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Global maps of Jupiter's ionosphere/thermosphere via H_3^+: ground-based observations from 2012 and 2015

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Abstract

We present observations from two observing campaigns using the 3-metre NASA infrared telescope facility (IRTF) telescope and SpeX instrument; three full nights of observations were performed in Dec. 2012, and 4 nights in Feb. 2015. Both observations obtained near complete 360 degrees system III longitude and ±90 degrees planetocentric latitude maps of ionospheric H_3^+ molecular ion emissions. This ion is considered in local thermodynamic equilibrium with its surroundings and as such the properties derived from it - e.g. temperature - are inferred to represent that of the ionosphere and co-located thermosphere. Therefore, these maps display global energy distribution over the ionosphere in the different years. This work is highly complementary to data set to be taken by the Juno spacecraft, which arrives in the Jovian system in 2016.

Preliminary results within the 2012 data indicate (amongst many other things) a global pattern in mid-low latitude ionospheric emissions whereby one half of planetary longitudes are more emissive than the other (see Figure 1). The cause for this may be tied to asymmetries in planetary magnetic field, as a larger magnetic field strength could inhibit particle precipitation and therefore emissions.

The observations from 2015 were taken at a time of exceptional output from the volcanic moon Io and we examine the impact this may have had on the aurora and Io footprint at the time. Further results include cross-comparisons of data taken in 1997, 2012 and 2015 to explore long term behaviours.

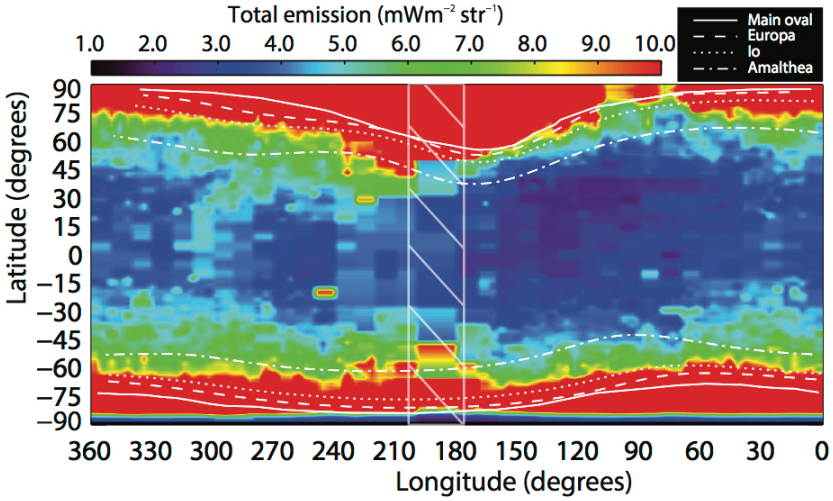

Figure 1: Global map of Jovian H_3^+ total emissions in Jupiter system III planetocentric coordinates.
The map has been limited to 10 $mWm^{-2}\,sr^{-1}$. All values are below 10% uncertainty. The grey diagonal lines in the centre indicate the interpolation of data. The over-plotted white lines show the magnetic footprints of satellites and the main oval, as indicated.