MUTUAL ORBIT, BULK DENSITY AND FORMATION SCENARIO OF VISUALISED MULTIPLE ASTEROIDS

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The advent of high angular resolution imaging provided by instruments such as ground-based telescopes equipped with adaptive optics (AO) systems, and also by the Hubble Space Telescope, permitted the discovery of several visualized mutiple asteroids on the last decade. At the time of writing, more than thirty systems have been imaged, including two triple asteroid systems: 45 Eugenia and 87 Sylvia. Despite recent simulations involving catastrophic collisions, fission via the YORP effect, and split due to tidal effect with a major planet among others, the formation of most of these multiple asteroid systems is not yet understood. Insights into these binary systems, such as the orbital parameters of the satellite, the size and shape of the components of the system, the physical and chemical properties of their surface, their bulk density and distribution of materials in their interior could provide a better understanding of how these multiple asteroidal systems formed. Over the past few years, our group has focused its attention on binaries located in the main-belt which have been discovered visually. We initiated an intensive campaign of observations from 2003 through 2006 combining the adaptive optics high-resolution capabilities of various 8m-class telescopes (UT4 of the Very Large Telescope, W.M. Keck-II and Gemini-North) equipped with Adaptive Optics (AO) systems that allow us to resolve the binary system. This project aims at studying the binary asteroid characteristics using high angular capabilities provided by large aperture telescopes with AO systems. We have separately published a complete analysis of the orbit, size and shape of 90 Antiope, a similarly sized doublet asteroidal systems (Descamps et al., Icarus, 2007). We performed the same analysis for binary asteroids with small satellite publishing a complete analysis of 12 binary systems (Marchis et al., Nature, 2005; Icarus 2007ab). Our work revealed a large diversity in their mutual orbits suggesting a different origin and evolution. Their bulk density is quite variable depending of their taxonomic classes and, in most of the case they have a significant macro-porosity (>30%) suggesting a rubble-pile interior.

This talk will give us the opportunity to present a synthesis of these multiple asteroid system properties, including additional studies in progress (lightcurve of mutual events in visible) and future ideas (comparative spectroscopy) which will help to get insights on the formation process of these systems.

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