

Preliminary design of a CubeSat for plume sampling and imaging at Europa

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Abstract

Europa is the closest and probably the most promising target to perform a comprehensive characterization of habitability and search for extant life. A proposal to ESA's Cosmic Vision programme has recently been submitted in order to propose that NASA and ESA join forces to design an ambitious planetary mission (JEM, for Joint Europa Mission) to reach this objective. JEM will be assigned the following overarching goal: Understand Europa as a complex system responding to Jupiter system forcing, characterize the habitability of its potential biosphere, and search for life in its surface, sub-surface and exosphere. The proposed JEM mission will consist of two space platforms: a carrier/relay/orbiter platform (hereafter referred to as orbiter), and a soft lander platform.

Possible CubeSat additions to JEM can complement the science objectives in a unique way, in order to study phenomena of great interest not achievable by the orbiter. The recent observations by the Hubble Space Telescope of plumes rising hundreds of kilometres above Europa's surface rises the interest for directly sampling the material from these plumes, when occurring, as part of our life search strategy.

In this paper, we will present a preliminary design of a 12U CubeSat designed to be deployed by the Joint Europa Mission in order to study in detail potential Europa plumes through in situ measurements of their charged particles and magnetic field environments as well as imaging of their surface sources. Flying a CubeSat in the Jupiter/Europa environment constitutes a significant challenge and we will address in particular issues related to propulsion, power as well as radiation mitigation.