N92-12867

Studies of Thermal Wave Phenomena on the Jovian Planets

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Ground-based and Voyager observations of Jupiter have provided evidence that the tropospheric temperature shows global-scale longitudinal variations which are often wavelike in character. Voyager data were reported to exhibit the presence of "slowly-moving thermal features" (Magalhaes et al., 1989 *Nature* **337,** 444), wherein the jovian tropospheric temperature patterns are not advected by the equatorial zonal winds, but are found to rotate at the System III (interior) rate. Ground-based data in a broad infrared band (8-13 μm) show a wavelike structure (Deming et al. 1989, *Ap.J.* **343,** 456) whose amplitude and spatial scale are similar to the reported properties of the slowly moving thermal features. This investigation is directed toward obtaining additional ground-based data in infrared spectral bands whose contribution functions are optimized for specific atmospheric regions (tropospheric at 20 μm, and stratospheric at 7.8 μm), in order to confirm the previous results, and to identify the nature and physical significance of wavelike longitudinal temperature fluctuations on the jovian planets. A 2-D infrared array detector and low resolution cryogenic grating spectrometer is being adapted to obtain maps in ~ 2 cm^{-1} bandpasses.

Subsequent to our initial exploratory observations in 1987, we obtained additional 8-13 μm data in 1989, and extended the observations to include 7.8 μm data. Additional observations have been hampered by relatively poor weather over Mauna Kea, and by instrumental problems in 1991. Nevertheless, significant additional data have been obtained at 7.8 and 20 μm, and all of the data are currently being analyzed. It is anticipated that the recent data should help to clarify the nature of longitudinal temperature variations on Jupiter.

In FY92, the cryogenic grating spectrometer will be made fully operational, and the spectral bands will be extended to include the strong stratospheric ethane emission near 12 μm. Exploratory observations will be made of possible longitudinal temperature variations on Saturn.