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Ethylene Line Emission from the North Pole of Jupiter T. Kostiuk

T. Kostiuk, F. Espenak (NASA/GSFC); P. Romani (SSAI) and J. Goldstein (LA/NASM)

A significant enhancement in infrared emission from hydrocarbon constituents of Jupiter's stratosphere has been observed at a north polar hot spot (60° latitude, 180° longitude). A unique probe of this phenomena is ethylene (C₂H₄) which has not been observed previously from the ground. The profile of the emission line from ethylene at 951.742 cm⁻¹, measured near the north pole of Jupiter, was analyzed to determine the morphology of the enhancement, the increase in C₂H₄ abundance and local temperature, as well as possible information on the altitude (pressure regions) where the increased emission is formed. Measurements were made using infrared heterodyne spectroscopy at the NASA Infrared Telescope Facility on Mauna Kea, Hawaii in December 1989. The spectral resolution was 0.00083 cm⁻¹ and the instantaneous spatial resolution was ~1 arcsec (Jupiter diameter ~46 arcsec). Measurements at 60° north latitude away from the hot spot over longitudes 260°-355° showed no strong line emission and the retrieved C₂H₄ abundance was representative of quiescent values. At 181° longitude a very strong emission line was seen, which corresponds to a 13-fold increase in C₂H₄ abundance or a 115K increase in temperature in the upper stratosphere, compared to values outside the hot spot. The hot spot was found to be localized to ~10° in longitude and the line shape (width) implied that the enhanced emission originated very high in the stratosphere, near the 10 μbar pressure region.