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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
RESEARCH AND TECHNOLOGY RESUME

## TITLE

Photometry of Pluto-Charon Mutual Events and Hirayama Family Asteroids

## PERFORMING ORGANIZATION

Planetary Science Institute  
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## INVESTIGATOR'S NAME

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DESCRIPTION (a. Brief statement on strategy of investigation; b. Progress and accomplishments of prior year; c. What will be accomplished this year, as well as how and why; and d. Summary bibliography)

(a) Once every 124 years, nature provides earth-bound astronomers with the opportunity to observe occultation and transit phenomena between Pluto and its satellite, Charon. Ground-based observations of these events will allow precise physical parameters for the Pluto-Charon system to be derived which are unlikely to be improved upon until *in situ* spacecraft observations are obtained. The proposed program will continue to support photometry observations from McDonald Observatory, a critical location in an International Pluto Campaign network. Knowledge of the diameters, masses, densities, and compositions derived from these observations will augment our understanding of Pluto's origin and its context within the problem of solar system formation.

A second task will continue to research the evolutionary processes which have occurred in the asteroid belt by measuring the physical properties of specific Hirayama family members. Photoelectric lightcurve observations of Koronis and Themis family members will be used to investigate the individual catastrophic collision events which formed each family. By comparing these properties with results of laboratory and numerical experiments, the outcomes of catastrophic disruptions and collisional evolution may be more precisely determined.

(b) This contract has been funded for eight months. Reduction and analysis of 1987 multi-color photometry has provided individual colors for Pluto and Charon and has shown they have relatively uniform hemispherical distributions (Binzel 1988a). During 1988, observations of 8 additional mutual events have been obtained or attempted.

New lightcurve observations have been obtained for ~20 asteroids in the Koronis and Themis families and also targets of opportunity such as the Galileo flyby target 243 Ida. A preliminary analysis supports the hypothesis (Binzel 1988b) of a recent formation for the Koronis family.

(c) This year, four to six Pluto-Charon mutual events will be observed using the McDonald Observatory 2.1- and 2.7-m telescopes. Events observed in 1989 will be partial transits and occultations involving the southern hemisphere of Pluto and the northern hemisphere of Charon. The McDonald data will be combined with those at other longitudes to allow the best possible solution to be derived for diameters, masses, and densities. These new observations will be combined with existing data to construct a preliminary albedo surface map for one hemisphere of each body.

Observations of 10-15 Hirayama family asteroids will be obtained this year utilizing about 20 nights of 1-m telescope time at McDonald, Kitt Peak, and other observatories. Lightcurve observations of Koronis family asteroids at ecliptic longitudes ~90 degrees away from previous measurements will be used to test whether their spin vectors have a preferential low obliquity alignment, which is evidence for a recent formation. Observations of Themis family asteroids will broaden our understanding of catastrophic disruption events.

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d. Publications

Binzel, R.P. (1988a). "Hemispherical Color Distributions on Pluto and Charon" *Science*,  
accepted.

Binzel, R. P. (1988b). "Collisional Evolution in the Eos and Koronis Asteroid Families:  
*Observational and Numerical Results.*" *Icarus* **73**, 303-313.