

Estimation of apparent areas of Earth-orbiting UV telescope required to detect water plumes on icy moons

*Ryoichi Koga¹, Fuminori Tsuchiya², Go Murakami³, Shotaro Sakai²

1. Nagoya University, 2. Tohoku University, 3. ISAS/JAXA

In this study, we estimated the apparent areas of Earth-orbiting UV space telescope, which can detect OI and HI emissions ejected from plumes on icy moons. Hubble Space Telescope observed the enhancement of HI 121.6 nm and OI 130.4 nm emissions near the Europa South Pole (Roth et al., 2014). They considered the electron impact of H₂O in the plume yields HI and OI UV emissions. However, frequency and geological conditions of ejecting gasses from Europa plumes are not understood. LOPYUTA (Life-environmentology, Astronomy, and Planetary Ultraviolet Telescope Assembly) is the future Earth-orbiting UV telescope project. One of the main goals of LOPYUTA is to observe icy moon's atmosphere continuously with high spatial resolution (~ 0.1 arcsec) and apparent area (~ 350 cm²), and confine conditions under which the plume eruptions occur.

To validate science feasibility of LOPYUTA, we considered the demand to detect the Europa plume by UV space telescope with integration time of 10 hours. We calculated the signal counts of OI 130.4 nm and HI 121.6 nm from Europa plume, and the noise from Europa atmosphere, solar reflection, Earth geocorona and interplanetary medium. The emission due to solar reflection at the limb is estimated to be several percentages of that at the center of the disk. Therefore, the setting of the plume position in this study is near the limb. The satellite should orbit under $\sim 1,000$ km or over $\sim 36,000$ km from the Earth ground to avoid the noise from the radiation belt. To detect both OI 130.4 nm and HI 121.6 nm emissions, requested apparent areas are ~ 350 cm² when the altitude of the satellite is about 1,000 km, and ~ 160 cm² when the altitude is 36,000 km, which meet the demand of the project. This presentation will also discuss the detectability of plumes of icy moons such as Enceladus.

Keywords: Europa, UV