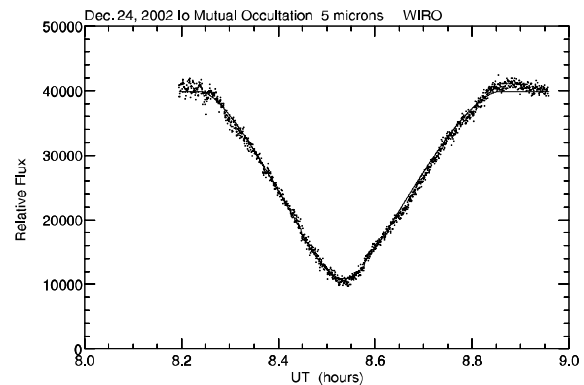


**MUTUAL EVENT OBSERVATIONS OF HOT SPOTS ON IO.** R. R. Howell<sup>1</sup>, <sup>1</sup>Department of Geology & Geophysics, University of Wyoming, Laramie WY 82071 (rhowell@uwyo.edu).

**Introduction:** Series of mutual events, where one Galilean satellite occults another, occur every six years as Earth passes through the equatorial plane of Jupiter. These events provide the highest spatial resolution observations of Io's volcanic hot spots obtainable from Earth. A new series of events is now underway, with the first observations having been obtained at the Wyoming Infrared Observatory (WIRO) on Dec. 24, 2002 UT. Beyond the results which are obtained from the new series, improvements to the ephemerides of the Galilean satellites (resulting from the Galileo mission) now make it possible to better interpret data from previous series. Several past series have coincided with brightenings of the Loki hot spot, and those observations can help address the issue of the nature of the brightenings at Loki. Two models of the brightenings have been proposed; episodic lava flows spreading over the caldera, or episodic disruption of the surface of a lava lake, with the latter one currently being the favored model [1]. A reanalysis of the existing data, using the new ephemerides, is now under way and will be presented along with any new observations obtained in the ongoing event series.

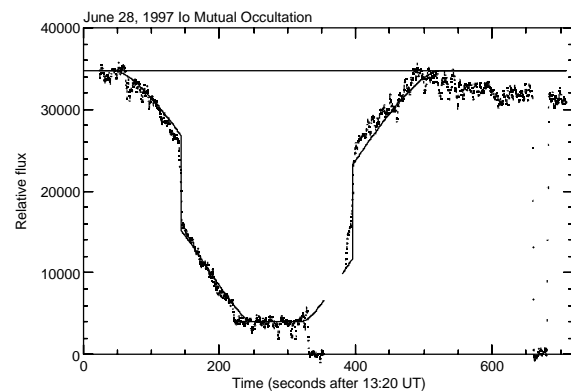
**The 2002/2003 Mutual Event Series:** Figure 1 shows 4.68  $\mu\text{m}$  photometry of the first of two events observed on Dec. 24, 2002. The Io hemisphere centered on 203° W longitude (which includes the Pele hot spot) was occulted by Europa. The dots are the observations and the line drawn through them is a very preliminary model. Hot spots would be indicated by steps in the curve, and the relatively smooth shape observed indicates that the brightest ones contribute at most a few percent of the total flux. In the preliminary model small steps at 8.519 and 8.828 UT represent the disappearance and reappearance of Pele, assumed to contribute approximately 1.7% of the total light. A second somewhat brighter hot spot may disappear at 8.446 and reappear at 8.578 UT. These are still very preliminary models, and a more refined analysis will be presented at the meeting. A second, grazing, occultation was also observed on Dec. 24th but preliminary analysis does not show any clear evidence of occulted hot spots in it.

The first observations of the current series which will include an occultation of Loki will be obtained on Jan. 18, 2003 UT, Wyoming weather permitting.



**Figure 1.** An occultation of the Pele hemisphere on Dec. 24, 2002 UT.

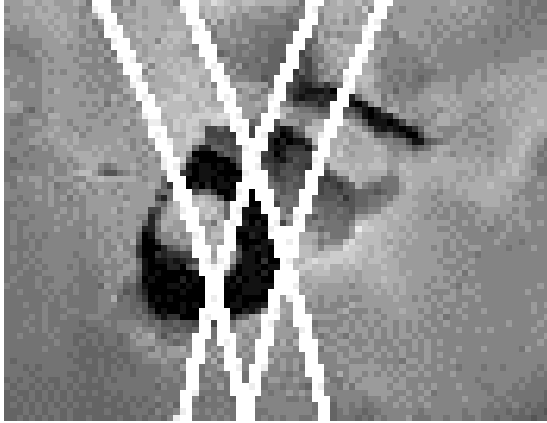
**Reanalysis of Earlier Event Series:** Occultations of Loki have been observed during events in 1985, 1991, and 1997. Figure 2 shows an occultation observed from WIRO on June 28, 1997 UT. The large drop at 144 sec. is the disappearance of Loki while the rise at 396 sec. is its reappearance. The smaller drop at 220 sec. is Pillan, which was very active on this particular date.



**Figure 2.** An occultation of the Loki hemisphere on June 28, 1997 UT.

The disappearance and reappearance of Loki actually take a few seconds, and the arcs in Figure 3 shows the locations of the limb of the occulting satellite at the time the Loki events begin and end. (These were obtained using the JPL JUP204 ephemeris by means of the Horizons web site.)

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**Figure 3.** The location and extent of the hot region on June 28, 1997.

The diamond shaped region in the center represents the location and extent of the hot emitting region. The other occultation events showing Loki are now being analyzed. They will enable monitoring of possible migration of the hot emitting region across the caldera, and also provide a measure of the Loki brightness for comparison with lava flow and lava lake resurfacing models.

**References:**

[1] Rathbun J. A. et al. (2002) *Geophys. Res. Lett.*, 29(10), 1443, doi:10.1029/2002GL014747.