
Abstract for the International Conference "Asteroids 2001: from Piazzi to the 3rd Millennium" that will be held in Santa Flavia (Palermo, Italy) from June 11 to June 16, 2001.

Title: "Adaptive optics study of asteroid 4 Vesta"

First Author: Christophe Dumas, Jet Propulsion Laboratory/Caltech (USA)

Co-Authors: Olivier Hainaut and Audrey Delsanti, European Southern Observatory (D)
Antonella Barucci, Observatoire de Paris-Meudon (F)
Chris Shelton, Mount Wilson Observatory (USA)

Presentation: poster

Abstract: (500 words max.)

Ground-based telescopes equipped with adaptive optics can resolved main-belt asteroids with a typical spatial resolution from about one hundred kilometer (medium-size telescope) down to a few tens of kilometer (8-10 m class telescopes) at 2 micron. This resolution is sufficient to start a geological study of the largest asteroids by measuring their shape, estimating their collisional history and mapping the distribution of minerals in surface.

Among the large main-belt asteroids, Vesta is of particular interest since it is the sole ''intact'' asteroid that may have undergone heating at temperatures capable to produce a complete planetary-type differentiation. From earlier reflectance spectroscopic studies (e.g. Gaffey et al. 1997), we know that the surface of Vesta is characteristic of igneous rocks, mostly a pyroxene-plagioclase assemblage with few regions where the excavated crust displays the feldspar-poor inner mantle material (diogenite). At a few locations, impacts occurred at energy sufficient to expose the deeper olivine rich layer of the mantle. Such impact sites are a possible source for the HED meteorites collected on Earth and Vesta is also presumed to be the parent-body of a group of small Vesta-like asteroids located near the 3:1 resonance with Jupiter (Binzel and Xu 1993). Observations of Vesta carried-out with the Hubble Space Telescope (Thomas et al. 1997, Binzel et al. 1997) revealed the presence of a large impact zone located near Vesta south-pole. In order to understand how Vesta differentiated, a measure of the distribution of the diverse geological units over its surface is needed: in case of total melting of the asteroid, the diogenite-like layer would be confined underneath the eucritic crust while a partial melting would implicate a crust composition made of a mixture of feldspar-rich (plagioclase) and feldspar-poor (diogenites) units.

Over the past few years, we focused our interest on adaptive optics observations of the asteroid 4 Vesta from several astronomical facilities (Mt Wilson Observatory, Canada-France-Hawaii telescope, European Southern Observatory and Palomar Observatory). Several narrow band filters matching the absorption bands of pyroxene, olivine and also feldspar have been used to image Vesta between 0.9 and 2.0 micron during the 1996 and 1997 oppositions, while spatially resolved spectroscopy of Vesta surface was obtained last year from Palomar Observatory. We will present the results obtained from these campaigns and discuss their implication on our understanding of the formation and collisional history of Vesta.

References:

- Binzel, R. P., Xu, S. 1993. Science 260, 186.
- Binzel, R. P., Gaffey, M. J., Thomas, P. C., Zellner, B. H., Storrs, A. D., Wells, E. N. 1997. Icarus 128, 95.
- Thomas, P. C., Binzel, R. P., Gaffey, M. J., Storrs, A. D., Wells, E., Zellner, B. H. 1997. Science 277, 1492.