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Press Release

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FOR IMMEDIATE RELEASE

Naval Observatory Telescope Provides Key Astrometry for Successful SOFIA Observation

Astronomers using the Kaj Strand 1.55-m (61-inch) telescope at the Naval Observatory Flagstaff Station (NOFS) played a crucial role in predicting the shadow path of the 5 October 2017 occultation by Triton, the largest moon of the planet Neptune, of a 12th-magnitude star in the constellation of Aquarius. This new, more accurate information allowed another team of astronomers aboard NASA's Stratospheric Observatory For Infrared Astronomy (SOFIA) to capture an anticipated effect called a "central flash". This event occurs when a background star is precisely behind the center of an object like a planet or moon and the object's outer atmosphere acts as a lens, causing a brightening of the light level at mid-occultation. This circumstance, if captured, can be a sensitive probe of the various layers in the object's atmosphere. With an apparent angular diameter of just 128 milliarcseconds (mas), Triton presents a very small target for such an observation. One mas is about the size a U.S. quarter-dollar coin would subtend as seen from a distance of 3100 miles (5000 kilometers).

For seven nights before the occultation, astronomers at NOFS imaged Triton and the occultation target star for several hours each night. As Triton moved through the star field, they compared its position to predictions from the latest ephemeris generated by the Jet Propulsion Laboratory (JPL), and they found a small but crucial offset.

At the same time, another team also collected data at the Lowell Observatory's 4.3-meter Discovery Channel Telescope (DCT) located in Happy Jack, AZ. The proximity of the nearly full moon complicated observations at both sites; additionally, the brightness of Neptune, Triton's host planet, meant that CCD exposure times had to be kept very short, resulting in few background stars being visible in the images. However, drawing on extensive experience with stellar parallax measurements done at NOFS, for which it was found that longer exposure times produced more accurate results, teams at both telescopes employed narrow-band filters to image

the field with longer exposure times. The filter used at NOFS made Neptune an order of magnitude less bright compared to Triton and background stars.

With the change in observing strategy, astrometry from the NOFS and DCT measurements agreed to high precision, just one to two mas, giving astronomers confidence in their calculation of the central flash path on the surface of the Earth. The combined result was sent to the SOFIA flight planning team at 1400 UTC on 5 October -- just five hours before takeoff. The flight plan was modified to place SOFIA over the Straits of Florida for the observing run, rather than near Jacksonville in northern Florida per the original plan. SOFIA team members had good news upon touchdown: the observations succeeded. SOFIA's corrected flight path was very close to the center line, and its onboard telescope measured the central flash.

The 1.55-meter (61-inch) Kaj Strand Astrometric Telescope at the U.S. Naval Observatory Flagstaff Station (NOFS). Completed in 1964, it remains the largest instrument of its kind in the world.