International Session (Oral) | Symbol P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS01_30PM2]Toward JUICE and future explorations of outer solar system

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Wed. Apr 30, 2014 4:15 PM - 6:00 PM 418 (4F)

Giant planets are the most prominent representative bodies not only in the solar system but also in the extrasolar systems. In this session, origin, interior, atmosphere, composition, surface feature, and electro-magnetic field etc. of the Jovian planets and the icy moons will be comprehensively discussed. Toward future exploration missions, we'd like to promote the study of giant planetary systems, and also progress in developing a solar sail mission to observe Jovian system and Trojan asteroids will be discussed.

5:50 PM - 6:00 PM

[PPS01-P02_PG]Development of JUICE/Ganymede Laser Altimeter (GALA)

3-min talk in an oral session

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The overarching theme for JUICE is: The emergence of habitable worlds around gas giants, and the focus is to characterise the conditions that may have led to the emergence of habitable environments among the Jovian icy satellites, with special emphasis on the three oceanbearing worlds, Ganymede, Europa, and Callisto. JUICE will be launched in 2022, and will arrive at Jupiter in 2030. After several fly-bys to Europa and Callisto, JUICE will be inserted into an orbit around Ganymede in 2032 and will continue scientific observations for eight months until the end of nominal mission in 2033. Ganymede Laser Altimeter, GALA, measures distance between the spacecraft and the surface of the satellite from time of flight of a laser pulse. Together with positions of the spacecraft and mass center of the satellite, surface topography of the satellite is calculated from measured distances. The GALA data are particularly important for finding of internal ocean. 1) if the ocean exists beneath icy crust, tidal deformation of the satellite is so large that temporal variation of the topography as great as a few tens meter shall be detected. 2) small eccentricity of orbit of Ganymede causes libration that will be observed as lateral shifts of footprint of laser beam at the surface. 3) improved determination of spacecraft orbits by cross over analysis results in precise estimate of low degree harmonics of gravity field. Thus accurate Love number will be calculated to infer internal density structure of the satellite. Global topographic data derived by GALA are also important for the study of tectonic history at the surface, elastic and viscous structure of ice crust, and thermal evolution of interior of the icy satellite.

For example, linear structures such as ridges and grabens reveal extension stresses due to past variation of thermal states. As well, flat surface and thin crust may indicate partial melting of the crust and consequent internal lake. These observations on various geologic activities lead to understanding of transport of heat and materials from interior to the surface. Further, a comparison of styles of tectonics of ice crust and that of silicate lithosphere will likely shed a new light on the theory of plate tectonics of the Earth.GALA is developed by international collaboration of scientists and engineers in Germany, Switzerland, and Japan. Its conceptual design is based on the laser altimeter on board of Mercury orbiter, BepiColombo, and consists of transceiver unit (TRU) with laser optics and appropriate electronics, electronic unit (ELU) with digital range finder module, digital processing module and power converter module, and laser electronic unit (LEU) with laser control electronics. Japanese team provides receiver telescope, backend optics, detector, and analogue electronics of TRU. The transmission optics of TRU and entire LEU are developed at DLR in Germany, and ELU is developed at Bern University in Switzerland. Assembly and integration are conducted at DLR under a supervision of the principal investigator of GALA. We therefore need to pay special caution on interfaces between analogue electronics and range finder, low-temperature environment, and radiation environment that Japanese space scientists have never experienced before.