Design of a Lyman alpha telescope LAICA2 for exoplanetary exploration

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Recently, small planets, which orbit around small cool stars have gained considerable attentions as objects of Earth-like exoplanetary exploration. These small planets can be detected by the transit observation. Moreover, if their atmospheres are rich in oxygen and receive high extreme ultraviolet (EUV) radiation, their oxygen atmosphere might expand (Kulikov et al., 2007, Tian et al., 2008b). Hence, the transit observation of expanded-oxygen absorption is considered to be effective to detect the Earth-like exoplanets. However, most of the EUV radiation cannot be measured, because it gets absorbed by the interstellar neutral hydrogen. Therefore, in order to estimate the EUV spectrum of the star, we quoted the empirically derived relationships between the total hydrogen Lyman alpha intensity and the EUV spectrum presented in Linsky et al. (2014). The deep space microspacecraft PROCYON is equipped with the Lyman Alpha Imaging Camera (LAICA). Based on LAICA, we designed the telescope LAICA2, which can measure the Lyman alpha intensity from distant stars. The field of view (FoV) of LAICA is wide for observation of widely expanded geocorona but that of LAICA2 is to be narrower for observation of distant stars. Therefore, in LAICA2, the focal length was extended by 1.5 times while maintaining a spot size, by making the primary mirror elliptical; in LAICA, both the primary and secondary mirror have a spherical shape. In addition, the influence of stray light was reduced by designing a baffle that can block the correspondent light path. We evaluated the stray light originated by internal reflection and scattering in the optical system: our analysis indicated that the influence of stray light on LAICA2 observations can be ignored.

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