Optical design study for Submillimeter Wave Instrument for the Jupiter mission

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Abstract— **We present an overview of the optics including a telescope designed for Submillimetre Wave Instrument (SWI), which is one of 11 instruments of the ESA's JUpiter ICy moons Explorer (JUICE) mission. The SWI is a radiometer and is dedicated to observe molecular line emissions from Jupiter atmosphere and Icy moons so that it can measure and map temperatures, winds, chemical species, and surface properties with polarimetry. The instrument consists of two identical passively cooled Schottky diode receivers that operate over a frequency range between 530 GHz and 625 GHz, a telescope, and back-ends. The telescope is an offset Cassegrain dual-reflector antenna that can be rotated around two orthogonal axes. This along-track and cross-track scanning mechanism is needed to map the entire disk of the Jupiter.**

The SWI optics consists of a telescope, four reflectors for guiding incident beam to corrugated feedhorns, and a polarizing beam splitter for splitting incident beam into two orthogonal polarizations that allows polarization observation. Because of the space restriction in the spacecraft, the SWI optics layout and physical sizes are optimized so that all units can be accommodated into the instrument envelope. The main reflector is chosen to be an offset reflector, hence it causes unwanted degradations, especially cross-polarization, on the far-field patterns. This presentation gives an overview of the optical design and beam pattern analysis using physical optics, as well as a discussion on the far-field pattern degradations due to rotating the telescope.