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Presentation Abstract

Title **Pre-flyby Determination Of The Size, Shape, Pole, Density, And Satellites Of (21) Lutetia From Ground-based Observations**

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Abstract Prior to the flyby of (21) Lutetia by Rosetta, we initiated a campaign of observations to characterize the system, primarily using ground-based adaptive optics (AO) on large telescopes, including Keck, Gemini, and VLT. We coordinated these efforts with HST observations (Weaver et al. 2010 A&A in press) made in support of the Rosetta ALICE UV spectrometer. Lutetia was 0.10" in diameter, allowing disk-resolved imaging with AO and tracking of its shape during rotation. We modeled the shape using both a triaxial-ellipsoid model (Drummond et al. 2010 A&A submitted) and a full 3D radius-vector model (Carry et al. 2010 A&A submitted, in which we combine AO imaging with decades of lightcurve data to produce an improved 3D model using our inversion algorithm KOALA). To overcome limitations in each model, we combined the best aspects of each to produce our best-estimate 3D shape model, a hybrid having ellipsoid-equivalent dimensions of 124 x 101 x 93 km (± 5 x 4 x 13 km) and effective diameter 105 ± 7 km. We find the spin axis of Lutetia to lie within 5 deg of [long, lat (52,-6)] or [RA DEC (52,+12)], and determine an improved sidereal period of 8.168270 ± 0.000001 h. We predicted the geometry of Lutetia during the flyby and showed that the southern hemisphere would be in seasonal shadow at that time. The model suggests the presence of several concavities that may be associated with large impacts. Using two separately determined masses and the volume of our hybrid model, we estimate a density of 3.5 ± 1.1 or 4.3 ± 0.8 g/cc, favoring an enstatite-chondrite composition for this large M-type asteroid, although other compositions are formally allowed. No satellites larger than 1 km diameter were detected in the AO-data over a significant fraction of the Hill sphere (10-240 asteroid radii).