R009-04
B 会場 ：11/6　AM1 （9:00-10:30）
09:45〜10:00

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Mercury Flybys of BepiColombo/Mio PWI and Prelaunch of JUICE RPWI: Collaborations with Europe

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In electromagnetic waves and electron sensing, we are now running two major collaborations with Europe. The first is Plasma Wave Investigation (PWI) aboard the Mio spacecraft in BepiColombo, ESA-JAXA joint mission to Mercury, which was launched in 2018 and will observe Mercury on the orbit from the end of 2025. The second is Radio and Plasma Wave Investigations (RPWI) aboard ESA JUpiter ICy moons Explorer (JUICE) mission to Jupiter, which will be launched in 2024 (next year) and will observe Jovian system on the orbit from 2032. In both Japan and Europe, main players are overlapped and collaborating strongly in both missions and beyond.

In this presentation, we show (1) the latest status of BepiColombo/Mio PWI, focusing to recent two Mercury flybys, and (2) the prelaunch status of JUICE RPWI, focusing to the feasibility studies and the calibration plans. Other collaborations may also be introduced if those proposals will go on the track.

The PWI aboard the BepiColombo Mio will enable the first observations of electric fields, plasma waves, and radio waves in and around the Hermean magnetosphere and exosphere. After full deployment of all sensors following insertion into Mercury orbit at the end of 2025, the PWI will start its real measurements in the electric field from DC to 10 MHz along the spin plane and in the magnetic field from 0.3 Hz to 20 kHz in three-axis and from 2.5 kHz to 640 kHz in one-axis, with similar performance of Arase PWE which is now investigating Geospace.

During the cruising phase, unfortunately, long wire antennas (15-m x 4) for electric fields and the solid boom (4.5-m) for magnetic fields are not yet deployed. In this restricted configuration, we observed Hermean electromagnetic waves during the 1st fly-by in October 2021 and the 2nd fly-by in June 2022. In both flybys, we saw (1) the magnetic turbulences in several kHz in the dawn side magnetosphere after the closest approach, and (2) electric turbulences around the electron plasma density. For next flyby planned in June 2023, we are investigating our capability and try to detect better data including the waveforms.

The RPWI abord JUICE will provide an elaborate suite for electromagnetic fields and plasma environment around Jupiter and icy moons, with 4 Langmuir probes (LP-PWI; 3-axis E-field -1.6 MHz, and cold plasmas), a search coil magnetometer (SCM; 3-axis B-field -20 kHz), and a tri-dipole antenna system (RWI; 3-axis E-field 0.08-45 MHz, 2.5-m tip-to-tip length). RPWI Japan team mainly contributes to the high frequency part of this system, i.e., Preamp of RWI and its High Frequency Receiver (HF).

We will show the performance and operation concepts with their feasibilities, including the test and emulation results on the ground, planned activities in commissioning and cruise phases, and the full observations around Jupiter and icy moon system. It has been confirmed that this system has high sensitivity reaching close to the galactic background enough for the detection of Jovian radio emissions from magnetosphere (aurora etc.), atmosphere (lightning), and icy moons. Direction and polarization capabilities are first enabled in the Jovian system, to identify their source locations and characteristics.

The most key parts is the sensing of the ionospheres, surface, and subsurface of icy moons during the flybys and on the orbit around Ganymede. Our 'High frequency part of RPWI' can do unique remote observations of the ionospheres below the spacecraft orbit by the radio occultation and reflection of Jovian radio signals, It has a capability to detect the ionospheric density not only in usual status but also episodic plume ejections triggered by expected crustal activities. The sensing of surface and subsurfaces are more challenging topics, based on the passive subsurface radar (PSSR) concept which sounds the icy crusts of Galilean satellites by the reflections of penetrated Jovian radio emissions (HOM/DAM).