



## **Instrumentation for imagery of the terrestrial plasmasphere and the ion outflow at the polar ionosphere**

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The two dimensional imaging has been known to be a powerful tool to see the magnetospheric and atmospheric plasma and neutral particles in perspectives. We propose an imagery of the terrestrial upper atmosphere, ionosphere and plasmasphere from the lunar orbiter, SELENE and Engineering Explorer (SELENE), which will be launched in 2007.

Our instrument, named Upper atmosphere and Plasma Imager (UPI), has the gimbal system (UPI-G) to follow the earth from the Moon, and has two telescopes for the visible and the extreme ultraviolet (EUV) light (UPI-TVIS and UPI-TEX). UPI-TVIS detects the visible light from the upper atmosphere, such as aurora and atmospheric airglow, and UPI-TEX is sensitive to resonantly scattering emissions from He<sup>+</sup> and O<sup>+</sup> ions in the EUV region.

SELENE is a three-axial stabilized satellite, and one of axes tracks the Moon surface. So the field-of-view (FOV) of the telescopes rotate with the satellite motion, UPI-G is used as the rotate canceller. The system has two-axis control; one axis is parallel to the rotating axis, and always moves during observational periods. The other is the perpendicular, and revolves by 360 degrees every a month.

In this paper, we focus the design and the scientific motivation of the UPI-TEX. The main targets are the global distribution of the plasmaspheric He<sup>+</sup> ions and the overall picture of O<sup>+</sup> ions escape from the polar ionosphere. UPI-TEX is a prime focus optics with an aperture of 12cm, a focal length of 168mm, and a FOV of 10 degrees. It has a multilayer-coated mirror, a band-pass filter parted into two areas for He<sup>+</sup> and O<sup>+</sup>

emissions, and a detector of MCPs. The images has a spatial resolution of  $0.1R_E$  at the Earth's surface, and time resolutions of 1 minute for plasmaspheric  $He^+$  ion images and of 30 minutes for  $O^+$  ion images of polar ionospheric outflow.

The plasmaspheric images in the equatorial plane have been obtained by the IMAGE satellite. The global plasma distribution in the inner magnetosphere made clear the plasmopause motion at the substorm periods. However, the UPI-TEX imager will take images from the lunar orbit to perspective the latitudinal shape of the plasmopause, which has never been observed. The polar ionospheric images will make clear when, where, and how heavy ions, such as  $O^+$  ions, outflow from the ionosphere. These images also have never been taken. We expect the UPI-TEX images to lead to the understanding of the 3-dimensional plasma distribution in the inner magnetosphere.