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Development of the EUV imager onboard the ISS

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EUVI (Extremity Ultra-Violet Imager) for the ISS-IMAP mission (Ionosphere, Mesosphere, upper Atmosphere and Plasmasphere mapping onboard the International Space Station) is under development. The instrument consists of two detectors, EUVI-He? and EUVI-O?. The former observes resonantly-scatted light from He+ (30.4 nm) and the latter observes resonantly-scatted light from O+ (83.4 nm) in the plasmasphere. Both of them have band-pass filters and look for the direction of the earth's limb. So, they can take images of the distribution of those ions in the plasmasphere over the limb.

The ISS-IMAP mission can make long-term (more than half year) and steady observations of the vertical and horizontal structure of the plasmasphere by using EUV light that cannot be observed on the ground. Furthermore, it can take images with higher special resolution comparing to the conventional spacecraft missions because the orbit of the ISS is closer to the plasmasphere than that of the other missions. So the ISS-IMAP mission will make up the interactions of the solar wind magnetic field variations and plasma transportation such as the supply from the ionosphere, pilling up and the ejection of the plasmas in the plasmasphere.

These detectors employ 5-staged microchannel plates (MCPs) as 2-dementional photon-counting devices and a resistive anode to encode the event location by distributing the charge signal among 4 output terminals. Both of the detectors require high sensitivity to identify weak ionic signatures and to archive high time resolution (1 minute for He+, 10 minutes for O+). In order to enhance the detection efficiencies, the surface of the top MCP of those detectors are covered with Cesium Iodide (CsI). The work function of CsI is lower than that of the channel wall (mainly composed

of PbO_2). Furthermore, we have optimized the pore angle of the MCP and the depth of the CsI to be able to get highest sensitivity. As a result, this method improves the quantum detection efficiencies for 30.4 nm about a factor of 1.5 and a factor of 3 for 83.4 nm comparing to bare one. The total detection efficiencies of the detectors are 0.06 cps/Rayleigh/Pixel for He+ and 0.006 cps/Rayleigh/Pixel for O+.

CsI is hydroscopic and must be handled in the vacuum condition (lower than 1 Pa) because it suffers significant loss in quantum detection efficiency. Furthermore, EUV radiation cannot penetrate crystal windows and consequently EUV MCP detector must be open-faced.

We have developed bread board model of 5-staged MCP assembly with a resistive anode and a light weight (0.58 kg) vacuum door assembly to protect the detector during ground handling which consists of MgF_2 door, paraffin actuator and stainless steel vacuum chamber. In our presentation, we will show the development status and performance of those detectors.