

Numerical simulation of the passive subsurface radar for Jupiter's icy moons

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The subsurface ocean at icy bodies in our solar system is one of the most likely habitable environments except for Earth. While the subsurface ocean of Enceladus at Saturn has been already demonstrated with the Cassini explorer, it is still unclear that Europa and Ganymede at Jupiter have it although they are theoretically predicted to have greater amount of liquid water than Earth. The highest priority is placed on detections of the subsurface ocean and related water plume activities at Jupiter's icy moons in the Jupiter Icy Moon Exploration mission JUICE, which is going to start exploration in early 2030s. Here we numerically simulate the passive subsurface radar PSSR for the icy moon's ocean that is going to be observationally made by receiving Jupiter's auroral radio emissions with the radio and plasma wave instrument RPWI onboard JUICE. Based on the ray tracing method, we simulate propagation of Jupiter's radio emission in the icy moon's water plume, tenuous ionosphere, and interior assuming the plasma density and dielectric constant structures. The simulation indicated that some of the structures are clearly detectable by PSSR if the incident radio emission forms chirpy waveform packets at HF frequencies.

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