Observational evidence for heat transfer from Jupiter's polar auroral region to lower latitudes

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Jupiter, Saturn and Uranus have non-auroral ionospheres that are measurably 100s of Kelvin hotter than models can explain by solar heating alone. This problem has existed for many decades and is generally termed in literature as the "energy crisis". One way to cause heating in the non-auroral ionosphere is to redistribute heat from the auroral ionosphere at the poles down to lower latitudes (the auroral region itself is heated thermally by collisions as a result of the auroral mechanism). Most models of global circulation suggest that heat within the polar/auroral is confined there by Coriolis forces, such that auroral energy cannot be communicated to lower latitudes, but until now there have been no high spatial resolution observations of temperature in the auroral region simultaneous with non-auroral regions to confirm it. Today we will present ground-based observations of Jupiter's ionospheric H3+ temperature at high spatial resolution (~1000km per pixel). H3+ is a major ion at Jupiter, considered in quasi-thermodynamic equilibrium with its surroundings, and therefore a good proxy for energy balance of the ionosphere. These observations, taken by the 10-meter Keck telescope on April 14, 2016 and Jan 25, 2017, strongly suggest heat from the auroral region is spreading to lower latitudes, such that the missing heat source causing the "energy crisis" may ultimately be auroral in nature.