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Development of geocoronal hydrogen Lyman Alpha Imaging CAmera (LAICA) and observational results

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Exospheric hydrogen atoms resonantly scatter the solar ultraviolet radiation, causing an ultraviolet glow called geocorona. Previous research revealed that the geocorona extends to an altitude of about 20RE. The hydrogen Lyman alpha radiation (121.567 nm) is the brightest emission of the UV glow.

Bailey and Grantman (2011, 2013) reported that the geocorona has an asymmetric spatial distribution and the total number of hydrogen atoms increases abruptly (from 6% to 17%) during geomagnetic storms. These observations of the geocorona have mainly been performed using earth orbiters. Therefore, features of the geocorona, such as geocoronal distribution and variation in the number of hydrogen atoms during geomagnetic storms at high altitude are still unclear. In addition, only a few satellites have observed the geocorona from deep space and, among them, only Apollo16 had a 2D imager. However, its FOV was 10RE and was not wide enough to image the whole geocorona.

In this study, we developed a UV camera called LAICA (Lyman Alpha Imaging CAmera) for imaging the geocorona from deep space. We started developing the LAICA in October 2013. LAICA has a spherical Cassegrain telescope, a bandpass filter, and a detector (a micro channel plate and a resistive anode encoder). The detector is a copy of PHEBUS/FUV on board the Bepicolombo/MPO satellite. We designed and manufactured the LAICA optical system. Furthermore, we established the gluing method to attach the primary/secondary mirrors and the bandpass filter to the aluminum body. Finally, we completed the development of LAICA in July 2014. LAICA was then installed in the very small deep space explorer PROCYON, which was launched in December 2014. In this presentation, we will describe the details of the LAICA instrument and report our initial results.

Keywords: geocorona, Lyman alpha line, earth’s atmosphere, space telescope