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Near-infrared detections of surprisingly bright Ganymede and Callisto in the Jovian shadow

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The Galilean satellites (Io, Europa, Ganymede, and Callisto) are expected to be dark when eclipsed by the Jovian shadow. However, we have discovered that Ganymede and Callisto are still surprisingly bright at 1.5 μm even when not directly lit by sunlight, based on observations from the Hubble Space Telescope and the Subaru Telescope. Their eclipsed luminosity was one-millionth of their uneclipsed brightness (i.e. $\sim$50 μJy for Ganymede and $\sim$30 μJy for Callisto in eclipse), which is low enough that this phenomenon has been undiscovered until now. In contrast, Europa in eclipse was not detected ($<$5.5 μJy), a potential clue to the origin of the source of luminosity. Likewise, Ganymede was observed at 3.6 μm by the Spitzer Space Telescope but it was not detected either ($<$3.6 μJy), suggesting a significant wavelength dependence. Why are they luminous even when in the Jovian shadow? These facts may be consistent with sunlight scattered by dust in the Jovian upper atmosphere, and if this is the case, observations of Ganymede and Callisto while eclipsed by the Jovian shadow provide us with a new method to investigate Jupiter's atmospheric composition.

Keywords: Galilean satellite eclipse, Ganymede, Callisto, Europa, Jovian upper atmosphere