

Icy moon exospheres: the interface between Jovian environment and satellite surfaces as a key scientific target for JUICE

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The exospheres of Jupiter's icy satellites -often referred to as tenuous atmospheres- represent the actual interface between the surfaces of these moons and the giant planet's environment. In this perspective, their characterization is of key importance to achieve a fully understanding of the alteration processes induced on the icy surfaces by the radiation environment. Therefore, a full interpretation of the surface data and a thorough understanding of the surface evolution history, have as a necessary prerequisite the accurate determination of the role of the exospheres in the interactions between the icy moons and the Jupiter's magnetospheric environment. Moreover, in order to understand the mass and energy exchange between satellites and Jovian environment, the detailed characterization of the exosphere as a boundary region between the moon and the giant planet's magnetosphere, is fundamental. In this paper, we show that the achievement of the science objectives of the JUICE mission related to the icy satellites exospheres will be feasible only through an interdisciplinary approach characterized by coordinated observation scenarios and joint campaigns in payload operations. It is evidenced that it is of key importance to measure - in the larger possible extent - the following quantities: density of neutral species; density of ionosphere and charged particles fluxes; efficiency of interactions of the exosphere with particle and photon radiation fields. Through the planning of potential synergies between different datasets to be obtained during different mission phases, the current paper aims to contribute to the achievement of both of the JUICE mission's Key Science Goals, i.e. 1) the characterization of Ganymede, Europa and Callisto as planetary objects and potential habitats and 2) the exploration of the Jupiter system as an archetype for gas giants. The suggested planning for joint observations by different JUICE payload instruments could be extended later in the mission, when further investigations dedicated, for example, to multi-data analysis, comparative interpretation and modeling, will be required.