Homogeneous spectral units on Ceres as inferred from Dawn/VIR

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Abstract

The dwarf planet Ceres, the largest object in the main asteroid belt, is being closely investigated by the NASA Dawn mission since the beginning of 2015. The Visible InfraRed (VIR) mapping spectrometer onboard Dawn has obtained hyperspectral images of Ceres, with spatial resolution increasing with decreasing distance from the surface. Using its overall spectral range from 0.25 to 5.1 μm, VIR will ultimately enable a comprehensive mapping of Ceres' mineralogy and surface temperature. Prior to Dawn, Ceres was extensively observed with the Hubble Space Telescope (HST), which resulted in low-resolution (30 km/px) albedo and color maps in the UV-VIS spectral domain. During the approach phase VIR acquired data with a spatial resolution of ~11 km/px, and confirmed the regional color trends identified by HST earlier. In the subsequent Survey mission phase hyperspectral coverage of Ceres was obtained at ~1.3 km/px, while in the High Altitude Mapping Orbit (HAMO) the nominal spatial resolution will be ~0.4 km/px. Unlike Vesta, which was investigated by Dawn in 2011-2012, the spectrum of Ceres does not display prominent absorption bands in the VIS-near IR range. Ground-based observations of Ceres highlighted a decrease in reflectance shortward of 0.4 μm and the existence of a broad absorption feature in the 3-μm region, associated with hydrated minerals. VIR data are key to unveiling the surface composition of Ceres at different spatial scales, providing answers to several unsolved questions. Compositionally homogeneous surface units, emerging in the VIS-IR spectral range sampled by VIR, are presented here for the first time. These units and their degree of similarity in terms of spectral parameters might provide insight on the surface processes that led to the composition observed nowadays.