of a massive greenhouse atmosphere. In this paper we explore the characteristics and implications of such an atmosphere. Using a model developed originally for Triton, we consider the basic characteristics of a thick atmosphere sustained by pressure-induced infrared opacity from collisions among nitrogen, carbon monoxide, methane, and hydrogen. All but the last have now been identified as ices on the present surfaces of Pluto and Triton. The stability of such an atmosphere is a sensitive function of the surface heat flux, elevated perhaps early on by tidal evolution of the Pluto-Charon system, and the atmospheric hydrogen mole fraction. During the lifetime of the atmosphere rapid escape and associated fractionation of the volatiles transpired. The fractionation led to preferential retention of methane, with loss of carbon monoxide and nitrogen. The current nitrogen-dominated surface, with carbon monoxide and methane secondary, can be understood in the context of such a models if ammonia (which is cold-trapped near the surface) was available to supply additional nitrogen. We also use our atmosphere model to investigate the important suggestion of Stevenson (1993, LPSC XXIV, 1355) that volatile loss during accretion may have been maximized for bodies between 100 and 1000 km in radius.

35.15-T

Temperature dependent absorption spectra of CH₄ and N₂ ices.


The optical properties of methane and nitrogen ices have traditionally been studied in thin films in the laboratory. At the wavelengths required for interpreting visible and near infrared spectra of Pluto and Triton, thin films of methane and nitrogen ices are too transparent to yield accurate absorption coefficients. Thus the interpretation of telescopic spectra has been hindered by a poor knowledge of the optical behavior of the ices.

We have obtained new absorption coefficient spectra for pure nitrogen and methane ices and liquids, measured in 1 cm thick samples at L.G.G.E. Our spectral resolution was 1 cm⁻¹ and our wavelength coverage was approximately 0.68 to 2.5 μm for methane and 1.5 to 2.5 μm for nitrogen. Spectra were obtained at temperatures ranging from 17 K up to the 1-bar boiling points of the liquids. The spectra of both CH₄ and N₂ were observed to change as a function of temperature. In methane ice, our wavelength region contained numerous vibrational overtone bands. Each band became weaker and broader at higher temperatures, with very small changes in the shapes of some compound bands. In β and liquid nitrogen, similar effects were observed for the 2-0 overtone band around 4650 cm⁻¹ (2.15 μm), with a secondary band becoming visible at 4605 cm⁻¹ (2.166 μm) at temperatures below ~41 K. On transition to cubic α N₂ below 35.6 K, the 2-0 absorption shifted to 4607 cm⁻¹ (2.166 μm) and became much weaker. A strong, narrow double phonon absorption appeared at 4656 cm⁻¹ (2.148 μm) as well as a broad, unidentified band of comparable integrated absorption, centered around 4600 cm⁻¹ (2.132 μm). In both CH₄ and N₂, a spectral behavior changed very little across the liquid-solid phase transition.

These new data are needed for modeling the albedo spectra of bodies such as Triton and Pluto, and introduce the possibility of independently and remotely determining the temperatures of their icy surfaces via spectroscopy.


35.16-T

Correlation of Composition with Albedo on Pluto: Past Results and New Problems.

R. L. Marcials (Pima Community College, Tucson, AZ).

Time-resolved near-IR spectrophotometry of the Pluto-Charon system was obtained in 1998 by Marcials & Ledbetter (1998, Icarus 89, 255). The observations included ~50% of the 6.4-day lightcurve, approximately centered on minimum light. Methane band depth varies in the same manner that equivalent width varies near minimum light. The most plausible interpretation is that dark regions of the planet's surface are depleted in methane relative to bright areas. This "darkband" model gain added plausibility from the 0.3-mag visible lightcurve amplitude.

Recently, spectral features attributed to CO and N₂ were identified in Pluto's near-IR spectrum by Owen et al. (1992, JAV Circular No. 5032).

35.17-T

Introducing PLUBIB: A Pluto-Chiron Bibliography Database

R. L. Marcials (Pima Community College, Tucson, AZ).

PLUBIB is a database of literature citations which has been assembled as a by-product of 13 years of research on the Pluto-Charon system. As of this writing it contains 1,085 citations (copies—make that 1,000), and continues to grow at an average rate of about 3 per week.

PLUBIB has been found to be an extremely valuable research tool. Some of its uses include: preliminary search of the literature for topic, author, or year of interest; rapid assembly of references for publications in progress; verification and tracking down incorrect or incomplete citations; rapid location of sources; and inclusion in databases on the Sadusky system as the primary investigator is unreachable (who is this guy "AI" et al.), preparation of review articles, and to gain insight into the historical perspective of Pluto-Chiron research. More than once, browsing through PLUBIB has sparked new ideas for future investigation.

Inclusion of a citation into the database (and the accuracy thereof), is the sole responsibility of this author. The main criteria for inclusion of a citation into PLUBIB are that the reference must mention "Pluto" or "Chiron," or for those predication citations, refer to searches for a new planet. Gratitude, reference to many topics having direct bearing on the Sadusky system are excluded by this criterion (e.g., vapor pressure of methane as a function of temperature). However, examination of the literature cited by those relevant references included in the database usually can direct the researcher where to look.

The current format of PLUBIB is an ASCII file of TYP-based definitions, with citations arranged alphabetically by name of the first author. The definitions are supplied in a separate file called BIBlio.TEX. Both files are available via anonymous ftp at a registrar's ends, in the subdirectory /pub/public/p.l.marcials. Alternatively, an up-to-date copy of the file may be obtained if the magnetic medium is supplied in a self-addressed, stamped mailer package. Only under extraordinary circumstances will hard copy be provided. (The file currently is about 56 pages in length.)

35.18-T

Individual Light Curves of Pluto and Charon


Individual light curves of Pluto and Charon in the visible spectrum have been determined from B filter imaging data taken at the University of Hawaii's 88-inch telescope. Pluto, Charon and ten field stars brighter than B-mag 19 were observed for six days at the end of 1992 Feb, as Pluto passed through its stationary point in right ascension. Astronomical analysis of this data set is being reported by Young et al. (this conference). The Pluto and Charon images were fit using DAOPHOT (Stetson 1987, PASP 99, 91). The resulting light curves are displayed relative to one field star and then transformation coefficients were applied to the results to get standard magnitudes. The resulting light curves show a peak-to-peak amplitude of 0.370 +/- 0.007 mag for...