Microbial component detection in Enceladus snowing phenomenon; proposed missions instrumentation analysis

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Abstract

Enceladus is an attractive place to look for signs of life thanks to liquid water and the availability of energy. Recent research has proven that the ejected material of Enceladus south pole consists of water vapor, water ice, carbon dioxide, methane and molecular hydrogen. Possible similarities of physical and chemical conditions between Enceladus ocean bottom and the carbonate mineral matrix of actively venting chimneys of the Lost City Hydrothermal Field give an opportunity to create a mathematical model of microbial ascent process through the ice shell. In this study we present first results of particle-in-cell kinetic simulations of microbial distance through 10 km deep ocean. We have obtained results for microbial component – *Methanosarcinales* sp. analogue – characterized by 6.6 pg mass and 2.0 μm diameter distribution in Enceladus plumes. We have assumed 0.1 W m-2 heating process, 5 km ice shell and cells concentration near ocean bottom 105 cells/mL. We have confirmed assumption of Porco research team about cells concentration near ocean surface _˜104 cells/mL and vertical density diversity in plumes. We have found that the optimal altitude for microbial component detection is $<$ 1.0 km and that *in-situ* measurements done previously by Cassini mass spectrometer and proposed for Enceladus Orbiter mission 50 km altitude would be ineffective.

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