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Analysis of dust in the coma of comet 67P using VIRTIS-M observations

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Abstract

We present a preliminary overview of the analysis on the dust spectrophotometry in the inner coma of comet 67/P that was obtained during the escort phase (started on December 2014) with the imaging spectrometer VIRTIS-M onboard the Rosetta mission [1]. The morphology and behavior of the dust coma has been monitored by VIRTIS–M from the arrival at the comet (~August 2014) throughout the early escort phase. The data reveal intricate details and numerous radial jets coming from different regions on the surface. On March 15, 2015, VIRTIS-M performed a set of 22 coma observations, each about 23 minutes in duration and offset from the nucleus by about 1 km. The 22 observations lasted about 12 hours and thus covered a complete rotation of the comet.

The maps of the dust distribution in the coma reveal three major structures: a roughly uniform background dusty coma, several enhanced radiance jet features and a region that shows a thermal radiation component between 3.5 and 5.0 µm. (Figure 1 and Figure 2) The jets features can be traced back to several region of the comet, neck, body and head.

We shall analyse the three major structures to provide the basis to understand coma composition and properties and the relation between gas and dust. We will discuss the morphology of the background coma, the jet and the enhanced thermal radiation. We will also examine correlations between the water vapor column density and the coma/jet /thermal radiation intensity. For the thermal radiation component there are several explanations, viz: stray instrumental scattered light or instrumental ghosts from heated part of the nucleus, or thermal radiation emanating from the nucleus and scattered by the dust in closest proximity or a region of small particles in the coma heated by solar radiation.

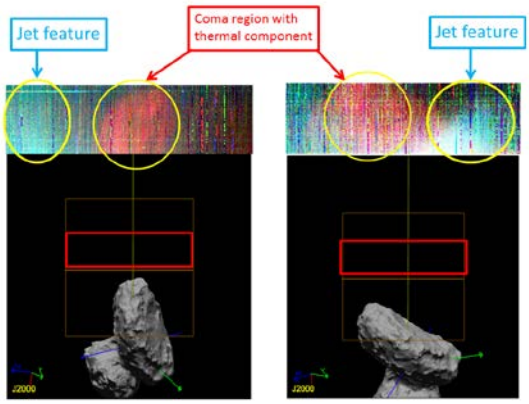

Figure 1: This figure shows two VIRTIS-M cube images (above) taken on March 15th at 2.11 AU and images of the Rosetta 3dtool below. The 3dtool shows the position of the comet with respect to the VIRTIS-M FOV (yellow square). The VIRTIS-M images start at the horizontal yellow line and extend about 2 km up. The figure shows the main structures in the coma: jet feature and the coma region with the thermal component.

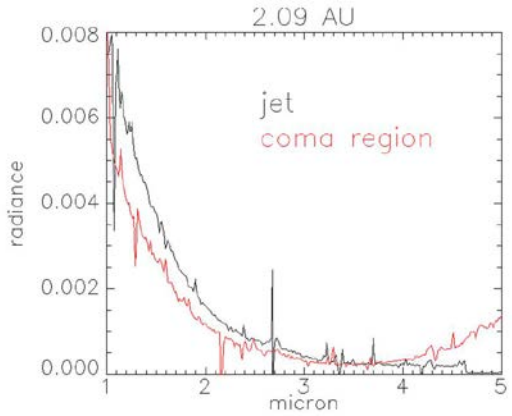

Figure 2: Example of VIRTIS-M spectral profiles in the IR channel. The black curve is a spectrum for the jet feature and the red curve is a spectrum of the region showing thermal emission. The figure shows that in the range between 3.5-5 μm the jet has a flat spectrum while the red curve shows a definite thermal signature.

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[1] Coradini et al.: VIRTIS: an imaging spectrometer for the Rosetta mission. Space Science Reviews, Volume 128, Issue 1-4, pp. 529-559, 2007.

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