Geocorona observation by PROCYON/LAICA and exoplanetary exosphere

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The hydrogen exosphere constitutes the uppermost atmospheric layer of the Earth, and its shape may reflect the last stage of the atmospheric escape process. The distribution of hydrogen in the outer exosphere remains unobserved because outer geocoronal emissions are difficult to observe from within the exosphere. In this study, we used the Lyman Alpha Imaging Camera (LAICA) onboard the Proximate Object Close Flyby with Optical Navigation (PROCYON) spacecraft, located outside the exosphere, to obtain the first image of the entire geocorona that extends to more than 38 Earth radii. The observed emission intensity distribution can be reproduced using our analytical model that has three parameters: exobase temperature, exobase density, and solar radiation pressure, which implies that hot hydrogen production in the magnetized plasmasphere is not the dominant process shaping the outer hydrogen exosphere. However, the role of the magnetic effect in determining the total escape flux cannot be ruled out.

Many Earth-size exoplanets have already been discovered, but it is difficult to distinguish an Earth-like planet with an ocean from a Venus-like planet. Among Venus, Earth, and Mars, only Earth has a large hydrogen exosphere. Here we show the Earth’s far-extended hydrogen exosphere is caused by the high temperature of the upper atmosphere, which is consistent with the existence of an ocean through CO_2 removal. In this presentation, we introduce our plan to observe exoplanetary exosphere to detect an Earth-like planet using a UV space telescope.

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