Optical Design of FUVI onboard the Proposed IMAP Satellite

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The IMAP satellite is proposed as a small satellite mission in the near future to investigate interactions between the mesosphere, thermosphere, ionosphere and plasmasphere. The spacecraft will have optical imagers, a GPS receiver and a Langmuir probe aboard. A geosynchronous orbit or a GTO in an equatorial plane is preferable for simultaneous imaging observation of both hemispheres. Visible and FUV imagers will acquire images of the specific altitudes from which night airglow is emitted, while an EUV imager will visualize the plasmasphere using solar light scattered by OII and HeII.

The FUV imager (FUVI) is proposed to depict time and spatial extent of plasma bubbles and traveling ionospheric disturbances. Since intensity of OI 135.6 nm night airglow is proportional to the square of electron density in the F-layer, OI 135.6 nm night airglow is suitable for imagery of the ionosphere. However, OI 135.6 nm night airglow has intensity of only 10R in the mid-latitudes. Exposure time as long as 20 min is required to take a global snapshot of OI 135.6 nm nightglow even by a highly sensitive camera, and consequently a satellite must be three-axis stabilized.

From the requirement mentioned above an optical layout of a Schmidt camera is adopted to achieve a fast and wide-field optics with moderate spatial resolution, but it is found that production of a correcting plate for a pure Schmidt camera is quite difficult especially for that can be used in the FUV region where wavelength of light is one-fourth of that of visible light. We started from an optical layout of a pure Schmidt camera, and modified it so that a correction amount to form an aspherical surface can be as small as possible without severe degradation in a spatial resolution. The optical design including a correcting plate, a main mirror and a field flattener lens will be presented.