Radio & Plasma Wave Investigation (RPWI) aboard JUICE: Post launch status and its expected sciences for Jupiter and Icy Moons

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JUpiter ICy moons Explorer (JUICE), ESA's first L-class mission, will be launched in April 2023. This talk shows a view of Radio & Plasma Wave Investigation (RPWI) aboard JUICE which provides a unique and first opportunity in this huge mission, especially the view from Japanese contributors. We, JUICE RPWI Japan team, mainly provide the high frequency radio observation capabilities.
The RPWI will 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. For lower frequency side, 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 RPWI Japan team provides the high frequency part of this system, i.e., Preamp of RWI and its High Frequency Receiver (HF), under the collaboration with the colleagues in France, Poland, and Sweden. This part will enable characterization of Jovian radio emissions (including gonio-polarimetry), passive radio sounding of the ionospheric densities of icy moons, and passive sub-surface radar measurements. In this paper, we provide the performance and operation concepts with their feasibilities, including the test and emulation results on the ground, the deployment operations executed after the launch, and planned activities in commissioning and cruise phases, and the full observations around Jupiter and icy moon system.
We have confirmed that the HF part of RPWI 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. RPWI with other instruments covers the survey of harsh environment around Jupiter, environments and interaction with icy moons, and their surface and subsurface characteristics.
The most key part of the HF part 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 subsurface 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).

We will introduce their possibility and the evidences of achieved performance taken before and after the launch.

Keywords: Jupiter, icy moons, RPWI, JUICE, radio, plasma wave

