

Faculty Perspective

-- *Stellar Occultation Observations with KBO*

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The Kuiper Belt Objects (KBO), which include at least three dwarf planets and thousands of comet-like bodies, lie beyond the orbit of Neptune between 30 AU and 55 AU from the Sun. An Astronomical Unit (AU) is the average distance from the earth to the Sun (1.5×10^8 km). More than 70,000 KBOs over 100 km in diameter are believed to exist. Dwarf planets like Pluto, Makemake and Haumea are distinguished from their regular planet counterparts in that they were unable to clear debris from their orbital paths.

Pluto's diameter (2800 km) is estimated to be about 2/3 that of our Moon. Its distant location and thin atmosphere of nitrogen, methane and carbon dioxide add to the difficulty of determining its true solid size. Until the New Horizons spacecraft reaches Pluto in 2015 after its nine-year journey, astronomers must rely on other techniques to narrow down the error bar for Pluto's size. One such method is stellar occultation, which occurs when a star is obstructed by a passing object. The light curve resulting from this miniature eclipse can be analyzed to calculate the intervening body's size as well as to provide a profile of any existing atmospheric pressure and temperature.

The NASA New Horizons Innovation augmentation grant that Windward Community received is being used in part to provide such observational experience for two student interns — Nathan Hiraoka and Samuel Plunkett, Jr. Along with their co-mentor (Marvin Kessler and Joe Ciotti), these students have teamed with researchers from MIT, Williams College Hopkins Observatory, and elsewhere to form a network of observatories around the Pacific-Asia region from which stellar occultations of KBOs can be conducted. In February 2011, Nathan and Sam assisted with the observation of the KBO Varuna, which was predicted to block out a star of magnitude of 15.5. Although no occultation was observed, these negative results are nevertheless useful for updating the ephemeris for this large KBO.



(Left to Right) Marvin Kessler, Samuel Plunkett and Nathaniel Hiraoka. (photo: Joe Ciotti)

In June 2011, Nathan and Sam re-joined the same team of researchers to observe occultations by Pluto and two of its four moons, Charon and Hydra. A custom-built high-speed CCD camera designed by the lead team—called the Portable Occultation, Eclipse, and Transit System or POETS—was fitted to the 0.4-m Schmidt-Cassegrain telescope at Windward Community's College Lanihuli Observatory. Although cloudy weather conditions interfered with these events for most of the observatories throughout the network, one set of measurements was successfully obtained from the Leeward Community College observatory. These data were usable to reduce the length of Charon's chord and will further serve to improve on the diameter of this satellite (approximately 610 km).

The New Horizons Innovation internships that were granted these two WCC students offered invaluable observational opportunities—among them, collaborating with wide variety of research groups, gaining hands-on experience with a research-grade CCD camera, and preparing the telescope pointing parameters for these extremely faint targets using coordinates that were constantly being updated until the very night of the event.

For their efforts and teamwork these student interns were listed as co-authors of the paper, *The Double-Double Pluto-Charon and Pluto-Hydra Predicted Stellar Occultation of June 2011*, that was presented at the Division of Planetary Sciences in Nantes, France in October 2011.