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Scientific objectives and current status of the SPRINT-A/EXCEED mission

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The EXCEED (EXtreme ultraviolet spectroSCOpe for ExosphERIC Dynamics) mission is an Earth-orbiting extreme ultraviolet (EUV) spectroscopic mission and the first in the SPRINT series being developed by ISAS/JAXA. EUV spectroscopy is suitable for observing tenuous gases and plasmas around planets in the solar system (e.g., Mercury, Venus, Mars, Jupiter, and Saturn). The aim of the SPRINT-A/EXCEED mission is to investigate the plasma and energy transport processes in the inner and outer planets.

This mission has two primary scientific targets. The Jovian magnetosphere is known to be dominated by the plasma flow co-rotating around the planet. Co-rotating regions are common in the magnetospheres of magnetized bodies. Although the terrestrial magnetosphere also has a co-rotation region in the inner magnetosphere, it is strongly affected by the solar wind. Because Jupiter's co-rotation electric field is orders of magnitude higher than the solar wind electric field, plasmas in the inner magnetosphere inside a radial distance of 10-20 planetary radii are co-rotating with the planet. Jupiter provides us with good opportunities to study energy and plasma transport processes in the co-rotation region itself.

Another primary objective is to investigate an unresolved problem concerning the escape of the atmosphere to space. Although there have been some in-situ observations by orbiters, our knowledge is still limited. This mission plans to make imaging observations of plasmas around the planets to determine the amounts of escaping atmosphere. The instrument's field of view (FOV) is so wide that we can get an image from the interaction region between the solar wind and planetary plasmas down to the tail region at one time. This will provide us with information about outward-flowing plasmas, e.g., their composition, rate, and dependence on solar activity.

EXCEED has two mission instruments: the EUV spectrograph and a target guide camera that is sensitive to visible light. The EXCEED spectrograph is designed to have a wavelength range of 55-145 nm with minimum spectral resolution of 0.4 nm. Three spectrograph slits have a field of view of 400 x 10, 400 x 60, and 400 x 140 arc-seconds. The 10 arc-sec slit will be used to achieve the best spectral resolution of 0.4 nm. The target guide camera will be used to capture the target and guide the observation area of interest to the slit. Emissions from outside the slit's FOV will be reflected by the front of the slit and guided to the target guide camera. The image is taken every 5 seconds and sent to a mission data processor (MDP), which calculates the centroid of the image. During an observation, the bus system controls the attitude to keep the centroid position with an accuracy of 10 arc-seconds.

The SPRINT-A/EXCEED mission is now under development and plans to launch in 2013.