LOKI, IO: AN UPDATE ON ACTIVITY FROM GROUNDBASED DATA. J. A. Rathbun, S. T. Johnson, *University of Redlands, 1200 East Colton Ave., Redlands CA 92373, USA*, J. R. Spencer, *Lowell Observatory, 1400 West Mars Hill Road, Flagstaff AZ 86001*.

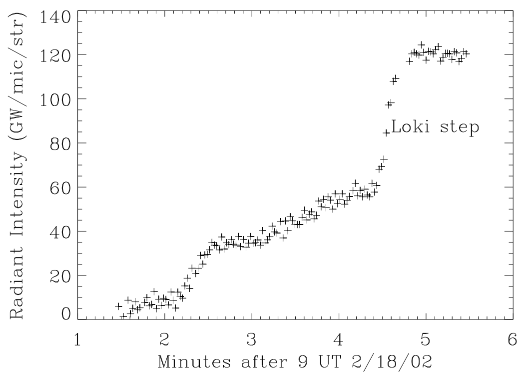

Figure 1: *Occultation reappearance lightcurve from 2/18/02. The increase in brightness that occurs near 9:04.5 UT is due to the reappearance of the Loki volcano from behind the limb of Jupiter.*

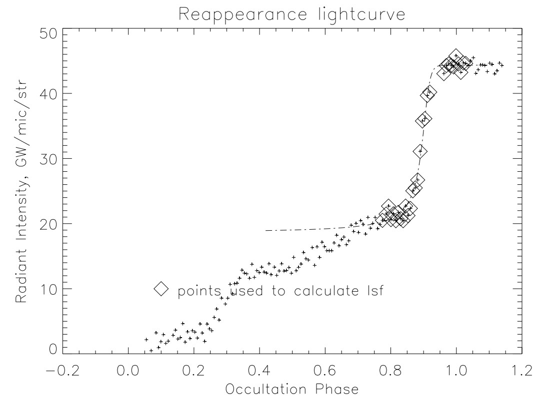

Figure 2: *Same occultation reappearance as in figure 1 except plotted as a function of occultation phase instead of time. "Occultation Phase" is defined to be zero when Io first touches Jupiter's limb, and 1.0 when Io has completely disappeared. Loki's disappearance is at an occultation phase of approximately 0.80. The diamonds indicate the points that were used to match the curve to a model for a single hotspot reappearance (which takes into account Jupiter's atmosphere).*

Introduction. Loki Patera is a 200 km diameter horseshoe-shaped low albedo feature on Io, located at approximately 10 N 310 W. Rathbun et al. [1], using infrared data from various sources, determined that Loki erupted periodically, with eruptions beginning approximately every 540 days and lasting typically 230 days. They examined high-resolution PPR images which suggested a resurfacing wave moving at a velocity of 2 km/day, resurfacing the entire patera in about 230 days. They also noted a similar darkening wave in Voyager 1 & 2 images with the same velocity. All of the data they examined, including groundbased infrared occultation data, mutual satellite occultation data, voyager images, and Galileo PPR, NIMS, and SSI data were consistent with a hot resurfacing wave traveling counter-clockwise around the patera in approximately 230 days.

Rathbun et al. [1] proposed that the resurfacing wave was caused by periodic lava lake overturn. This is consistent with all observations. They found a report of Hawaiian lava lake overturn which yielded the same thermal and temporal signal. They found that the solidified crust on the lava lake would overturn on the observed timescale if it had a lower porosity than the underlying liquid lava. As the solidified crust cools, its density increases eventually leading to gravitational foundering and overturn.

New data have been obtained since the publication of this paper. In October 2001, during i32, Galileo NIMS obtained high spatial resolution spectral data of Loki Patera [2] which match the Rathbun et al. model. Using the Rathbun et al. model, the next resurfacing event should have begun in the spring of 2001, about 160 days prior to the NIMS observation. Ages derived from the NIMS temperatures using a cooling model match ages from the model.

Methods. We have continued to obtain groundbased occultation lightcurves which reveal Loki's brightness. The last data published in that paper were from spring 2001. We have continued taking data and have analyzed through spring 2002. All recent data were taken at NASA's Infrared Telescope Facility (IRTF) using either the NSFCam or SPEX instruments. Each data point is the result of one series of observations. We observe in-eclipse occultation reappearances of Io from behind Jupiter [3]. Since Io is in eclipse, all light from Io is due to hotspots. As Io reappears from behind Jupiter, each hotspot is revealed one at a time, resulting in a stairstep pattern of intensity as a function of time (fig. 1). Loki appears near the end of the reappearance and is often the highest step. We match a theoretical curve to the step (fig. 2). This curve takes into account Jupiter's atmosphere and from the matching parameters the brightness of Loki is calculated.

Results. These new data (fig. 3) are no longer consistent with the periodic behavior Loki had exhibited the preceding decade and do not show a brightening beginning in the spring of 2001. Instead, the brightness of Loki has remained at a consistent mid- to low-brightness level.

These new data raise interesting questions. Without a major resurfacing event, how did the caldera maintain elevated temperatures through the 2001/2002 Jupiter apparition? Perhaps several smaller-scale resurfacing events were responsible, though the I32 NIMS image suggests that a single event resur-

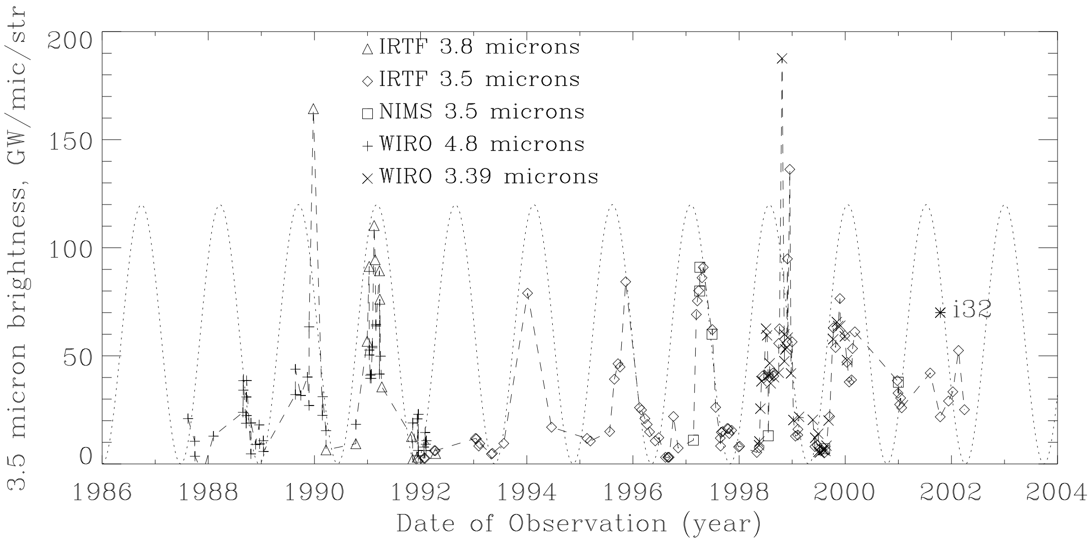

Figure 3: *3.5 μm brightness of Loki as measured primarily from Jupiter occultations. Some of the data were taken at other wavelengths (3.8, 4.8, and 3.39 μm). The 4.8 μm data were translated to 3.5 μm assuming a color temperature of 355 K [4]. The 3.39 μm data were translated to 3.5 μm using a color temperature found to be 500 K by equating data taken at both wavelengths at the same time. Similarly for the 3.5 to 3.8 μm color temperature of 500 K. Also included are 3.5 μm measurements from Galileo NIMS observations that resolve Loki. The dotted sine wave has a period of 540 days to show the periodicity of Loki's brightenings through 2000. The time of the I32 NIMS observation is also indicated.*

faced at least the southern portion of the caldera.

REFERENCES: [1] J. A. Rathbun *et al.* *Geophys. Res. Lett.*, 29:10.1029/2002GL014747, 2002. [2] R. M. C. Lopes *et al.* *33rd LPSC, abstract no.1793*, 2002. [3] J. R. Spencer *et al.* *Nature*, 348:618–621, 1990. [4] J. R. Spencer *et al.* *Science*, 257:1507–1510, 1992.