of DART will change the period of Dimorphos by a few minutes, so it will likely be only a few months before the period change is detected with more photometric observations; occultations won't be needed for that. But the occultation observations could be valuable in accurately determining the other orbital elements.

Once a first occultation is observed, the following ones can be predicted more accurately; then, especially valuable would be any observations of occultations by Dimorphos as well as by Didymos, to help measure the effect of the DART impact. Much more about these occultations is given on IOTA's page for Near-Earth Asteroid (NEA) occultations in North America during 2022 on pages 246-248 of this year's RASC Observer's Handbook, but much more extensively (and recently updated) on our Web page at <https://occultations.org/publications/rasc/2022/nam22NEAoccs.htm> and especially the link to the .pdf document near the top there, directly at <https://occultations.org/publications/rasc/2022/nam22NEAoccs.pdf>. Maps and information are given about the first Didymos opportunity, an occultation of a 13.5-mag. star that will occur at 9h UT on June 25<sup>th</sup>, from Long Beach, California to Tucson, El Paso, n. of Austin and Houston, to n. of Jacksonville. It will need scopes of 12-in., maybe 11-in., aperture and larger. Since the central duration is only 0.11s, the most integration you should use is 2 frames or 4x (Watec cameras) or NS2 (Runcam Night Eagle Astro). You should check the star's visibility at these settings with your telescope, before committing to trying the occultation. The ACROSS team (supported by ESA) is obtaining extensive astrometry for Didymos and making their predictions available on Occult Watcher (OW). But the Didymos campaigns will be like the successful campaigns we ran for other NEA's, Phaethon in 2019 and Apophis last year (there is a link to a .pdf document about them near the top of IOTA's NEA occultations page), where observers

need to carefully position themselves along a coordinated network of lines that take into account the shifts needed due to elevation above sea level; John Irwin has provided Google Earth files suitable for this for the Apophis occultations, and he plans to help out similarly for Didymos. We are awaiting a final update of the orbit from ACROSS for the June 25<sup>th</sup> event (their prediction for it now on OW is probably it) to pass on to John, and when available, the Google Earth files will be posted on the NEA occultations page. Roger Venable, [rjvmd@progressivetel.com](mailto:rjvmd@progressivetel.com), with his large scopes, is leading the effort for June 25<sup>th</sup>; if you can, you are encouraged to join him, whether from a fixed observatory that may be close enough to the path, or even better, with mobile equipment suitable for the event.

Dimorphos is about 1/5<sup>th</sup> the size of Didymos, so to detect its occultation, you'll need to record with 5 times the cadence of what you need for Didymos. Fortunately, Didymos' motion after June decreases some, with typical durations of 0.20s, up to 0.3s in November. The Dimorphos events then are of the order of 0.04s, or a little more than an NTSC frame, so you might not need to depend on field resolution to detect it. PyOTE's new tool to estimate if a single-frame event could be reliably detected in a given recording, will be useful for pre-event testing.

After June 25, as shown in the IOTA NEA events .pdf document, we are planning campaigns for the following Didymos occultations in North America, with needed scope size shown:

July 20, 7.2h UT, mag. 11.2, dur. 0.18s, 8in scope, Que., n. Maine, N. Scotia  
July 24, 8.8h UT, mag. 11.7, dur. 0.19s, 10in scope, AB MT NE MO GA  
Aug. 23, 5.7h UT, mag. 11.9, dur. 0.21s, 10in scope, Colo. (Denver) to Texas (Houston)  
Sep. 3, 10.8h UT, mag. 10.4, dur. 0.19s, 8in scope, s. Tex.; FL, GA (low)

I plan to lead the expeditions for July 20 and 24, but will try July 20 only if the weather forecast is very favorable; the July 24<sup>th</sup> path is longer, with more chances for clear skies. I don't plan to try Aug. 23 myself, but will help with its coordination for others.

Besides the events in North America, there is also an occultation of a 12.4-mag. star that will occur over the southern part of Hawaii Island on September 15 at 13:20 UT; the Occult map for it is on the NEA occultations page.

I gave short presentations about the Didymos occultations at January and June meetings of NASA's Small Bodies Assessment Group (SBAG); links to those are given at the top of IOTA's NEA occultations page, as well as information about occultations by others that was presented at the recent meeting.

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Besides Didymos, at 9h UT on July 9, for much of the USA, Saturn's large moon Titan will occult 8.7-mag. SAO 164648 = HIP , spectral type F0V; some information about it, including a map showing the northern limit extending from southern Manitoba to central California, is at <https://occultations.org/publications/rasc/2022/nam22distantoccs.pdf> . Adventurous observers might try to record the central flash from the central line, which passes over the

southern parts of Eleuthera and Andros Islands in the Bahamas; near Cienfuegos in Cuba; and over northern Belize and southernmost Mexico. More information about the event will be posted at <https://occultations.org/publications/rasc/2022/nam22distantoccs.htm> in a week or two.

The morning of Aug. 16, we'll try an occultation by the NEA (3122) Florence following the IOTA meeting the previous weekend. For some, this will be a nearby opportunity to test deployment ideas for Didymos and other NEA occultations. 2017 Radar observations found 2 small moons of Florence and determined its orbit well enough to give a rather good path prediction for Aug. 16. The path is shown on the overall NEA occultations map on our Web site for these events.

There are several other good occultations that warrant regional occultation campaigns; look at <https://occultations.org/publications/rasc/2022/nam22MBoccs.htm> for occultations of bright stars by main-belt asteroids. It has links to all the pages for special events that I've set up, including special main-belt objects, NEAs, Trojans, and distant objects. The links to the .pdf documents at the tops of each of these include maps showing the better events in North America during 2022. The special MB objects page shows occultations by Kleopatra on July 13 (n. Calif. to B.C.), Antiope on July 23 (Manitoba to Calif.), Viipuri (probable binary asteroid) on Aug. 3 (s. Georgia), and a 9.2-mag. one by Antiope (again) on Aug. 8 (w. Texas to Ontario).

David