

New infrared telescopic observation of Vesta

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Abstract

In this work we present new telescopic observations of the Vesta asteroid made at the Subaru Telescope by using the COMICS IR spectrometer. We were able to obtain 5 different observations in 5 day, at two different epochs. The obtained spectra do not exhibit Reststrahlen bands and show only weak features attributable to the Christiansen peak and to the transparency feature compatible with a fine grain size regolith.

1. Introduction

Vesta have been explored and mapped in detail by the Dawn space mission [1]. The measurements obtained by the VIR spectrometer demonstrated that Vesta is the parent body of the HED meteorites [2], in which the pyroxene mineralogy varies locally. Small deposits of olivine were found in the northern hemisphere of the asteroid [3,4]. The regolith grain size has been suggested to be < 45 micron [5]. Nevertheless, plagioclases which are one of the most important mineralogical component of the HED have not been detected on the surface of Vesta yet, since they have not clear features in the NIR. In addition, due to orbital and geometrical constraints, the northern hemisphere was not mapped completely and in large part it is still not explored.

2. Observations and data reduction

Vesta was observed on 23-24 January 2016 with two consecutive observations of 30 minutes. The HD5112 was also observed as standard star, used for removing absorptions of Earth's atmosphere and estimating the seeing size. The air mass during the spectroscopic observations of Vesta was 1.205, whereas the exposure time was 0.904 s. Background (sky+telescope) was subtracted from target spectra, then flat-field and spectral calibrations were performed. The successive data reduction operations were image transformation, shift-and-add spectra to

improve SNR and retrieval of Vesta spectra by means of standard spectra.

3. Results

Comparison with previous telescopic observations

Vesta has been already observed in the mid-IR by the ISO telescope with ISO-PHOT instrument [6] and the Kuiper Airborne Observatory (KAO) [7]. After a preliminary re-analysis we discarded the KAO data because they are not reliable [Cohen, personal communication]. The ISO spectrum doesn't match at all with our new observations. By comparing the emissivities, the ISO spectrum exhibit a larger spectral contrast with a completely different behaviour from the Subaru ones. The Christiansen frequencies obtained with the Subaru and ISO are 8.52 and 9.08 μ m, pointing to a pyroxene and olivine composition, respectively. We believe that both the very large spectral contrast and the composition retrieved by the ISO observation make these data a bit questionable

4. Conclusions

Our results are in line with what found by the Dawn space mission. The very low spectral contrast and the presence of a transparency feature indicate the presence of a very small grain size regolith, as suggested by some VIR analysis. The pyroxene composition is in agreement with the HED mineralogy. In addition preliminary analysis of the emissivity slopes could indicate, for the first time, the presence of plagioclases.

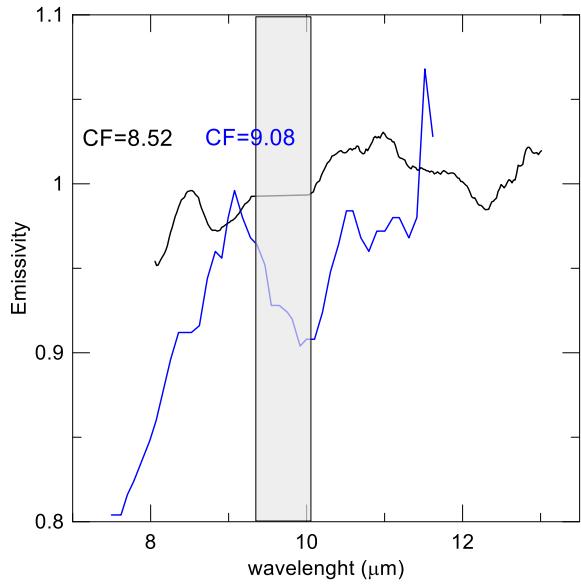


Figure 1. Vesta emissivity spectra. Subaru smoothed (black). ISO-PHOT (blue). The grey rectangle is a non-reliable spectral interval for the Subaru observation

References

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