

Comparing the VIRTIS Spectrum of 67P/Churyumov-Gerasimenko to Wild 2 and in Primitive Interplanetary Dust Particles

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The Visible and Infrared Thermal Imaging Spectrometer (VIRTIS) instrument, a point spectrometer with high spectral resolution covering the range from 2 to 5 microns, on the ESA Rosetta spacecraft obtained spectra of the surface of Comet 67P/Churyumov-Gerasimenko. The spectral region covered by VIRTIS has been well studied in meteorites, interplanetary dust particles (IDPs) collected by NASA from the Earth's stratosphere, and the samples of Comet 81P/Wild 2 that were delivered to Earth by the NASA Stardust spacecraft. Infrared spectra of the nucleus of Comet 67P/Churyumov-Gerasimenko acquired by VIRTIS show a broad absorption band observed at $\sim 3.3 \mu\text{m}$, a region of the spectrum where C-H, O-H, and N-H stretching features occur (Capaccioni et al., 2015). This broad feature is similar to the O-H feature exhibited by hydrous minerals, but shifted to a significantly longer wavelength. Capaccioni et al. (2015) compared the VIRTIS spectra to laboratory spectra of carbonaceous chondrite meteorites of the CI, CM, and CR types and concluded that none of the typical features of these meteorite spectra are compatible with the spectra of the surface of 67P/Churyumov-Gerasimenko. Comparison of VIRTIS spectra of 67P/Churyumov-Gerasimenko to the laboratory spectra of well-characterized extraterrestrial materials including the Wild 2 dust and the IDPs, a significant fraction of which are believed to be cometary, could aid in the interpretation of the 67P/Churyumov-Gerasimenko spectra. None of the Wild 2 particles examined by infrared spectroscopy exhibit an O-H feature, but this may be due to the high temperature reached during their capture in the aerogel collection medium. The O-H feature is also absent in all anhydrous IDPs. The hydrous IDPs exhibit varying strengths of both aliphatic C-H absorption features and the O-H absorption feature, but, as with the meteorites, the O-H feature occurs at a significantly shorter wavelength than the broad feature detected in 67P/Churyumov-Gerasimenko. Only one of the more than 50 IDPs analyzed by infrared spectroscopy has an infrared spectrum similar to that of 67P/Churyumov-Gerasimenko. This large, hydrous IDP, L2021 C10, has a broad absorption feature centered at the same position as the feature observed in 67P/Churyumov-Gerasimenko. In the case of L2021 C10 this feature is attributed to an O-H absorption feature in the position normally seen in hydrous minerals as well as a broad aromatic C-H feature, rarely detected in IDPs, and the aliphatic C-H feature seen in all IDPs examined thus far (Flynn et al., 2004). In the case of the VIRTIS spectrum of 67P/Churyumov-Gerasimenko the apparent shift of the broad O-H feature may actually result from the superposition of O-H and aromatic C-H features, both at their normal wavelengths.

References: Capaccioni, F. et al. (2015) *Science*, 347 no. 6220, DOI: 10.1126/science.aaa0628. Flynn, G. J. et al. (2004) *Advances in Space Research*, 33, 57-66.