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ESO/VLT/SPHERE Survey of D>100km Asteroids (2017-2019): (16) Psyche

M.Viikinkoski (1) P. Vernazza (5), M. Marsset (2), J. Hanuš (3), B. Carry (4), A. Drouard (5), R. Fetick (5), F. Marchis (6), E. Podlewska (7), P. Bartczak (7), T. Santana-Ros (7), M. Birlan (8), C. Dumas (9), M. Kaasalainen (1), B. Yang (10), J. Ďurech (3), L. Jorda (5), P. Lamy (5), A. Vigan (5), T. Fusco (5), T. Michalowski (7), A. Marciniak (7), M. Pajuelo (8), P. Michel (4), P. Tanga (4), J. Berthier (8), F. Vachier (8), J. Castillo-Rogez (11), O. Witasse (12), F.Cipriani (12), E. Jehin (13), M. Ferrais (13) (1) Tampere University of Technology, Mathematics Laboratory, Finland (matti.viikinkoski@tut.fi) (2) Queen's University of Belfast, UK (3) Charles University in Prague, CZ (4) OCA, France (5) Laboratoire d'Astrophysique de Marseille, France (6) Seti institute, USA (7) Astronomical Observatory Institute, Faculty of Physics, Adam Mickiewicz University, PL (8) IMCCE, FR, (9) TMT, USA, (10) ESO, CL, (11) JPL, USA, (12) ESTEC, NL, (13) Institut d'Astrophysique de l'Université de Liège , BE

Abstract

Asteroid (16) Psyche is the largest of the M-type asteroids in the main belt. High radar albedo is an indicative of metallic nickel-iron composition and albedo variegation both at radar and visible wavelengths suggest surface heterogeneity. Recent studies [1, 2] estimate that Psyche is an exposed core (either intact or a rubble pile) of a Vesta-like planetesimal. The uniqueness of Psyche is the main reason for its selection as the target of Discovery-class mission, which is planned to be launched in 2022.

The asteroid has been previously observed with both the Arecibo range-Doppler radar and the Keck adaptive optics system. While the Keck observations covered most of the asteroid's surface, their resolution were insufficient to distinguish any details. The range-Doppler images, on the other hand, showed a detailed view of the southern hemisphere, although everything above 45° latitude was unseen by the radar.

We present new high-resolution images obtained with the SPHERE/ZIMPOL visible light adaptive optics camera at VLT during May-June 2018. The adaptive optics system facilitates observing at the resolution close to the diffraction limit, which is approximately 18 mas in the visible band. The camera pixel size is 3.6 mas, or about 6 km projected at the distance of Psyche. Observed at opposition, the images provide a highly detailed view of the previously unobserved northern hemisphere.

We use the SPHERE adaptive optics images, together with the earlier Keck data, stellar occultations, lightcurves, and range-Doppler images to derive a non-convex 3-D shape model of the asteroid. We estimate shape and size uncertainties, analyze prominent topographic features and study their consistency across observations.

References

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