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Simulation of Europa's water plume

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Abstract.

Plumes on Europa would be extremely interesting science and mission targets, particularly due to the unique opportunity to obtain direct information on the subsurface composition, thereby addressing Europa's potential habitability. The existence of water plume on the Jupiter's moon Europa has been long speculated until the recent discover. HST imaged surpluses of hydrogen Lyman alpha and oxygen emissions above the southern hemisphere in December 2012 that are consistent with two 200 km high plumes of water vapor (Roth et al. 2013). In previous works ballistic cryovolcanism has been considered and modeled as a possible mechanism for the formation of low-albedo features on Europa's surface (Fagents et al. 2000). Our simulation agrees with the model of Fagents et al. (2000) and consists of icy particles that follow ballistic trajectories. The goal of such an analysis is to define the height, the distribution and the extension of the icy particles falling on the moon's surface as well as the thickness of the deposited layer. We expect to observe high albedo regions in contrast with the background albedo of Europa surface since we consider that material falling after a cryovolcanic plume consists of snow. In order to understand if this phenomenon is detectable we convert the particles deposit in a pixel image of albedo data. We consider also the limb view of the plume because, even if this detection requires optimal viewing geometry, it is easier detectable in principle against sky. Furthermore, we are studying the loss rates due to impact electron dissociation and ionization to understand how these reactions decrease the intensity of the phenomenon. We expect to obtain constraints on imaging requirements necessary to detect potential plumes that could be useful for ESA's JUICE mission, and in particular for the JANUS camera (Palumbo et al. 2014).

References

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