

2. Imaging the Terrestrial Plasmasphere by the XUV Scanner from Space

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An extreme ultraviolet (XUV) scanner on board the Mars orbiter, Planet-B, observed the terrestrial plasmasphere while it was in a parking orbit around the earth. This was the first image from space (Nakamura, et al., 2000; Yoshikawa, et al., 2000). The helium ions populated in the terrestrial plasmasphere resonantly scatter the solar EUV rays at 30.4 nm. Therefore, the global imaging resulting from detection of 30.4 nm HeII emission represents the structure of the terrestrial plasmasphere. The visualization of the plasmasphere has been a long-cherished goal in magnetospheric physics.

The key technology of the scanner is the multi-coated Mo/Si mirror, which reflects preferentially EUV rays at 30.4 nm. The reflectivity shown in Fig. 1 gives the peak at 30.4 nm, where the reflectivity is enhanced to 18%.

Fig. 2 shows the EUV image of the dusk-side terrestrial plasmasphere on September 9-10, 1998. With the spacecraft's motion along its orbit, the telescope scanned the whole plasmasphere. The field of view of the telescope is 3.2 degrees, which corresponds to 1,800 km spatial resolution when the target is observed 5Re (earth radius) away. The lines in the images are magnetic field lines of L=4 and 6 (L is the L shell parameter which gives the distance from the earth's center to the dipole field line at equator divided by earth radius). The signal was as strong as 6.3Rayleigh (where 1Rayleigh= 10⁶photons/cm²/sec) at L=4. Surprisingly, many helium ions are distributed beyond the L=6 field line. This finding appeals us to challenge further global EUV imaging.

References:

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2. Yoshikawa, I., Yamazaki, A., Shiomi, K., Yamashita, K., Takizawa, Y. and Nakamura, M., Evolution of the outer plasmasphere during low geomagnetic activity observed by the EUV scanner onboard Planet-B, *J. Geophys. Res.*, (2000), 105, 27,777-27,789.

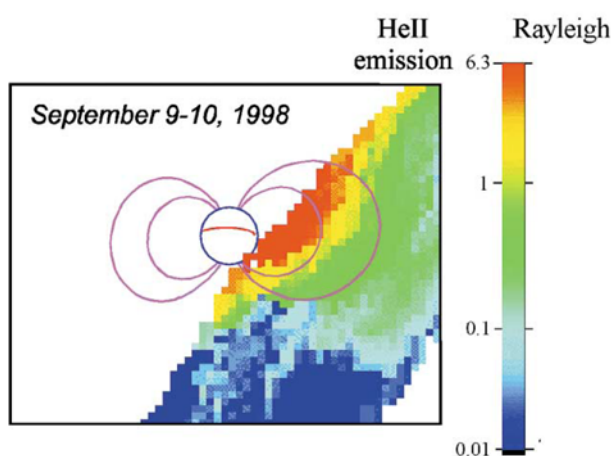


Fig. 1

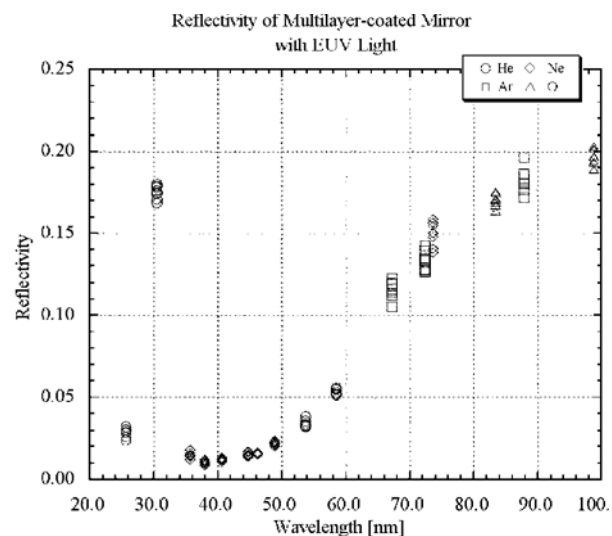


Fig. 2