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NIR spectral constraints of Europa's surface with ESO/VLT/ SINFONI

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Europa is a major exobiological target with its possible sub-surface briny ocean buried under a water-ice dominated crust of several km-thick. The upcoming ESA L-class mission JUICE to the Jupiter system and its payload will partly address this question, in particular through compositional remote sensing in the near-infrared (using the MAJIS imaging hyperspectral spectrometer) and visible (using MAJIS and the camera JANUS) wavelength range. A global compositional mapping campaign was performed between October 2011 and January 2012 with the integral field spectrograph SINFONI on the Very Large Telescope (VLT) in Chile for increasing our knowledge acquired with the NIMS instrument onboard the Galileo spacecraft and previous telescopic observations. The high spectral binning of this instrument (0.5 nm) is suitable to detect any narrow signature in the wavelength range 1.45-2.45 μm. The spatially resolved spectra we obtained over five epochs nearly cover the entire surface of Europa with a pixel scale of 12.5 by 25 m.a.s ($\sim$35 by 70 km on Europa's surface).

Depending on the hemisphere, our spectra are globally (1) dominated by crystalline water-ice distorted and asymmetric absorption features, or (2) dominated by sulfuric acid hydrate (Carlson et al. 1999b) coming from Iogenic sulfur ion bombardment. However, some well-identified geological structures such as crater (Pwyll) and some chaos regions (Tara Regio, Powys Regio) look spectrally different.
Although hydrated magnesium sulfates as epsomite ($MgSO4.7H_2O$) and chlorine hydrated salts were proposed to be present on the surface (Brown et al. 2013, Hanley et al. 2014), our preliminary fits from linear spectral modeling (using cryogenic laboratory spectra of these materials) cannot reproduce this result. Finally, no narrow signature, which could indicate the presence of material of exobiological interest, has been so far detected in this complex data set.