**Title:** Further constraints on the surface composition of asteroid (16) Psyche using laboratory reflectance spectroscopy and implications for the NASA Psyche mission’s Multispectral Imager

**Authors:** Steven Dibb, James F. Bell III, Linda Elkins-Tanton, David A. Williams, and the Psyche Mission Team

 The NASA Psyche Discovery-class mission will explore the solar system’s largest M-type asteroid, (16) Psyche, to test theories about its composition and formation. Recent measurements of density, radar reflectance, and spectral signatures indicate that the asteroid is likely to have a significant non-metal component (between ~40–70 vol.%) and/or significant bulk porosity (up to 20%). To further constrain the surface composition of the asteroid, we compared the measured reflectance spectra of 40 meteorite and mineral samples (irons, mesosiderites, pallasites, ordinary, enstatite, and carbonaceous chondrites, and both terrestrial and meteoritic sulfides) with available telescopic spectra of (16) Psyche. Lab data were collected relative to a Spectralon white reference target at ambient conditions using an ASD FieldSpec 4 with a phase angle of 30°. Surfaces were roughened and/or smoothed with a set of diamond files, and powders were produced by grinding with the files or crushing in an impact mortar and pestle. In addition to spectral slopes and band centers/depths, we use a Chi-square test statistic to compare our measured spectra to published spectra of (16) Psyche. The published spectra are most consistent with our spectra of powders of iron meteorites, CB chondrites, and both meteoritic and terrestrial troilite. Larger grain sizes (>75 micron fractions and mixtures of grains up to ~2 mm) are generally slightly more consistent with spectra of (16) Psyche than smaller grain sizes (<75 micron fractions). The Psyche spacecraft’s Multispectral Imager is designed to map the surface at high spatial resolution using 7 narrowband filters at visible to near-infrared wavelengths (~400–1100 nm). Our lab spectra convolved to Imager bandpasses show that reflectances, spectral slopes, and band depths in this wavelength range can be used to discriminate the materials most spectrally similar to (16) Psyche.