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Origins and evolution of asteroid (2) Pallas

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1. Introduction

(2) Pallas is the largest main-belt asteroid never explored by spacecraft. Because it was never studied in situ, its surface geology remains largely unknown, limiting our understanding of its origin and collisional evolution. Ground-based observational campaigns returned different estimates of its bulk density [1,2] that are inconsistent with one another, one measurement [1] being compatible within errors with that of the icy dwarf-planet Ceres (2.16 ± 0.01 g/cm^3), and the other [2] compatible within errors with that of the rocky protoplanet Vesta (3.46 ± 0.03 g/cm^3).

2. Observations

We used the sharp angular resolution of the SPHERE/ZIMPOL camera on the Very Large Telescope [3] to characterize Pallas' bulk and surface properties and, in turn, bring new constraints on its origin and evolution. A total of 11 series of images were acquired during two apparitions as part of our ESO "HARISSA" large program [4]. These images provide a full surface coverage, Pallas being resolved with $\sim$120 to 130 pixels along its longest axis. The optimal angular resolution of each image was restored with Mistral, a myopic deconvolution algorithm [5].

3. Results

We will present the results of our observations and discuss the origins and evolution of Pallas. Specifically, we will introduce a detailed analysis of Pallas' bulk density, global shape, and high crater density, as well as series of numerical simulations used to interpret these observations in terms of formation time and location, and subsequent thermal and collisional evolution. Finally, we will discuss possible links between Pallas and other small bodies in the asteroid belt and the near-Earth space in light of our new observations and simulations.

References

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