

Feasibility studies on Mars and Venus science for LOPYUTA

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Life-environmentology, Astronomy, Planetary, Ultraviolet Telescope Assembly (LOPYUTA) is an ultraviolet space telescope mission to study habitable environments in the solar system and beyond, which we prepare to propose for a future Japanese small class mission. LOPYUTA is designed to address much larger effective area ($>100 \text{ cm}^2$) and much better angular resolution (0.1 arcsec) than those of JAXA Hisaki space telescope, and thus achieves comparable sensitivity and spatial resolution to those of the Hubble Space Telescope. Taking advantage of the long machine time, we will observe variations of UV signatures from solar system bodies, exoplanets, and astronomical bodies to explore habitable environments in the universe.

Two of the main targets of LOPYUTA are our neighboring planets, Mars and Venus. Today, these planets have extreme and inhospitable environments. Studies, however, suggest that Mars and Venus might have been habitable planets; They had much water, atmosphere, and possibly life. Then a big question immediately arises; Where did water and atmosphere go? By monitoring hydrogen, oxygen, and carbon UV emissions in their upper atmospheres, we aim to study how Mars and Venus have lost water and experienced climate changes over the history.

In this study, we conducted a feasibility study for LOPYUTA to detect hydrogen (Lyman-alpha), oxygen (1304Å and 1356Å), and carbon (CII 1335Å) emissions as water and carbon tracers in the upper atmosphere of Mars and Venus. These emissions are mainly excited by solar resonant scattering in the exosphere and/or photoelectron impact in the ionosphere. We estimated required accumulation time to accomplish the signal to noise ratio of 5 for each emission line, using measurements from previous missions such as Pioneer Venus Orbiter, MAVEN, and Hisaki. In this presentation, we report spatial and time resolutions that LOPYUTA can address for each emission line when observing the disk, limb, and corona of Mars and Venus, and discuss feasibilities of several scientific objectives.

Keywords: Mars, Venus, LOPYUTA, Ultraviolet observations, Upper atmosphere