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The Submillimetre Wave Instrument (SWI) for JUpiter ICy moons Explorer (JUICE)

YASUKO KASAI[1*], Hideo Sagawa[1], Toshiyuki NIshibori[2], Kenichi Kikuchi[1], Yasumasa Kasaba[3], Takeshi Manabe[4], Satoshi Ochiai[1], Takeshi Kuroda[3], Takao M. Sato[2], Katsuyuki Noguchi[6], Takeshi Imamura[2], Hiromu Nakagawa[3], Hiroyuki Maezawa[4], Paul Hartogh[6], JUICE/SWI team[1]

[1]NICT, [2]JAXA, [3]Tohoku University, [4]OSAKA Osaka Prefecture University, [5]Max-Planck-Institut, [6]Nara Womans University

The Submillimetre Wave Instrument (SWI) is an instrument proposed to form part of the scientific payload instruments for the JUpiter Icy Moons Explorer (JUICE) mission of the ESA's Cosmic Vision 2015-2025 program.

SWI is a very high spectral resolution (up to R=107), dual band (600 and 1200 GHz), sub-millimeter heterodyne instrument on the JUICE spacecraft, achieving 1000-2000 km spatial resolution on Jupiter's disk and 0.5-1 km on icy satellites. SWI will determine the composition, structure and dynamics of Io's atmosphere. On Europa, Ganymede and Callisto, SWI measurements will detect active regions, generally determine sources and sinks of the atmospheres, their interaction with magnetospheric plasma; the interaction of Ganymede's magnetosphere with the Jovian magnetosphere will be derived.

SWI has four scientific targets as fellow: 1) the Jovian system with particular emphases on the chemistry, meteorology and structure of Jupiter's middle atmosphere, and atmospheric coupling processes, 2) Characterize the regoliths, icy-crusts, atmospheres, and exospheres of Ganymede, Europa and Callisto, thereby providing important inputs for the exploration of their habitable zones, 3) Study Ganymede as a planetary object and possible habitat; study and explore Europa's young icy crust in recently active zones, 4) Explore the Jovian system as an archetype for gas giants in characterizing the Jovian atmosphere and its satellite and ring systems.

SWI will measure Three-Dimensional of temperatures, winds (with accuracy of ˜10 m/sec) and chemical species (e.g. CO, CS, HCN, H2O, CH4) in Jupiter's stratosphere. The Icy moon measurement will be performed with water vapor, its isotope ratio, and ortho/para ratio in their tenuous atmospheres/exospheres. It will measure thermophysical and electrical properties of satellite surface/subsurfaces and correlate them with atmospheric properties and geological features. SWI will determine key isotopic ratios in Jupiter's and satellite atmospheres, especially the deuterium-to-hydrogen ratio, diagnostic of the formation and evolution of Jupiter's satellite system.

SWI is a instrument with a passive, heterodyne receiver for simultaneous observation in two submillimetre spectral bands, 530-601 GHz and 1082-1271 GHz. In combination with two high-resolution Chirp Transform Spectrometers (CTS), SWI obtains a resolving power v/dv of up to 107. The local oscillator is tunable to observe at any frequency within the bandwidth of the two receivers. SWI is equipped with a movable 30 cm telescope to change its viewing direction independent of the spacecraft orientation. In this presentation, the overview of the SWI mission will be introduced.

Keywords: Jupiter, icey moon, JUICE, SWI, atmospheric dynamics, sub-millimeter sounder