



## Revisiting the Jovian moons' surfaces in the infrared using the Galileo/NIMS database

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The Galileo spacecraft, which orbited the Jovian system between 1995 and 2003, allowed the most detailed investigation to date of the morphology and spectral properties of the surface of Io, Europa, Ganymede, and Callisto. The Near-Infrared Mapping Spectrometer (NIMS, Carlson et al. [1992]) onboard Galileo operated nominally in the near-infrared from 0.7 to 5.2 micrometres using 17 detectors, producing infrared spectra of up to 408 wavelengths. In practice, the instrument was operated in different modes, reducing the spectral dimension, and unfortunately suffered from detector failures, a stuck grating, and changes in the wavelength calibration over the course of the mission. This resulted in a heterogeneous, yet valuable, data set to use to explore the surfaces of the Jovian moons.

In this work, we present our current approach to revisit the Galileo/NIMS data in order to investigate the spectral and photometric properties of Jupiter's icy moons. The calibrated and georeferenced Galileo/NIMS archived data were gathered from the PDS Imaging Node and decomposed into a MySQL relational database. The database consists in a series of related data tables where, for each surface pixel of the calibrated g-cubes, we extract a series of key parameters of interest such as: radiance factor (I/F) and radiance (I), varying wavelengths, viewing geometry (incidence, emission, phase, and recomputed azimuth), and the location of the observations (pixel geographic latitudes and longitudes, spatial resolution). In addition, we store useful metadata inherited from the PDS3 data labels such as the sensitivity, dark levels, solar flux, temperatures, observation descriptions, detector numbers and original bands in order to support our investigations. The smallest object that can be retrieved from the NIMS database is a single spectrum.

All the data are linked within this framework, in such a way that the spectral data can be extracted from any geographical queries in latitude/longitude, per target, or per individual g-cube, within seconds. Coverage analyses of the full data set per target can easily be performed in view of spectroscopic or photometric regional studies, by defining regions of interest on a target based on their angular and/or spectral coverage across data cubes (Figure 1). This allows for an efficient and comprehensive exploration of the data set and can be used for different types of studies. Our effort currently focuses on the spectral and photometric properties of Europa's terrains coupling these database capabilities and advanced data analysis techniques [Belgacem et al., 2022; Cruz-Mermy et

al., 2022].

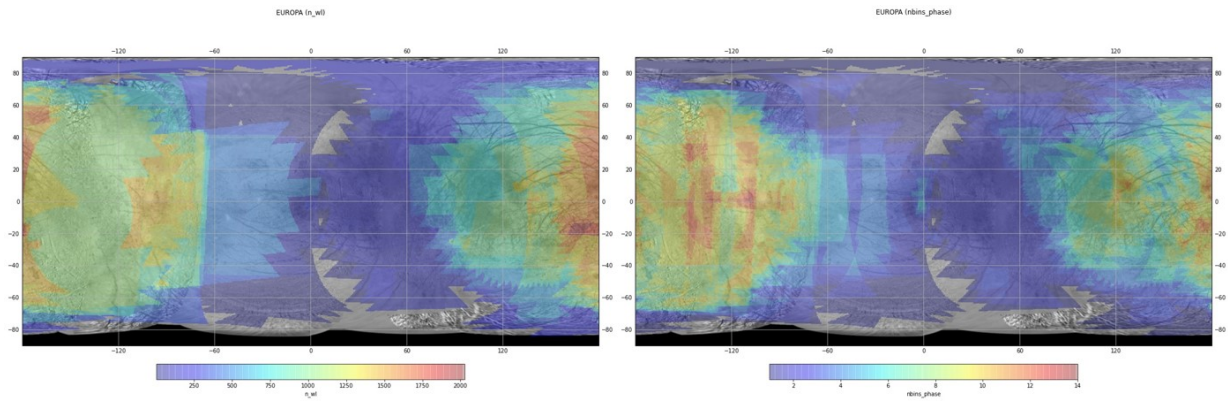


Figure 1: (Left) Spectral and (right) angular coverage of the NIMS data set on Europa. Colour coding: (left) number of unique wavelengths, and (right) number of 5degrees phase angle bins in a given 1deg x 1deg gridded area of Europa. Basemap: USGS Galileo SSI global mosaic.

### References

Carlson et al., *Space Science Reviews*, 60, 457-502, 1992.

Belgacem et al., 53<sup>rd</sup> LPSC, 1985, 2022.

Cruz-Mermy et al., 53<sup>rd</sup> LPSC, 2141, 2022.