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The first observation of the altitude distribution of Jovian near-IR auroral emission using SUBARU/IRCS with Adaptive Op

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The altitude emission profile is very important to understand that why the spatial distribution of the IR emission from H_2 and H_3^+ are morphologically different (e.g., Raynaud et al., 2004). The origin of this morphological deference is still unknown. It may be caused by the difference of heating altitude and/or difference of precipitation energy.

Although the altitude distribution of IR auroral emission of H_2 and H_3^+ is well discussed by the theoretical model (e.g., Kim et al., 1990; Grodent et al., 2001), observational study is limited. The observation of vertical distribution of H_3^+ column density and vibrational-rotational temperature are only reported by Lystrup et al., 2008. And there is no vertical-resolved observation of H_2 emission.

Based on the model calculation, it is thought that the difference of IR emission altitude between H_2 and H_3^+ is about 500-1000 km (Grodent et al., 2001). It is impossible to detect this vertical difference by ground-based observation, because the typical seeing of 0.6 arcsec is corresponding to the vertical resolution of about 1800 km at the Jupiter. The recent technique of Adaptive Optics (AO) makes it possible to get the high spatial resolved data about 0.1 arcsec, corresponding to the vertical resolution of about 300 km.

Simultaneous H_2 and H_3^+ observation near 2.1 um took place on 30 Nov. 2011 using the SUBARU/IRCS with AO188 system. The slit is set along rotational axis (vertical to the equator) at northern pole. Using Europa for the guide star for AO system, we succeeded the first limb observation of Jupiter H_2 and H_3^+ IR auroral emissions.

In the polar region, H_2 emission lines S1(0), S1(1), and S1(2) at the wavelengths of 2.22, 2.12, 2.03 um and several H_3^+ emission lines are detected.

We will report the difference in the spatial and vertical distributions of those emissions and temperatures, derived from the observation.

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Keywords: Jupiter, ionosphere, Infrared, spectroscopy, thermosphere, aurora