The Submillimeter Wave Instrument on JUICE

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JUICE – JUpiter ICy moons Explorer it the first large class mission of ESA's Cosmic Vision 2015 - 2025 program [1-3]. The JUICE satellite is planned to be launched in April 2023 and its Jupiter orbit insertion is foreseen in 2031. The primary mission in the Jupiter system will take about three years. The focus of the mission is Jupiter itself and the Galilean satellites, their internal oceans and potential habitability. Recent ground-based observations of Europa and Ganymede showed water vapor plumes, probably related to geysers on their surfaces. JUICE intends to identify the geysers, monitor their potential activity and molecular and isotopic composition in order to constrain satellite formation models and development processes (of chemical, physical and potentially biologic nature) in the interior of their oceans. Jupiter itself is seen as an archetype of a gas giant. A better understanding of its atmospheric processes will be a baseline for a better understanding of gas giants outside of our solar system. JUICE will characterize the general circulation of Jupiter's atmosphere, its meteorology, chemistry and structure between the upper cloud deck and the ionosphere and magnetosphere.

The Submillimeter Wave Instrument (SWI) on JUICE sounds the middle atmosphere of Jupiter and the exospheres and surfaces of the Galilean satellites with a 290 mm telescope, movable in azimuth and elevation using two heterodyne spectrometers covering the frequency ranges of 530 to 630 GHz and 1065 to 1275 GHz. The heterodyne receivers with tunable solid-state local oscillators and sub-harmonically pumped mixers are passively cooled to about 150 K. The receiver temperatures are about 1000 and 2000 K DSB (600 and 1200 GHz respectively). The intermediate frequency outputs of 4.5 to 8.5 GHz are analyzed by two real-time spectrometer backends per receiver consisting of broadband autocorrelators (4 GHz bandwidth, 4 MHz resolution), high resolution Chirp Transform Spectrometers (1 GHz bandwidth, 100 kHz resolution) and continuum channels. The structure of the Telescope and Receiver Unit (TRU) and the 29 cm mirror are made of AlBeMet 162. The Flight Model (FM) was integrated into the JUICE satellite in September 2021. The main effort of the present work is put on Flight Spare (FS) testing. This presentation will address the science objectives, the technology challenges and details about the instrument and its performance.

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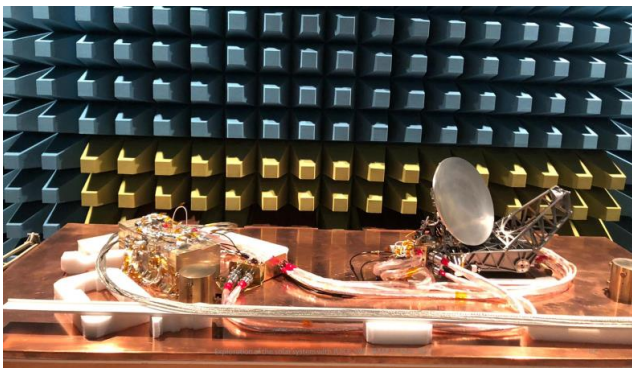

Fig. 1. SWI FM in MPS anechoic chamber during EMC test

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/#

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