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Methods for studying the Didymos - Dimorphos system using the observations from HyperScout-H instrument onboard of Hera mission

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ABSTRACT

The ESA/Hera planetary defence mission aims to provide detailed characterization of the (65803) Didymos near-Earth binary asteroid. The HyperScout-H (HSH) instrument, which will fly onboard on the spacecraft, will provide hyperspectral images over 665 - 975 nm wavelength range. The observations will allow to obtain compositional information regarding both asteroids, the main object Didymos and its moon, Dimorphos. Also, they will will complement the data obtained by the main camera (Asteroid Framing Camera) which are used for geomorphological studies. Furthermore, HSH will obtain images with high spatial resolution of the crater generated by the NASA DART impact.

The measurements obtained by HSH instrument represent a key element for understanding the Didymos - Dimorphos system, its composition, the space-weathering effects and the possible presence of exogenous material. This presentation will provide an overview of the ongoing scientific activities, the instrument setup, and the expected results. We introduce the methods that can be used to analyze the data obtained by this instrument.

Our first step was to generate test cases by using the images provided by Hayabusa for Itokawa. They were obtained with different broad band filters which cover the HSH spectral interval. We expect similar composition and space-weathering patterns at the surface of Didymos and Dimorphos. Thus, we designed an algorithm to convert these exposures into images as they would have been observed by the HSH.

Second, we implemented a preliminary demosaicking algorithm of the HSH images in order to retrieve the spectra. Two approaches were tested, a basic one

which takes into account the pixels position and their corresponding wavelengths, and another one based on the pattern recognition using neural networks.

Last but not least, we designed methods to analyze the data resulting from HSH observations. These include the taxonomic classification and the comparison with the Relab spectral database. We also monitor the spectral slopes across the surface and an estimation of band depth (we expected 1 micron band characteristic for olivine-pyroxene compositions).

These simulations allows us to imagine various test cases, including the presence of different surface heterogeneity or the presence of exogenic material, and to quantify the possibility to detect them using the HSH instrument.

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Comments: *Oral preferred*