EPSC Abstracts
Vol. 10, EPSC2015-483, 2015
European Planetary Science Congress 2015

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

C. Tao (1), L. Lamy (2), R. Prangé (2), N. André (1), and S. V. Badman (3)

(1) IRAP, Université de Toulouse/UPS-OMP/CNRS, Toulouse, France, (2) LESIA, Observatoire de Paris-CNRS, France, (3) Lancaster University, Lancaster, UK. (chihiro.tao@irap.omp.eu)

Abstract

The measurement of the H/H_2 brightness ratio of giant planets' far-ultraviolet (FUV) aurora is a proxy for the characteristics of precipitating electrons. Here, we check the relevance of this H/H_2 indicator with the Jupiter auroral observations obtained by the Hubble Space Telescope (HST) and compare it with (i) results evaluated from another technique at Jupiter (the FUV color ratio (CR) method) and (ii) results obtained with the same technique at Saturn.

An analysis of Saturn's southern aurorae with 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 [1]. This measurement was then investigated in details in the Saturn's case by [2] to show that the brightness ratio provides a sensitive diagnosis of low energy electrons (typically lower than 10 keV), in contrast with the FUV CR method which provides the energy of electrons > 10 keV [3]. Energy-flux relation converted from the observation using models shows different trend in the lower energy range (< a few keV) compared to the higher energy range (> a few keV), reflecting different magnetosphere-ionosphere processes [2]. Therefore, the H/H_2 index would be also useful for the Jupiter case to investigate the role of low energy auroral electrons.

Since HST observes Jupiter from the orbit around the Earth, it contains Lyman-α emissions from geo-coronal hydrogen atoms. Jupiter's coronal emission also contributes. We remove these contaminations by subtracting the emission at the disc. The H/H_2 ratio is then evaluated by spectral fitting as in [1]. We use HST/STIS long-slit spectra taken on the first half of January 2014 (ID: GO13035).

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 ratio still decreases at large H_2 intensity case, which indicates the existence of H at the low altitude. On the other hand, larger sensitivity on the H/H_2 for the main auroral emission at the limb compared to the CR method indicates a better sensitivity of the H/H_2 ratio at lower electron energy.

Acknowledgements

This work uses observations made with the NASA/ESA Hubble Space Telescope (observation ID: GO13035), obtained at the Space Telescope Science Institute, which is operated by AURA, Inc. for NASA. This research was supported by a grant-in-aid for Scientific Research from the Japan Society for the Promotion of Science (JSPS).

References

[1] Lamy, L., R. Prangé, W. Pryor, J. Gustin, S. V. Badman, H. Melin, T. Stallard, D. G. Mitchell, and P. C. Brandt: Multispectral simultaneous diagnosis of Saturn's aurorae throughout a planetary rotation, J. Geophys. Res. Space Physics, 118, 4817–4843, doi:10.1002/jgra.50404, 2013.

[2] Tao, C., L. Lamy, and R. Prangé: The brightness ratio of H Lyman-α/H2 bands in FUV auroral emissions: A diagnosis for the energy of precipitating electrons and associated magnetospheric acceleration processes applied to Saturn, Geophys. Res. Lett., 41, doi:10.1002/2014 GL061329, 2014.

[3] Gustin, J., J.-C. Gérard, W. Pryor, P. D. Feldman, D. Grodent, G. Holsclaw, Characteristics of Saturn's polar atmosphere and auroral electrons derived from HST/STIS, FUSE and Cassini/UVIS spectra, Icarus, 200, 176-187, 2009.