R009-06
B 会場 ：11/24　PM1 （13:15-15:15）
14:30〜14:45

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High-Frequency part of the Radio & Plasma Wave Investigation (RPWI) aboard JUICE: Lunar-Earth flyby in Aug 2024 and beyond

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This talk provides initial results of Radio & Plasma Wave Investigation (RPWI) aboard JUpiter ICy moons Explorer (JUICE) in the Lunar and Earth flybys (Aug 2024) and beyond, in the view for its high frequency radio observation capability in 80k − 45MHz.

JUICE was launched in April 2023. Lunar flyby was the first and last chance to observe an airless body before the arrival of Jupiter in 2030s. Earth flyby was also the first chance to observe a planet with magnetospheric activities. Next flybys are Venus (August 2025), Earth I (September 2026), and Earth II (January 2029). Arrival to Jupiter will be in July 2031.

RPWI provides unique opportunities to investigate electromagnetic fields and plasma environment around Jupiter and icy moons, with passive and active soundings by 4 Langmuir probes (LP-PWI; 3-axis E-field -1.6 MHz by four 10 cm diameter probes on the 3-m booms) and a search coil magnetometer (SCM; 3-axis B-field -20 kHz) + a tri-dipole antenna system (RWI; 3-axis E-field 0.08-45 MHz, 2.5-m tip-to-tip length) on the long MAG-Boom with JMAG. All antennas were successfully deployed in May 2023, and RPWI already has full observational capabilities. RPWI with other instruments covers the survey of harsh environment around Jupiter, environments and interaction with icy moons, and their surface and subsurface characteristics.

In lower frequency, RPWI enables to investigate electric field and electromagnetic interactions governing Jupiter - moon systems, cold plasmas in the ionospheres of icy moons for investigations of surfaces and salty conductive sub-surface oceans, and cold micrometeorite impacts.

The high frequency part of this system, i.e., Preamp of RWI and its High Frequency Receiver (HF) is procured by the RPWI Japan team, with the colleagues in Austria, France, Poland, and Sweden. This part enables the characterization of Jovian radio emissions (including gonio-polarimetry), passive radio sounding of the ionospheric densities of icy moons, and passive sub-surface radar measurements. It has an enough capability to detect 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.

During the Lunar flyby (passed in equatorial duskside with the closest altitude of 750 km, in the morning of Japan on 20 Aug.), we did a test observation for the ionospheres, surfaces, and subsurfaces of icy moons. We did unique test observations of the ionospheres below the spacecraft orbit by the occultation and reflection of terrestrial auroral kilometric radiation (AKR) in several 100s kHz, as an emulation using Jovian auroral radiations in several 100s to 10s MHz. The occultation of planetary auroral radiation investigates moons' ionospheric density profiles. The reflection of planetary auroral radiation is for the characterizing of moons' surfaces and subsurfaces, to try the passive subsurface radar (PSSR) concept which sounds the moons' crusts by the reflected radio waves. Although it was with strong RIME radar emission at 9MHz, this talk will report the test result of this first and last emulation for icy moons' flybys.

During the Earth flyby (passed in equatorial dawnside with the closest altitude of 6,800 km, in the morning of Japan on 21 Aug.), we did a continuous monitor of AKR and plasmaspheric waves above 80 kHz, including the test detection of HAARP radar emission at ˜9MHz. This test is for (1) first real test for the identifications of polarized emissions using real AKR, solar bursts, and magnetospheric waves, (2) critical calibration of the sensitivity and direction of three short RWI antennas, which only has 1.25-m and strongly affected by the couping with the spacecraft. Those are the first realistic test which cannot be executed on the ground without the deployment. This talk will report those test results, including the comparison of electromagnetic waves observed by Arase PWE.

Those observations require the low electric noise environment from the spacecraft. Unfortunately, large line noises as a harmonics of 200 kHz and wide-band noise in 4-10 MHz are emitted from the spacecraft. Those potentially suffers the observational capability, so we implemented the mask to the former in Jan 2024. We also report its effect to reduce the artificial noise, and will summarize plans with the proved performances for Jupiter and icy moons in 2030s.