N92-12802

Infrared Observations of Small Solar System Bodies

Caltech Jet Propulsion Lab

R. H. Brown

Strategy

Task 1: To continue measurement of the infrared refectance spectra of dark, primitive asteroids in the 2-5 micron wavelength region. This work, which is in collaboration with Dale Cruikshank at Ames Research Center is aimed primarily at searching for organic complexes such as CN, CH and NH in dark material on small bodies in the solar system.

Task 2: To continue the search for and study of volatiles such as nitrogen, methane, ammonia and carbon monoxide, both as free ices and hydrates/clathrates, on icy surfaces in the outer solar system, using high resolution spectra obtained with a multi-channel, cooled-grating, infrared spectrometer. Specific targets are Europa, Enceladus, Ariel, Titania, and Triton.

Progress and Accomplishments

Several spectra of dark, primitive asteroids were obtained last year and among some of those objects, we have observed an absorption that can be attributed to X-C≡N in the matrix of dark material on these objects. This signature has also been seen in other objects such as new comets and may represent a fundamental similarity in the dark materials on these two classes of objects. New spectra of Ariel obtained in 1989 and 1990, show a strong absorption, possibly a doublet, in the 2.38-micron region, the source of which I haven't yet identified. I will be attempting to obtain additional spectra in this wavelength region at the next apparition of Uranus in order help identify the responsible compound. Our Triton monitoring is going well, and data from last year's apparition of Neptune (which were of particularly high quality) have indicated that there are small regional variations in either the longitudianal distribution or the mean optical pathlength in the nitrogen and methane ices on Triton. This year we hope to confirm this effect and possibly further quantify it.

Projected Accomplishments

Additional spectra of Ariel will be obtained at this summer's apparition of Uranus and we will be analyzing previous spectra of Ariel consistent with the task involving the search for volatile ices on satellites. Cruikshank and I will continue obtaining and analyzing refectance data for primitive objects to further study organic material on small solar-system bodies. We will also continue our multi-year monitoring of seasonal changes in the volatile distribution on Triton. The goal of our new work on Ariel will be to obtain higher resolution data in the

region of the newly discovered absorption, as well as making further attempts to identify the responsible compound.

Publications

Brown, R. H., T. V. Johnson, R. L. Kirk, T. V. Johnson and L. A. Soderblom (1990). Energy sources for Triton's geyser-like plumes. *Science*, **250**, 431-434.

Cruikshank, D. P., W. K. Hartmann, D. J. Tholen, L. J. Allamandola, R. H. Brown, and C. N. Matthews (1990). Solid C≡N-bearing material on solar system bodies. *Nature*, submitted.

Hillier, J., P. Helfenstein, A. Verbischer, J. Veverka, R. H. Brown, J. Goguen and T. V. Johnson (1990). Voyager disk-integrated photometry of Triton. *Science*, **250**, 419-420.

Kirk, R. L., R. H. Brown and L. A. Soderblom (1990). Subsurface energy storage and transport for solar-powered geysers on Triton. *Science*, **250**, 424-428.

Brown, R. H., T. V. Johnson, J. D. Goguen, G. Schubert and M. N. Ross (1990). Triton's global heat budget. *Science*, **251**, 1465-1467.

Soderblom, L. A., S. W. Keiffer, T. L. Becker, R. H. Brown, A. F. Cook II, C. J. Hansen, T. V. Johnson, R. L. Kirk, and E. M. Shoemaker (1990). Triton's geyser-like plumes: Discovery and basic characterization. *Science*, **250**, 410-414.