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**COMPOSITIONAL ANALYSIS OF NEAR-EARTH ASTEROID 2015 JD1**

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##### ABSTRACT

Characterizing Near-Earth Asteroids (NEAs) is essential to improve impact probabilities. López-Oquendo et al. (2020) presented near-infrared (NIR) spectral variability of the NEA 2015 JD1 detected with the 4.3-m Lowell Discovery Telescope. The spatially resolved NIR spectra showed evidence for both red (positively sloped) and blue (negatively sloped) spectral slopes. The changes in spectral slope were interpreted as evidence for an inhomogeneous surface on 2015 JD1. Here, we present a detailed compositional characterization of such variability.

The spectra of 2015 JD1 presented a visible absorption feature centered at 0.5 µm, typical of sulfides, with featureless NIR spectra. Gaffey & Kelley (2004) and Clark et al. (2004) presented spectroscopic classifications of E-types asteroids based on absorption features in the spectra and compositional similarities to the E-types Nysa, Angelina, and Hungaria, respectively. According to these classifications, 2015 JD1 is an E[II] type asteroid compositionally similar to the Angelina-like group, which is characterized by having a sulfide absorption feature at 0.5 µm and a weak oldhamite one at 0.9 µm. The classification of 2015 JD1 as an E[II]-type with a 0.5 µm absorption feature indicates that the red surface is rich in sulfides.

We developed a compositional study to determine whether the blue spectra are due to grain size effects or different compositions. We selected meteorites analog to E-types (aubrites) and minerals from the Reflectance Experiment Laboratory database. We analyzed each meteorite's intrinsic visible reflectance color and NIR spectral slope to find the most likely scenario that could explain the spectral variability. We found that larger grain sizes decrease the spectral slope while also reduce the visible color. We noticed that grains ranging from 45 µm up to chip-size would contribute to a NIR slope change of <10%. Different grain sizes, uniquely, cannot explain the ~40% NIR slope variation of 2015 JD1 (López-Oquendo et al., 2020). The analysis indicates that the red (spectral) surface of 2015 JD1 is rich in iron and sulfides, also supported by the Clark et al. (2004) classification. On the other hand, the blue (spectral) region coincides with meteorites rich in enstatite-silicates and low iron content.

These results support the following scenario: 2015 JD1 is an E-types asteroid rich in sulfides and iron with a surface patch richer in silicates and deficient in iron, responsible for the spectral variability observed in this sub-kilometer NEA. These results show evidence for spectral heterogeneity across surfaces in the NEA population. Identifying potential heterogeneous bodies in near-Earth space is important for planetary defense. Heterogeneous NEAs may have different thermal radiation properties across their surface, leading to solar radiation forces (i.e., YORP) acting on the surface that could impact detailed orbital predictions.

References: [1] López-Oquendo, A., et al. 2020, in AAS/DPS Meeting Abstracts, Vol. 52, id. 415.01. [2] Gaffey, M. J., & Kelley, M. S. 2004, in LPSC, ed. S. Mackwell & E. Stansbery, 1812. [3] Clark, B. E., et al. 2004, J. Geophys. Res.(Planets), 109.

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