Galileo-related Ground-based Observations of the Jovian System

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Strategy

The scientific objectives of this work are to make millimeter observations of SO_2 and other neutral molecules in Io's atmosphere and to conduct a program of observational and interpretive studies of the Jovian system in connection with the Galileo mission.

Progress and Accomplishments

In the past year the principal investigator has participated in the acquisition and interpretation of microwave observations of Io using the IRAM (Spain) and the CSO (Hawaii) facilities. Fully resolved, individual rotational lines of SO_2 have been detected in the spectrum of Io for the first time as a result of this program. Two lines of different strengths and excitation have been observed so far, however, both are strongly saturated and we have not been able to cleanly separate the effects of temperature and abundance in the interpretation. We have one more observing opportunity in the current proposal year at the IRAM facility, and it is our intention to concentrate on the acquisition of data of much weaker lines so that this separation can be more easily effected. The data that we already have in hand show that the neutral atmosphere has limited extent on the disk of the satellite, as expected for an atmosphere in vapor pressure equilibrium with frosts on the surface, and is collisionally thick. The spectra show evidence for a stable component to the atmosphere (i.e., it is always present) on which is occasionally superimposed a highly variable component - perhaps related to episodic volcanic activity. We have also searched for lines of H_2S but so far have only been able to set upper limits to its column abundance. We have published a preliminary report of this work in *Nature*.

Publications

Lellouch, E., M.J.S.Belton, I. de Pater, S. Gulkis, and Th. Encrenaz 1990, "Io's Atmosphere from Microwave Detection of SO_2" *Nature* **346**, 639-641.