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JUICE: a European mission to Jupiter and its icy moons

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JUICE (JUpiter ICy moons Explorer) is the first L-class mission selected for the ESA's Cosmic Vision programme 2015-2025 which has just entered the definition phase. JUICE will perform detailed investigations of Jupiter and its system in all their inter-relations and complexity with particular emphasis on Ganymede as a planetary body and potential habitat. Investigations of Europa and Callisto will complete a comparative picture of the Galilean moons. By performing detailed investigations of Jupiter's system, JUICE will address in depth two key questions of the ESA's Cosmic Vision programme: *(1) What are the conditions for planet formation and the emergence of life?* and *(2) How does the Solar System work?*

The overarching theme for JUICE has been formulated as: *The emergence of habitable worlds around gas giants*. At Ganymede the mission will characterize in detail the ocean layers; provide topographical, geological and compositional mapping of the surface; study the physical properties of the icy crusts; characterize the internal mass distribution, investigate the exosphere; study Ganymede's intrinsic magnetic field and its interactions with the Jovian magnetosphere. For Europa, the focus will be on the non-ice chemistry, understanding the formation of surface features and subsurface sounding of the icy crust over recently active regions. Callisto will be explored as a witness of the early solar system.

JUICE will perform a comprehensive multidisciplinary investigation of the Jupiter system as an archetype for gas giants including exoplanets. The circulation, meteorology, chemistry and structure of the Jovian atmosphere will be studied from the cloud tops to the thermosphere. The focus in Jupiter's magnetosphere will include an investigation of the three dimensional properties of the magnetodisc and in-depth study of the coupling processes within the magnetosphere, ionosphere and thermosphere. Aurora and radio emissions and their response to the solar wind will be elucidated. Within Jupiter's satellite system, JUICE will study the moons' interactions with the magnetosphere, gravitational coupling and long-term tidal evolution of the Galilean satellites.


JUICE artist impression (Credits ESA, ATG medialab)

JUICE will be a three-axis stabilised spacecraft with dry mass of about 1800 kg at launch, chemical propulsion system and 60-75 m^2 solar arrays. The high-gain antenna of about 3 m in diameter will provide a downlink capability of not less than 1.4 Gb/day. Special measures will be used to protect the spacecraft and payload from the harsh radiation environment at Jupiter. The spacecraft will carry a highly capable state-of-the-art scientific payload consisting of remote sensing instruments, geophysical sounders and plasma experiments. The foreseen launch of the JUICE spacecraft is June 2022. After the Jupiter orbit insertion in January 2030 the spacecraft will perform a 2.5 year tour in the Jovian system focusing on observations of the atmosphere and magnetosphere of the giant. During the tour, gravity assists at Callisto will shape the trajectory to perform two targeted Europa flybys and raise the orbit inclination up to 30 degrees. 13

Callisto flybys will enable unique remote observations of the moon and *in situ* measurements in its vicinity. The mission will culminate in a dedicated 8 months orbital tour around Ganymede. The tour will include phases with high (5000 km), medium (500 km), and low (200 km) circular orbits that will have different observation conditions optimized for particular science investigations. The presentation will give an overview of the JUICE mission, its science scenario and observation strategy, and the newly selected payload.