Europa as measured by the Galileo NIMS and UVS

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Satellites of the Giant Planets

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We present results from a collaboration using data from the Galileo Ultraviolet Spectrometer (UVS) and Near Infrared Mapping Spectrometer (NIMS) to understand spectral absorption features on Jupiter's icy moon Europa. Intercomparison of UVS and NIMS data of the galilean satellites has proven successful and useful. Initial efforts included comparisons using Europa spectra to look for correlations in absorption features in lower resolution data from early in the mission (Matson *et al.*, 1997; Hendrix *et al.*, 1997). Also, NIMS data have been used to determine sulfur dioxide ($SO_2$) frost coverage on Io; this information has been incorporated in models to more accurately determine amounts of $SO_2$ gas measured by the UVS (Hendrix *et al.*, 2000). Most significantly, NIMS and UVS data were used to confirm the existence of hydrogen peroxide ($H_2O_2$) on the surface of Europa (Carlson *et al.*, 1999).

In the present study, we focus on the Europan hydrated compound and associated dark material concentrated on Europa's trailing hemisphere. The hydrate has been postulated to be hydrated sulfuric acid (Carlson *et al.*, 1999) generated by radiolysis acting on a water ice surface enriched with either endogenic or exogenic sulfur. An alternative suggestion for this material is hydrated salt minerals (McCord *et al.*, 1999). We look for correlations between these IR features and absorptions in the UV. In particular, we investigate whether the same process that causes the asymmetric hydrate bands in the NIMS data causes a broad absorption feature in the UVS data, centered near 0.28 microns (Hendrix *et al.*, 1998). This feature has also been detected in IUE (Lane *et al.*, 1981) and HST data (Noll *et al.*, 1995) and has generally been thought to be related to energetic particle bombardment, particularly sulfur ion implantation. Correlation of the IR and UV absorptions may help to confirm the nature of the dark material, and whether it is primarily endogenic or exogenic in source.

Because many Europa observations by UVS and NIMS were performed simultaneously, we can compare spectra from each instrument that were taken at the same time and under the same lighting conditions. The UVS has lower spatial resolution than the NIMS; to compare IR and UV spectra of the same surface area, we average the spectra from the NIMS pixels covering the UVS FOV. We look for correlations in spectra and where possible, in images from both instruments. We compare IR and UV spectra with laboratory spectra of candidate materials.