Jupiter's low-latitude hydrogen bulge

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Abstract

Here, we provide an overview of the phenomenon called the H Ly-α bulge at Jupiter, which manifests itself as a brightening in hydrogen emissions at low latitudes at around 100° longitude. We present observations of H Ly-α and molecular hydrogen emissions on the body of Jupiter obtained during the Cassini flyby in late 2000 and early 2001. The H Ly-α emission is highly organised by System III longitude and latitude, peaking at a brightness of 22 kR between 90 and 120° longitude, confirming the presence of the bulge. These observations add to a number of previous studies, showing that the feature is very long- lived, present over several decades. We show that there is a strong correlation between the prevailing solar H Ly-α flux (measured at Earth) and the peak brightness of the H Ly-α bulge at Jupiter, which supports the idea that it is primarily driven by solar resonance scatter. However, the primary source of this emission feature remains unknown, and we discuss a number of potential solutions.

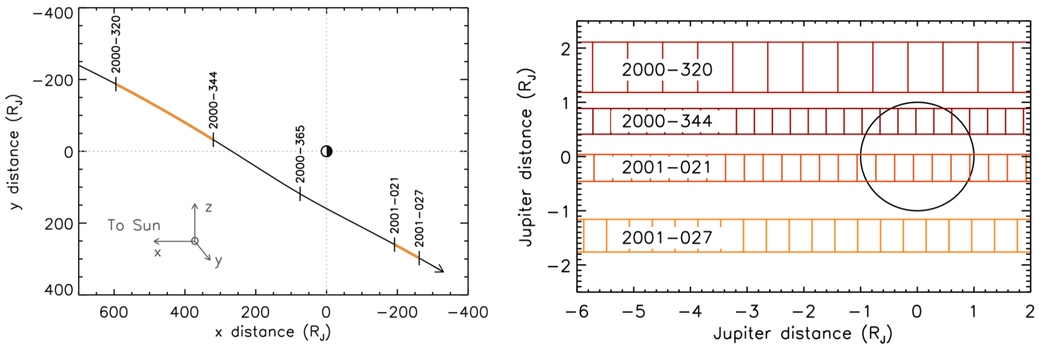

Figure 1: Geometry of observations and size of Cassini UVIS pixels on the planet.

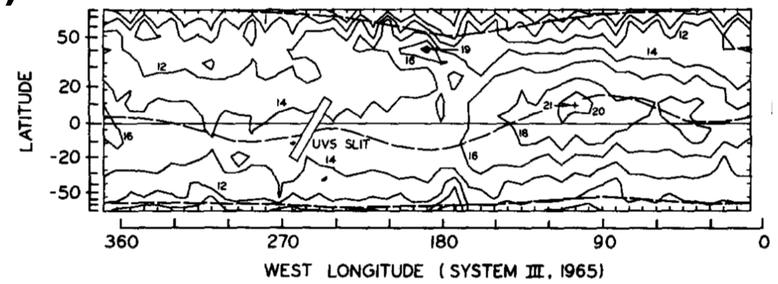

Figure 2: The H Ly-α bulge as observed by Voyager 2 UVS (Dessler et al., 1982, P&SS), showing enhancement at ~100° longitude.

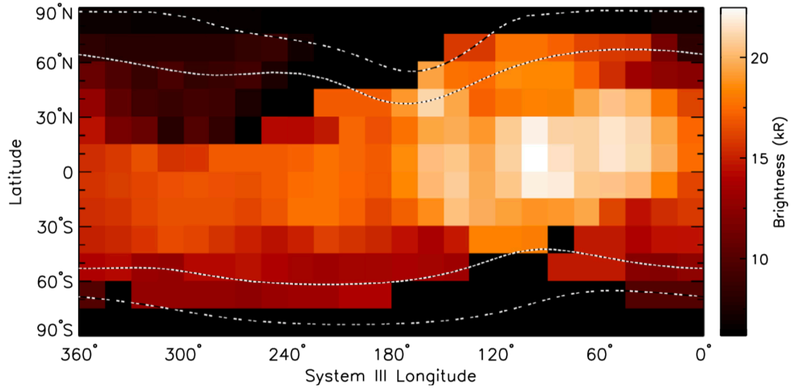

Figure 3: The H Ly-α bulge as observed by Cassini UVIS (Melin et al., 2016, Icarus), very similar to the observations of Voyager 2. This shows persistence over decades!

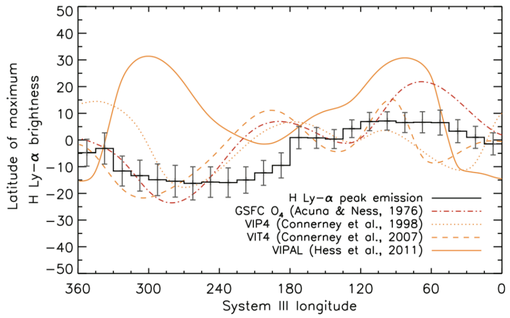

Figure 4: Position of the peak brightness of the H Ly-α bulge for each slice of longitude, very closely matching the magnetic equator derived by Stallard et al., 2019, Nat. Astro.)

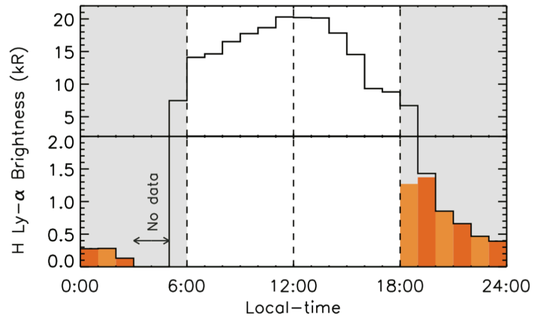

Figure 5: The Lyman H Ly-α brightness as a function of local-time, with the surprising feature that some is present at dusk, without the Sun as an excitation source. Could it be formed by the dissociation of H_3^+ into excited H?

$$H_3^+ + e^- \longrightarrow H + H + H$$

From the tail-off into the night-side, we derive a H_3^+ lifetime of 1.6 ± 0.4 h at equatorial latitudes.