

## DISSERTATION ABSTRACTS

## THE PLUTO-CHARON SYSTEM AS REVEALED DURING THE MUTUAL EVENTS\*

ROBERT LOUIS MARCIALIS

Department of Planetary Sciences, Lunar and Planetary Laboratory, University of Arizona, Tucson, Arizona 85721

Ph.D. Dissertation directed by: Dr. Larry A. Lebofsky  
and  
Dr. William B. Hubbard  
LPL, UA

This year is the last of a five-year interval when the Earth passes through the orbital plane of Pluto and its satellite Charon, causing alternate transits and occultations of the satellite as seen from Earth. Spectrophotometric observations of the system made both in and out of eclipse have been obtained in the visual and near-infrared. The Pluto-Charon system is found to be compositionally diverse, a result unanticipated before the mutual events. Water frost has been identified and is ubiquitous on the surface of Charon, while Pluto has a methane veneer. The spectral activity of the methane of Pluto is seen to vary with rotational phase, i.e., planetary longitude. On Pluto, surface albedo appears to be correlated with composition. Dark regions tend to be redder and depleted in methane relative to bright regions. Dependence of geometric albedo with wavelength has been calculated for both bodies, from 0.4 to 2.4  $\mu\text{m}$ . The albedo model of Marcialis (1983, 1988) has emerged favorably after several severe tests.

Accurate radii and system bulk density derived from the mutual events have been used to construct models of phenomena unanticipated a decade ago. The gravity of Charon is feeble enough that it could have shed a substantial primordial methane inventory to space and to Pluto, thereby explaining its different surface composition and lower albedo. Recent interior models are used to show that viscous relaxation of topography is expected to be significant on Pluto but not on Charon. Horizontal topographic features on the primary probably are limited in extent to less than a few tens of kilometers (or are geologically young), much as has been found subsequently for Triton. Globally, the figure of Pluto is essentially hydrostatic.

Astrometric observations of the system are presented, as is evidence that the discovery of Charon just seven years before the initial mutual events was not fortuitous, but most probable. The astrometry will help to refine the orbit of Pluto about the Sun, making prediction of future stellar occultations by the system more reliable.

## REFERENCES

- Marcialis, R. L. 1983, Master's Thesis, Vanderbilt University.  
———. 1988, *A.J.*, **95**, 941.

\*This work was done under the auspices of the NASA Graduate Researchers Program, grant NGT-50048.