EGU24-7979, updated on 11 Aug 2024
https://doi.org/10.5194/egusphere-egu24-7979
EGU General Assembly 2024


# VNIR Spectral comparison between S-Type asteroids and brachinites and ungrouped brachinites-like, in support of the HERA mission

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The Didymos-Dimorphos binary system, target of the DART mission that successfully impacted the small moon Dimorphos in September 2022, is classified as an S-type asteroid. It shows spectral properties that well fit with the regions that are closer to high olivine abundances in the Band Area Ratio (B.A.R.) versus Band Center at 1 μm (BCI) plane. Further investigation of the Didymos-Dimorphos system will be performed with the HERA mission, to be launched in October 2024. S-type asteroids are characterized by spectral properties that span from low-Ca pyroxene, up to high-Ca pyroxene and olivine content, with possible different abundances of those phases. Different potential types of meteorites can overlap this region as suggested in different works. High interest is generally attributed to those objects with spectral properties that are in between pyroxene and olivine composition to better understand the potential detection limit of olivine and so clarify the olivine-paradox. Here, we investigate the spectral properties of 12 brachinites and ungrouped achondrites brachinite-like (UBAs), that have olivine abundance between 57% and 94% (and fayalite, Fa, between 17.5% and 34%) with some minor variation in mineral association, abundance, and composition. We study the Visible to Near Infrared (VNIR) reflectance properties to evidence how they change in a spectral range suitable to investigate S-types and compare with Didymos spectral properties. In the VNIR spectral range these samples clearly show a systematic trend between the BCI and the B.A.R. that correlate with the olivine abundance and slightly with iron content on olivine. In fact, meteorites with high olivine amounts but a very low Fa content (i.e. low iron) have positions of the absorptions coherent with the associated pyroxene. Clearly the samples investigated in this work moved from the portion of S (III) type with higher BCI up to the region defined by the S (I) type as defined by Gaffey et al. (1993), with VNIR mainly dominated by olivine. We can notice how Didymos nicely fit within this domain defined by brachinites-UBAs and it is slightly out from the OC boot defined by the S (IV) type.

This research was supported by ASI-INAF n.2018-16-HH.0 (Ol-BODIES project) and by ASI (agreement n. 2022-8-HH.0) for ESA's Hera mission.