The Mineralogy Of Ceres' Surface

Andrea RAPONI[1#+], Maria Cristina DE SANCTIS[1], Eleonora AMMANNITO[2], Carol RAYMOND[3], Christopher RUSSELL[4]

[1] National Institute for Astrophysics, Italy, [2] University of California at Los Angeles, United States, [3] California Institute of Technology, United States, [4] University of California, Los Angeles, United States

[#]Corresponding author: andrea.raponi@iaps.inaf.it [+]Presenter

The NASA Dawn spacecraft is in orbit around Ceres since early 2015. It found a very dark, cratered surface punctuated by small and extremely bright areas. The minerals on the surface provide clues to the processes that have taken place inside Ceres.

We investigate this mineralogy with the Visible and InfraRed mapping spectrometer (VIR) (De Sanctis et al., 2011) capable to acquire images of the surface, and the spectrum of the reflected light for each pixel of the image. Thanks to the spectrum we are able to derive the composition of the surface on the base of the spectral signatures typical of each mineral, which are known from the laboratory measurements.

All the dark surface of Ceres exhibits a similar composition: Mg-phyllosilicates, Mg-Ca-Carbonates, ammoniated-phyllosilicates, and a dark component, like magnetite, or carbon (De Sanctis et al., 2015).

The mineralogy of the small bright areas, called "faculae", is quite different. VIR detected huge amount of sodium carbonates, together with Al-phyllosilicates and ammonium-chloride. Such a composition can be explained by a process involving carbon, ammonium, salts, and water in liquid or brine form (De Sanctis et al., 2016).

Water is suggested among the main bulk constituents (Russell et al., 2016). The surface appear mostly dehydrated because of sublimation processes, but in some craters at the mid latitudes, VIR detected water ice also on the surface (Combe et al., 2016).

Another very peculiar composition has been detected in a northern crater called "Ernutet", where spectra show signatures of organics (De Sanctis et al., 2017).

This overview casts a new light on the dwarf planet. Its composition is rather unusual for an object orbiting in the main belt asteroid. One possible explanation is an origin in the outer solar system where the environment is much more rich in volatiles like ammonium, water, and organics.