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Presentation Abstract

Title	**Pre-Rosetta Compositional Studies of Asteroid 21 Lutetia**
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Abstract	On 10 July 2010, Rosetta successfully flew by the large main-belt asteroid 21 Lutetia, providing a rare chance to compare close-up, spatially resolved observations and compositional interpretations with the lengthy, detailed record of Earth-based telescopic data. Lutetia (and two other asteroids) originally defined the M taxonomic type (Zellner & Gradie 1976, AJ 81, 262). This mnemonic for "metal" never exclusively meant "iron core," but included enstatite chondrites (EC), which are colored by metal grains. In the mid-1990s, some M-types (W's) were found to have 3 micron absorption bands indicating hydration; Rivkin et al. (2000 Icarus 145, 351) originally included Lutetia in this class. During four decades, Lutetia has been observed by radiometry, polarimetry, lightcurve photometry, spectrophotometry (UV into mid-IR), thermal IR, radar, and direct imaging. Lutetia's estimated mass, size, and shape tend to rule out low (carbonaceous chondrite) or high (nickel-iron) densities, but are not definitive. Relatively dense, high-albedo CV and CO chondrites were suggested as analogs for Lutetia (cf. Barucci et al. 2005 A&A 430, 313) but are marginal or ruled out by spectral traits that define the M/W types and separate them from C-like types. W's are uncommon but not extremely rare in the main belt, so one would expect sampling by meteorites, yet the only hydrated ECs are clasts within the unusual Kaidun meteorite. If Lutetia is not a hydrated EC, then it may be either (a) not significantly hydrated, (b) masked by unknown surface properties analogous to space weathering, (c) a mixture of known meteorite types (like the 2008 TC3 = Almahata Sitta meteorite), or (d) an unknown or extreme kind of meteorite, like Allende but with a superabundance of CAIs. Since Rosetta's remote-sensing techniques resemble those employed from Earth, it may not fully resolve these issues.