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Saturn's response to ring rain - latest results from Keck

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Abstract

A global-scale interaction between Saturn's ionosphere and ring system was found in April 2011, during Saturn's northern hemisphere spring using the 10-metre Keck telescope[1]. Saturn's ionosphere is produced when the otherwise charge-neutral atmosphere is exposed to a flow of energetic charged particles or solar radiation. At low-latitudes the latter should result in a weak planet-wide glow in infrared, corresponding to the planets uniform illumination by the Sun. The observed low-latitude ionospheric electron density is lower and temperature is higher than predicted by models. A planet-ring magnetic connection has been previously suggested in which an influx of water from the rings could explain the lower than expected electron densities in Saturn's atmosphere. We reported the detection of a pattern of features, unexpected in the ionosphere, extending across a broad latitude band between 25-55 degrees that is superposed on the lower latitude background glow, with peaks in emission that map along the planet's magnetic field lines to features in Saturn's rings. This pattern implied the transfer of charged particles from the ring-plane to the ionosphere. This transport may be responsible for the low electron densities found in specific locations. Here we examine a new dataset from 2013 which have far superior signal to noise, owing to 5 times more spectral data. Saturn's northern hemisphere is tilted ~10 degrees more towards us than before, leading to better spatial resolution of the ionosphere and so a better look at its modulation by ring water influx.

References

[1] J. O'Donoghue et al. The domination of Saturn's low-latitude ionosphere by ring 'rain'. *Nature* **496**, 193-195, 2013