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Advance knowledge of New Horizons target 2014 MU69 from stellar occultations

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The Trans-Neptunian Object 2014 MU69 is a member of the cold classical Kuiper belt. It is the planned target of the New Horizons spacecraft: the closest-approach flyby will take place on 1-JAN-2019. MU69 has an apparent magnitude of 26.8. It was discovered in an Hubble Space Telescope search for TNOs that could be reached by the New Horizons spacecraft, and as of this writing, there are no published reports of positive detections from other telescopes.

We made a concentrated effort to observe MU69 on three dates during the summer of 2017 as it occulted three separate stars. In conjunction with the Gaia team (who provided early results on stellar proper motions), we set up networks of observers with portable telescopes in South Africa and Argentina on 3-JUN-2017 and 17-JUL-2017; we flew close to the center of the shadow path on SOFIA on 10-JUL-2017, and we observed from several fixed sites on all three dates to search for rings or dust hazards near MU69.

Observations from all three dates are constraining. Five portable telescopes (spanning about 25 km) in Argentina detected MU69's shadow on 17-JUL-2017. Their chords are absolutely incompatible with a spherical object, but are consistent with either a peanut-shaped object, a contact binary or a separated binary whose elements were observed in state of projected overlap. SOFIA did not detect a signature of MU69 itself, but did detect a small obscuration 2 seconds before the expected event mid-time. If MU69 is indeed a true binary, this feature (about 3 km long) could be a graze of one of the components, or it could be a separate member of the MU69 system. If MU69 is a separated binary, its orbital plane is constrained by the 3-JUN-2017 non-detections; ground-stations on that date would have detected excursions by MU69 binary components if they were located a few tens of km north of the nominal center of mass. We will discuss these constraints quantitatively and present observations from SAAO, Gemini and SOAR that are sensitive to narrow ring features. An upcoming occultation on 4-AUG-2018, 150 days before encounter, will provide a chance to probe the MU69 system for the shape of the primary, the possible multiplicity of components and a more sensitive search for rings.