The Radio & Plasma Wave Investigation (RPWI) for JUICE: Contribution plan from Japan

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We present the current status of Radio & Plasma Waves Investigation (RPWI) [PI: J.-E. Wahlund (IRF-Uppsala, Sweden)] on the ESA JUICE mission to Jupiter (launch: 2022). RPWI consists of a highly integrated instrument package that provides a whole set of Langmuir probe and electromagnetic wave measurements, and will study the electro-dynamics of the Jovian magnetosphere and the affected exospheres, surfaces, and conducting subsurface oceans of Ganymede, Europa and Callisto.

RPWI first focuses on cold plasma around Jupiter and its satellites by 4-axis Langmuir probe combined with 3-axis search coil sensor, for the understanding of how the momentum and energy transfer occurs through electro-dynamic and electromagnetic coupling in Jovian environments with icy moons. Exhaust plumes from cracks on icy moons will also be studied, as well as micron sized dust and related dust-plasma surface interaction processes.

RPWI also first provides the spatially resolved information of radio sources in auroral regions of Ganymede and Jupiter and possibly lightning activity of Jovian clouds, by the first 3-axis measurement in radio frequency. As a byproduct, reflected Jovian emission can be expected from the boundary of crust (ice) and subsurface ocean (conductive water), which could observed as the Lunar surface reflection in terrestrial auroral kilometric radiation seen by Kaguya Lunar Radar Sounder.

For these objectives, RPWI sensors consist of 4 Langmuir probes (LP-PWI) for determination of the vector electric field up to 1.6 MHz and cold plasma properties (including active measurements by LP sweeps and mutual impedance sounding) up to 1.6 MHz, a tri-axial search coil magnetometer (SCM) for determination of the vector magnetic field up to 20 kHz, and a tri-dipole antenna system (RWI) for monitoring of radio emissions (80 kHz - 45 MHz). From Japan, we will provide the RWI preamp and its High Frequency receiver with the onboard software, modifying from the BepiColombo PWI and ERG PWE developments. We will also provide Software Wave-Particle Interaction Analyzer (SWPIA) function to RPWI DPU, for the onboard quantitative detection of electromagnetic field - ion interactions, modifying from the ERG SWPIA developments.

The RPWI consortium covers all the best international scientists and engineers in this field who have provided a long heritage record in ESA/NASA/JAXA missions and a track record of collaboration with each other. The team also includes the expert members in numerical modeling of all relevant sciences related to RPWI, in order to maximize the science return from the investigation. Followings are the participating organizations: [Sweden] Swedish Inst. Space Physics (IRF); Royal Inst. Technology (KTH). [France] Lab. de Physique des Plasmas (LPP); LESIA - Obs. de Paris; CNRS-LPC2E, Univ. d'Orleans; CNRS-IRAP, Univ. Paul Sabatier 9; Univ. de Versailles Saint-Quentin (LATMOS). [Poland] Space Research Centre of the Polish Academy of Sciences. [Czech] Inst. Atmospheric Physics; Astronomical Inst. [UK] Imperial College London; Univ. Sheffield [Austria] Space Research Inst. [Germany] Univ. Cologne. [Japan] Tohoku Univ.; Toyama Pref. Univ.; Kyoto Univ.; Kanazawa Univ.; ISAS/JAXA; Nagoya Univ. [USA] Space Science Lab., UC Berkeley; Univ. Iowa; Johns Hopkins Univ.; NASA/GSFC; Boston Univ.; Univ. Michigan.