

Exploration of Jovian System by ESA-JUICE Mission: Participation of Japanese Team

Sho Sasaki^{1*}, Masaki Fujimoto², Jupiter Exploration WG²

¹National Astronomical Observatory of Japan, ²ISAS/JAXA

Jupiter is the largest planet in the solar system with mass more than 300 times as large as that of the Earth. It is a rapidly rotating hydrogen-helium gaseous body with strong magnetic field and associated magnetosphere. Recent discoveries of exoplanets suggest that Jupiter should represent a body not only in the solar system but also in the universe. Four large satellites, Io, Europa, Ganymede, and Callisto, were discovered by Galileo 400 years ago. Three of them except Io are icy satellites. Europa and Ganymede are considered to have the interior ocean, which might foster extraterrestrial life. Ganymede has own magnetic field.

The Jupiter system was observed by several flyby missions such as Pioneer 10 and 11, Voyager 1 and 2, Cassini, New Horizons and investigated by Galileo orbiter and its atmospheric entry probe. Galileo spacecraft data were very limited due to the malfunction of its high-gain antenna. JUNO mission will start observation of Jupiter in 2016. But since the main target of JUNO taking polar orbits is structure and composition of Jupiter, observation of satellites would be limited.

JUICE (Jupiter Icy Moon Explorer) is the first Large-class mission of ESA Cosmic Vision 2015-2025 program. It will be launched in 2022 and will reach Jupiter in 2030. JUICE will continuously observe the atmosphere and magnetosphere of Jupiter and the interaction of the Galilean satellites with the gas giant planet. Using multi-flybys with Callisto, JUICE will change orbital inclination. It will twice fly by Europa. It will finally enter orbit around Ganymede in 2032, where it will study the icy surface and internal structure, especially its subsurface ocean. Ganymede would have molten metallic core generating intrinsic magnetic field. JUICE will observe the unique magnetic and plasma interactions of Ganymede with Jupiter's magnetosphere.

After the selection of JUICE in May 2012, several Japanese groups were invited to participate in the mission as Co-Is with instrument development for model payloads. Those includes plasma instruments such as low, middle, high-energy particles and plasma wave detectors, a submillimeter sounder, an UV imager and a laser altimeter. They participates in ESA AO at October 2012. After the selection in February 2013, ISAS/JAXA will support but check the progress of instrument developments by Japanese team.

It should be noted that discussion for the international collaboration for Jupiter mission between ESA and Japan (JAXA) started from 2006 and International Jupiter Mission Working Group started at JAXA in 2007. The initial plan was that JAXA will take a role on the magnetosphere spinner JMO (Jupiter Magnetosphere Orbiter) and JMO would be launched and transported together with ESA orbiter. The original plan was similar to the framework of the BepiColombo Mercury mission. Then in the framework of EJSM (Europa Jupiter System Mission), ESA will launch JGO (Jupiter Ganymede Orbiter) and NASA would launch JEO (Jupiter Europa Orbiter), whereas JAXA would launch JMO. Only JGO was selected as JUICE for the first ESA cosmic vision L-class mission. And Russia is considering to launch Ganymede lander which would arrive at the icy surface when JUICE is observing from polar orbits.

Keywords: Jupiter exploration, magnetosphere, Ganymede, Europa, interior ocean, icy satellites