Invited Talk

The Submm Wave Instrument on JUICE

Paul Hartogh* and the SWI team

*Max Planck Institute for Solar System Research
Email: hartogh@mps.mpg.de

The Submillimetre Wave Instrument (SWI) is one of the scientific instruments on the JUpiter ICy moon Explorer (JUICE), [1-3]. JUICE is the first Large Class mission (L1) of the European Space Agency (ESA). SWI's primary scientific objectives are to investigate the middle atmosphere of Jupiter and the atmospheres and exospheres of the Galilean satellites. SWI will contribute to the understanding of the circulation regime in Jupiter's stratosphere as a function of latitude and altitude, how the various atmospheric regions are dynamically coupled, and how the energy originating in Jupiter's interior vertically propagates to the upper layers to be radiated in space. In this sense SWI complements NASA's Juno mission. Io's volcanic atmosphere will be studied through lines of SO_2, SO, NaCl, and perhaps other species. Water vapour and its sources and sinks will be observed in Ganymede's, Callisto's and Europa's atmospheres. Water isotopes and atmospheric properties like temperature and wind profiles will be derived for Ganymede's and Callisto's atmospheres from highly resolved simultaneous observations of at least two water lines. Depending on the final hardware design the water ortho-to-para ratio (OPR) will be derived and provide information together with the isotopic ratios about the formation region of the water ice the moons are made of. Furthermore thermophysical properties of the Galilean satellite surfaces will be measured by radiometric observations.

In the baseline configuration SWI consists of two tunable submm wave receivers operating from 530 to 625 GHz. Alternatively one receiver may cover the frequency range of 1080 and 1275 GHz. The latter solution is for instance required for the OPR determination, allows higher spatial resolution and extended altitude coverage in Jupiter's stratosphere and the detection of additional isotopes therein. The antenna of SWI has a diameter of 30 cm and will be movable by ± 76 and ± 4.3 degrees along and cross track respectively. Two low power consumption and low mass wideband high resolution Chirp Transform Spectrometers (CTS) with 1 GHz bandwidth and 100 kHz spectral resolution are foreseen and complemented by 2 autocorrelation spectrometers (ACS) with 5 GHz bandwidths and 20 MHz spectral resolution. The total mass/power of the instrument design is < 10 kg/50W.

The definition phase (A/B1) for SWI started in April 2013 and will last until end of March 2015. ESA requires the achievement of Technology Readiness Level (TRL) 5 until end of this phase. The JUICE implementation phase is planned to start in April 2015 followed by the launch of the satellite in summer 2022.

This presentation will give an overview of the scientific objectives and the present technical status of SWI.

References

1. http://sci.esa.int/juice/50073-science-payload/
2. http://sci.esa.int/juice/50068-science-objectives/
3. http://sci.esa.int/juice/49837-juice-assessment-study-report-yellow-book/#