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Searching for the spectral features of minerals on the surface and in the dust of the comet 67P/Churyumov-Gerasimenko in NIR spectral range of VIRTIS-M data

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Abstract

The main subject of the paper is constraining the composition of the surface and possibly of the dust on the comet 67P/Churyumov-Gerasimenko by means of comparison between the data from the VIRTIS instrument [1] onboard Rosetta and adopted model of the surface of asteroids [9]. As a first step we have taken into account the spectral range 2.0 - 4.0 µm. For our calculations Mie and Hapke's models have been considered.

1. Introduction

There are some observational evidences that the mineralogical composition of the comet 67P/C-G and the asteroid 24Themis can be similar [2,6]. The presence of water ice and organic compounds were detected on both objects [3,2,9]. Pyroxenes are also suggested as important mineral species. Spectra from these astronomical bodies show very similar trends around 3.0µm. Taking into account these facts we started to use as cometary analogs elaborated models of the surface of the asteroid 24Themis [9]. Considering the surface with various kinds and proportion of minerals suggested for the surface of asteroid 24Themis as a starting point for analysing cometary spectra we can expect that several new features will be detectable. The possibility of revealing a feature depends on the abundance of the particular species.
We show in Fig.1 an average VIRTIS-M spectrum (MTP008 I100371997863) from darkest regions of the surface of the Comet 67/P compared with preliminary simulation. The model is an intimate mixture containing 29% pyroxene coated with a 0.045-µm-thick layer of water ice and 71% of amorphous carbon [6,5]. The modelled grain size is about 20µm for all the components. The minimum in the model is shifted in comparison to the VIRTIS data toward smaller wavelength The work is in progress. Simulation will be continued and improved using better spectral resolution of optical constants and new size distribution of grains and new sources of optical data [7,8].

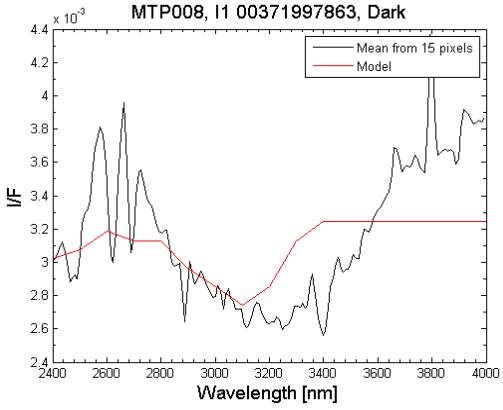

Fig 1.The average spectrum (black) from 15 pixels of darkest region of the surface of the comet 67/P C-G compared with smoothed low spectral resolution model [9]

2. Method

For our analysis the VIRTIS-M data the IDL\ENVI and additional codes written in MATLAB were used. The programs used for modelling the reflectances are Mie (e.g. for particles coated with water ice) and Hapke (for the reflectance of the mixtures).

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