R009-08
Zoom meeting D ：11/1 AM2 (10:45-12:30)
11:15〜11:30

Numerical radar simulation for the explorations of the ionosphere at Jupiter's icy moons

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Jupiter's icy moons such as Europa and Ganymede may harbor subsurface liquid water oceans and have ionospheres and plumes created from the oceanic water materials. While only Earth has the ocean on the surface in the current solar system, multiple icy bodies like the icy moons of giant planets have oceans in their subsurface under the icy crust. The icy bodies' oceans are potentially more universal habitable environment than the Earth-type surface ocean. Structures of the ocean and the ionosphere of the icy moos are essential information for understanding the universality of habitable environments. However, the structures of the oceans are unknown because in-situ or lander explorations on the surface of icy objects, the most effective method for exploring the structures, are still at technically conceptional level at present. The structures of ionospheres are still unclear as well because the ionospheric radio occultation and other effective explorations have difficulties of limited observing opportunities. Here we are going to uncover the structures of the ocean and the ionosphere of Jupiter's icy moons by the radar exploration with the Radio & Plasma Wave Investigation (RPWI) and the Radar for Icy Moon Exploration (RIME) onboard the JUpiter ICy moons Explorer (JUICE) launched in 2022. For the investigations of radio wave sounding in and around the icy moons with RPWI and RIME ranging in tens KHz to tens MHz, we are now developing a numerical simulation code that models the propagation of electromagnetic (EM) waves in the ionospheres of the icy moons. As the first step, we emulate occultation of the Jovian radio waves by the icy moon's ionospheric structures during the flybys of the Galileo spacecraft to Jupiter's icy moons. In this presentation, we are going to propose the vertical ionospheric profiles at the altitude below the orbiter where only remote observations can reach. So far (July 2021) we have found that the EM wave rays are significantly refracted in the ionosphere and have demonstrated that the structures are detectable by the comparison between the observed dynamic spectra and simulated ones. As the next step, we will also simulate the reflection and transmission of the EM waves in the icy crust and underlying ocean. After completing these studies, we will be able to elucidate icy moon's ionospheric and subsurface structures by combining our model with the JUICE radar explorations. The combination of our model and the JUICE radar explorations would also constrain the pressure and temperature of the subsurface, which finally lead to deep understandings of the icy moon's habitability.