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MAJIS AND JANUS: TWO INSTRUMENTS FOR JUPITER EXPLORATION ON-BOARD JUICE

Abstract

The JUICE mission will conduct an in-depth comparative study of Ganymede, Callisto, and Europa, and then extend its analysis to most of Jovian system and Jupiter itself. To pursue all these objectives,

the JANUS instruments are designed for optimum performances in planetary investigation i.e. geology, composition, structure of Jovian satellites, from the Galilean ones to the inner ones and the ring system, and on the external layers of Jupiter atmosphere.

MAJIS is one of the payload for the JUICE mission: it is a compact imaging spectrometer with two channels covering the spectral ranges: 0.5 to 2.35 μm and 2.25 to 5.54 μm . A TMA telescope is shared between the two channels, as well as a slit and collimator, then a dichroic filter splits the light between the channels, each one is endowed with its own grating and focusing lens. The same detector 400 x 533 pixel is used for both spectrometers. The achieved spectral sampling is compliant with the science requirement of ≤ 3.5 nm for the VIS-NIR channel and ≤ 7.2 nm for the IR one.

JANUS is a camera that will have a major role in the mission, in addition to its own scientific goals also in providing the necessary context for most of the other instruments aboard the JUICE mission. JANUS has a signal-to-noise-ratio SNR ≥ 100 as a reference value achievable during most of the observing phases with the highest spatial resolution capability and well defined observation conditions. JANUS will provide Ganymede high-resolution panchromatic imaging, with a spatial resolutions 5-10 m/pixel in the 500 km orbit. This translates into an Instantaneous Field of View (IFoV) requirement of about 10-15 rad. As far as color imaging requirements of JANUS are concerned, a violet filter helps to emphasize the slope towards the Ultra-Violet (UV), the RGB-filters allow to recombine true-color imagery, more than one filter is needed in the Near InfraRed (NIR) to discriminate between different Fe²⁺ minerals, more than one methane absorption band is needed for sounding the Jovian atmosphere and a filter at the H-line will help in lightning detection and a sodium D-line filter is necessary for investigating the exospheres of Io and Europa.

MAJIS and JANUS architecture is described, as well as the technological challenges to cope with JUICE mission requirements.