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NEO Characterization

JURA: THE JUVENTAS RADAR ON HERA TO FATHOM DIDYMOON

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ABSTRACT

Five years after the impact of DART/NASA on Dymorphos, ESA HERA mission will be a unique opportunity to observe in detail this bodies, the crater and the ejecta in order to better constrain mechanical models providing a global characterization of the binary system: shape, density, dynamic properties, thermal properties and composition. The Hera mothercraft will carry two CubeSat's, Juventas and Milani. The small spacecraft Juventas will investigate the asteroids' internal structure. Information about the internal structure is crucial for science, planetary defense and exploration since our current knowledge relies entirely on inferences from remote sensing observations of the surface and theoretical modeling.

JuRa is a monostatic radar, BPSK coded at 60MHz carrier frequency and 20MHz bandwidth, inherited from CONSERT/Rosetta and redesigned in the frame of the AIDA/AIM phase A/B. The instrument design is under validation for a flight model delivery end of 2022.

JuRa maps the backscatter coefficient (sigma zero - σ0) of the surface and of the subsurface, which quantifies the returned power per surface or volume unit. It is related to the degree of heterogeneity at the scale of the wavelength and to the dielectric contrast of heterogeneities, giving access to both, the sub-meter texture of the constituent material and larger scale structures.

- The first goal of JuRA is to characterize the moonlet's interior, to identify internal geological structure such as layers, voids and sub-aggregates, to bring out the aggregate structure and to characterize its constituent blocks in terms of size distribution and heterogeneity at from submetric to global scale.
- The second goal is to estimate the average permittivity of the moonlet and its spatial variation in order to retrieve information on the composition and porosity. Radar signals bypasses the near surface alteration due to the space-weathering and thermal-cycling as which is observed with the optical remote sensing. The observation of the structure and composition of the moonlet will provide constraints on the mechanical model of the impact process.

- The secondary objective is to characterize the main asteroid of the binary system to detect differences in the texture and in the composition when compared to the observation of the moonlet. This will permit to constrain the model of binary system formation, to discriminate between progressive versus catastrophic process and more generally to constraint the stability conditions of the system.

In this talk, we will review the JuRa science objectives and the instrument development status. We will show the results of the model end-to-end tests and the corresponding instrument performances. Then we will present the proposed radar operation strategy and the developed approaches for data processing.

Acknowledgments

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Comments: Oral presentation preferred.

(Alternative session, Time slot, Oral or Poster, Etc…)