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Variations of the radiation emitted and scattered from the dust in the inner coma of the Comet 67P/Churyumov-Gerasimenko: a possible basis for spectrometric searches

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Abstract

The work we present deals with the spectrometric measurements of the VIRTIS instrument part of the payload of the Rosetta mission to the Comet 67P/Churyumov-Gerasimenko (C-G).
The dust is an important constituent of cometary environment and is always present on the surface of the nucleus and in the inner coma. The cometary spectra are strongly affected by the processes taking place in the coma and by the structure, composition and the spatial distribution of cometary materials. The particles of the dust, illuminated by solar light, scatter, absorb and emit radiation. The reflected and emitted radiation are transmitted through the coma region before being collected by instruments such as VIRTIS. The reflection, absorption, scattering, and emission processes depend on the Comet-Sun geometry and on the thermal state of the nucleus.
In the present paper which is the continuation of our previous works (e.g. AGU fall meeting 2011, EGU 2012-abstracts) we are mainly concentrated on the influence of optical parameters of dust on spectra we expect from the VIRTIS/Rosetta measurements. To this purposes the equation of radiative transfer through the assembly of dust grains and various gases is solved. The number density distribution of the dust grains around the coma and their size distribution are drawn from the recent theoretical models. A few phenomenological scattering phase functions are taken into account.
The main purposes of the paper are:
1) discussion of various cometary dust materials, size distributions and optical parameters
- description of possible phase functions, extinction, asymmetry factors and their dependences
2) influence of state of activity of the coma on the signal to be measured by the VIRTIS spectrometer
3) demonstration of simulated spectra done by means of a radiation transfer models

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