Title: Dawn at Ceres reveals an ammoniated surface

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Abstract

The Visible and Infrared Mapping Spectrometer (VIR) on board the Dawn spacecraft has observed Ceres' surface and acquired spectra (0.5 to 5 µm) since January 2015. Here we report the average Ceres spectrum, including the important spectral range (2.6-2.9 µm) previously precluded from (telescopic) measurements due to telluric atmospheric absorptions. The VIR data confirm that the surface is very dark with an average albedo of 0.090 ±0.006 at 0.55 µm, consistent with Hubble Space Telescope data (Li et al., Icarus, 2006) and contains no prominent absorption features in the visible and near-Infrared at wavelengths less than 2.5 µm. Ceres' average spectrum, however, is characterized by a prominent diagnostic absorption band at 2.7 µm along with weaker absorption bands observed between 3.05-3.1, 3.3-3.4 and 3.9-4 µm. We modeled the new VIR spectra of Ceres with various ices, meteorites, silicates, carbonates, and hydrates using Hapke theory. Results of the spectral modeling indicate that extensive water ice is not present in spectra representing the typical surface acquired to date at relatively low spatial resolution (<11 km/pixel). The best fit is obtained with a mixture of ammoniated phyllosilicates mixed with other clays, Mg-carbonates, serpentine, and a strongly absorbing material, such as magnetite (De Sanctis et al., Nature, 2015, in review). The presence of ammonia-bearing materials in the crust across much of the surface has implications for the origin of Ceres and its internal structure and evolution. At the time of this presentation the Dawn spacecraft will have also completed its high altitude mapping orbit to look for anticipated small-scale mineralogy variations across this remarkable dwarf planet.Acknowledgements: VIR is funded by the Italian Space Agency–ASI and was developed under the leadership of INAF, Rome-Italy. The instrument was built by Selex-Galileo, Florence-Italy. The analyses are supported by ASI, NASA, and the German Space Agency. Enabling contributions from the Dawn Instrument, Operations, and Science Teams are gratefully acknowledged.

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