R009-10
B 会場 ：9/26　AM2 （10:45-12:30）
11:30〜11:45

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Feasibility study of ionospheric explorations at Jupiter's icy moons using Faraday rotation effect

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Jupiter's icy moons such as Europa, Ganymede, and Callisto may harbor subsurface liquid water oceans. While only Earth has oceans on the surface in the current solar system, multiple icy bodies like the icy moons of giant planets potentially have oceans under the icy crust. These icy bodies are candidates for more universal habitable bodies than Earth-type bodies. For keeping habitability, energy supplies to the bodies are necessary. Ionospheres of icy moons are formed by external energy supplies. The ionospheres therefore contain essential information for understanding the habitability of each icy moon. The ionospheric electron density distribution is key for narrowing down the candidates of dominant ionospheric formation processes driven by the energy supplies, e.g., photoionization, electron impact ionization, sputtering, and sublimation. However, the density distribution is still unclear because previous observation methods, radio science and in-situ observations using upper hybrid resonance emissions, were limited in the spatial range of observations.

Propagating paths of Jovian radio emissions across the icy moons' ionosphere have information on the ionospheric electron density distribution. We have developed a numerical calculation tool that simulates the propagating paths based on ray tracing and estimates occultation timing. In Yasuda et al., in prep., we compared this simulation with the occultation observed with the Galileo PWS and estimated the maximum electron density at the surface. However, we couldn't restrict the ionospheric scale height because the propagation paths with some different input parameters degenerated, which led to the difficulty in resolving the ionospheric scale height.

In addition to the propagation paths of Jovian radio emissions, changes in the polarization angle associated with the Faraday rotation effect also have information on the electron densities along the ray path. We conducted a feasibility study of electron density distribution estimation from the rotation angle measurement. With ionospheric models constrained by Yasuda et al., in prep., we found that the polarization of Jupiter's hectometric radiation in the MHz range rotates at least 2 π. For Jupiter's decametric radiation, we found the polarization angle rotation to be at most about 5 degrees at 10 MHz. We are going to examine the integration time and resolution required for reliable detection of polarization angle rotation by simulating upcoming JUICE/RPWI data in its orbit around Jupiter. Combining these simulations with the RPWI data, we will uncover the energy supply system to the icy moons to understand the habitability of the icy moons.