Auroral Electron Energy Estimation Using H/H_2 Brightness Ratio Applied to Jupiter

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The far-ultraviolet (FUV) aurora seen on giant planets is directly produced by the precipitating auroral electrons. An analysis of Saturn's aurorae taken by the Ultraviolet Imaging Spectrograph (UVIS) instrument onboard the Cassini spacecraft showed that the brightness ratio of H Lyman-α to H_2 auroral emissions statistically decreases with the brightness of H_2 taken as a proxy of the energy of precipitating electrons. This ratio is suggested to provide a sensitive diagnosis of auroral electron energy from modeling studies, and the measurement was then investigated in details for the Saturn's case to show that the brightness ratio provides low energy electrons (typically lower than 10 keV), in contrast with the FUV color ratio (CR) method which is sensitive to the high energyelectrons >a few 10s keV. Energy-flux relationship converted from the observation using models shows different trend in the lower energy range (a few keV), reflecting different magnetosphere-ionosphere processes. The H/H_2 brightness ratio would be also useful for the Jupiter case to investigate the role of low energy auroral electrons, and we investigated the relation as follows.

We use HST/STIS long-slit spectra taken on the first half of January 2014 (ID: GO13035). Since HST observes Jupiter from the orbit around the Earth, it contains Lyman-α emissions from geo-coronal hydrogen atoms, in addition to Jupiter's coronal emission. We remove these contaminations by subtracting the emission at the disc. The H/H_2 brightness ratio is then evaluated by spectral fitting following the previous auroral analysis for Saturn.

As a result, we show that the H/H_2 brightness ratio decreases with increasing H_2 brightness, which is qualitatively similar to the Saturn's case, but with different quantitative values. The H/H_2 brightness ratio, i.e., low energy electron precipitation, does not show clear relationship with the FUV CR, i.e., higher energy electron precipitation. Comparing to the same analysis applied to Saturn aurora, the relation at Jupiter shows decreasing flux with increasing energy without acceleration feature for the low energy range.

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