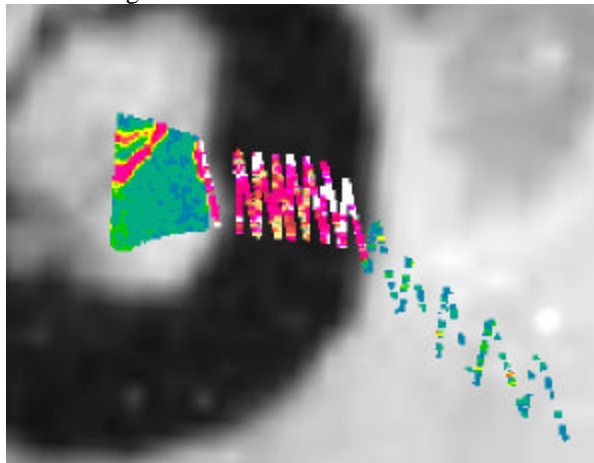


**THE THERMAL STRUCTURE OF LOKI SEEN IN GALILEO'S NEAR-INFRARED MAPPING SPECTROMETER (NIMS) DATA FROM THE I24 ORBIT** W.D. Smythe<sup>1</sup>, R. Lopes-Gautier<sup>1</sup>, L. Kamp<sup>1</sup>, A.G. Davies<sup>1</sup>, R.W. Carlson<sup>1</sup>, and the Galileo NIMS Team. <sup>1</sup> Jet Propulsion Laboratory/Caltech, 4800 Oak Grove Drive, Pasadena, CA 91109 (wsmythe@issac.jpl.nasa.gov)

The thermal structure of portions of the Loki caldera was measured by the Near Infrared Mapping Spectrometer (NIMS) during the Galileo Europa Mission I24 encounter. The observation was obtained during local night with a spatial resolution of 2 kilometers/pixel. The image was obtained in the NIMS "Fixed Long" mode (no grating motion) with an instrument gain state of "4" (the highest gain state). The last three detectors, (~ 4.1 to 4.8 microns - particularly sensitive to temperature), are auto ranging and unaffected by gain state. The observation is illustrated in Figure 1.



*Figure 1. NIMS I24 observation of Loki at spatial resolution of about 2 km/pixel and at 4.5 microns. The observation is overlaid on an image obtained by Galileo SSI in orbit C9.*

The upper right (colored) area shows the mosaic region targeted by NIMS for this observation. The sample density is quite high in this observation because the sample rate greatly exceeded the slew rate of the scan platform (by a factor of about 50). The input samples are summed to the output pixel yielding an excellent signal to noise ratio. The mosaic covers a portion of what appears to be a raft (or elevated area) that is surrounded by the dark ring (which may be relatively fresh lava.) The uniform color of a large portion of the 4.5 micron image implies a relatively uniform thermal output (and is indicative of high signal to noise). The red linear features in the upper left correspond to intersecting dark lines in the C9 visible image. This increased 4.5 micron output implies a higher thermal output than for the rest of the "raft". It is consistent with the general observation that dark (visible) = warm in Io images.

The part of the observation to the right of the mosaic (the zigzag) was obtained while the spacecraft scan platform was being targeted to Pele (which lies to the south east). For these data, the sample rate was less than the slew rate, leading to the zigzag appearance of the projected data. The apparent variance of the data is higher since it is rare for multiple samples to be included in an output pixel.

The analysis of this data can proceed from the observed thermal output, from derived temperatures and areas, and from the derived total power output ( $A\sigma T^4$ ). The measured power output is higher in the dark ring than for the "raft" by about a factor of 10, and the power output from the area on the lower right is lower than the "raft" by about the same factor (approximately 10, 1.0, and 0.1 microwatts centimeter<sup>-2</sup> microns<sup>-1</sup> steradian<sup>-1</sup> pixel<sup>-1</sup> respectively, in NIMS units).

The apparent variance for the dark ring seen in the image at 4.5 microns is not evident in single (and even multiple) temperature fits. The spectra for the dark ring closely fit a blackbody curve having a temperature of about 330K, a temperature which may have decreased from earlier observations [1]. This apparent difference in variance principally arises from the improvement in signal to noise realized by utilizing multiple wavelengths in the temperature fit. On the other hand, single temperature fits to data from the "raft" exhibit higher variances than those apparent in the 4.5 micron image. This may be the result of a higher spatial variance in temperatures for small areas (on the order of 100 m<sup>2</sup>) or an effect of projection, or noise (though there are approximately 50 samples per pixel.) When plotted as total power, the product of  $T^4$  and area reduces the variance since the derived areas having apparent higher temperatures are very small. The area outside of the dark ring exhibits the lowest temperatures (some at or below the detection limit of the instrument, ~180K [2]), and the highest variance (due to the low sample density.)

**References:** [1] Davies, A.G. et al., 2000, this volume. [2] Smythe, W. D. et al., 1995, JGR, 100, 18,957-18,972