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Occultation Studies of the Solar System

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Strategy

Because of their high spatial resolution, stellar occultations have proven extremely effective for learning about planetary upper atmospheres, asteroids, and planetary rings. Our occultation program at M.I.T. involves **(i)** identifying the scientific questions that can be answered by occultation events, **(ii)** predicting the zone of visibility for the useful events, **(iii)** maintaining and improving a high-speed CCD camera for observing occultations, **(iv)** obtaining the observations, and **(v)** reducing the data and interpreting the results.

Progress and Accomplishments

Our accomplishments during the past year include **(i)** development of a model fitting technique that includes, for the first time, an atmospheric thermal gradient as a fitted parameter for stellar occultation data; **(ii)** use of this technique to test the isothermal prediction of the "methane-thermostat" model by reanalyzing our occultation data for Pluto's atmosphere—we found that Pluto's upper atmosphere is isothermal to a limit of 0.1 $^{\circ}K\ km^{-1}$; **(iii)** a search for Pluto occultation candidates for the years 1991-5 with the CCD strip scanning technique; **(iv)** a collaboration with our colleagues at Lowell Observatory to use all available data from the 1988 occultation to determine accurate radii for several levels of Pluto's atmosphere; and **(v)** using Walker's 1980 Charon occultation data to establish upper limits of only a few cm-Amagats for any possible atmosphere of Charon.

Projected Accomplishments

We are currently drafting manuscripts for the results of **(i)**, **(ii)**, **(iii)**, and **(iv)**. Our search for Pluto occultation candidates with the CCD strip-scanning method will be extended to the latter half of the decade, and we shall attempt to use this method for identifying Triton occultation candidates as well. Observation of several Pluto occultations this spring will be attempted if final predictions indicate that these occultations might be observable. Also, we shall be looking ahead to the 1992 probable occultation of a 13th magnitude star by Pluto, which can be used to determine whether Pluto has a haze layer in its atmosphere.

Publications

Baron, R. L., R. G. French, and J. L. Elliot 1989. The oblateness of Uranus at the 1-μbar level. *Icarus* **78**, 119-130.

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Elliot, J. L., E. W. Dunham, A. S. Bosh, S. M. Slivan, L. A. Young, L. H. Wasserman, and R. L. Millis 1989. Pluto's atmosphere. *Icarus* **77**, 148-170.