Geophysical Research Abstracts
Vol. 13, EGU2011-13524, 2011
EGU General Assembly 2011

How to detect Eris' atmosphere: stellar occultations in the diffraction-dominated regime

Eliot Young
Southwest Research Institute, Space Studies, Boulder, United States (efy@boulder.swri.edu)

The TNO (136199) Eris was recently observed as it passed in front of a star (I-band magnitude of 15.2) from three sites in South America (IAU Circ. 9184). Because of the faintness of the occulted star, most observers used integration times of 3 seconds or longer. At a distance of 96 AU and for observations at 800 nm, the Fresnel scale for this event is 2.4 km. Given the sky plane velocity of the event (26.3 km/s), an observer would have to observe at a rate of at least 11 Hz in order to subsample the first diffraction ring.

Eris is not expected to have a global atmosphere in the present epoch - its expected surface temperature is in the neighborhood of 24 K, where the vapor pressure of nitrogen ice (the most volatile constituent known to exist on Eris) would be a negligible 2.4e-5 microbars - but Eris must develop an atmosphere as it approaches perihelion (37.77 AU). Its geometric albedo is currently greater than 0.7, which suggests that its atmosphere seasonally freezes out to produce a high albedo surface. At perihelion, Eris' frost temperature is expected to be approximately 34 K, at which point Eris will have a global $\sim$1.3 microbar atmosphere supported by the vapor pressure of nitrogen frost.

For Eris (and other cold, ice-covered TNOs on eccentric orbits), how will we detect the presence of very thin atmospheres from stellar occultation lightcurves? I present a Fourier Optics code that models the combined effects of diffraction and refraction, and present lightcurves diagnostic of thin atmospheres, non-symmetric atmospheres (e.g., plumes around "hot spots") and irregularly shaped objects. The specific case of Eris is presented at distances from aphelion to perihelion with plausible surface pressures commensurate with each distance.