

Results and thoughts on H_3^+ observations of solar system giant planets

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Abstract

The upper atmospheres of Jupiter, Saturn and Uranus consist of a quasi-neutral ionosphere co-located with a neutral (mostly hydrogen) thermosphere. One of the major ions of the ionosphere is H_3^+ (read: *Aitch three plus*) is a remarkably useful probe of these environments, with it's near IR emissions revealing the ion's line-of-sight column-averaged temperature, column density and total radiative cooling rate to space. H_3^+ is considered to be approximately in local thermodynamic equilibrium to it's surroundings, and therefore H_3^+ temperatures are representative of the upper-atmospheric temperature as a whole. In addition to this major scientific benefit, H_3^+ also emits at a range of convenient Earth and Gas Giant atmospheric windows, such that it can be readily observed using ground- and space-based platforms.

In this presentation we will detail how we observe H_3^+ and highlight the major results of the past 30 years at Jupiter, Saturn and Uranus. In addition, we will highlight recent results which show that the Great Red Spot heats the upper atmosphere above it, and that it's raining on Saturn and the rings are responsible. We will also discuss what H_3^+ can tell us about exoplanets, should it be detected at them and attempt to answer the general question:

“Could we see Jupiter's upper-atmospheric H_3^+ from Alpha Centauri?”