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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
RESEARCH AND TECHNOLOGY RESUME

TITLE

Planetary Astronomy: Rings, Satellites, and Asteroids

PERFORMING ORGANIZATION

Lunar and Planetary Laboratory
University of Arizona
Tucson, Arizona 85719

INVESTIGATOR'S NAME

Richard Greenberg

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) Strategy: Studies of planetary rings focus on the dynamical processes that govern astronomically observable ring properties and structure. These investigations thus help reveal properties of the rings as well as probe the gravity fields of the planets. Satellite studies involve interpretation of orbital motion to extract information regarding the gravity fields of the outer planets and the physical properties of the satellites themselves. Asteroid lightcurve work is designed to investigate the large-scale shapes of the asteroids, as well as to reveal anomalous features such as major topography, possible satellites, or albedo variations.

b) Progress: Work on the nature of viscous transport in planetary rings, emphasizing the role of individual particles' physical properties, has yielded a method for estimating both angular momentum and mass transport given an optical-thickness gradient. This result offers the prospect of ringlet instability, which may explain the square-profile ringlets in Saturn's C Ring. Thermal and reflected lightcurves of 532 Herculina have been interpreted to show that albedo variations cannot be the primary cause of variations. A lightcurve simulation has been developed to model complex asteroidal figures. Bamberga was observed during the December occultation as part of the joint LPL-Lowell program.

c) Proposed Research: The lightcurve simulation will be applied to modelling various asteroids with anomalous sets of data. Correlation will be made with infrared lightcurves. Results on viscosity will continue to be applied to Saturn's ring and then to models of Neptunian ring arcs and Uranian rings, and Saturnian ring structure. Uranian ring occultations will be studied for evidence of local swarms of small bodies.

d) Summary Bibliography: 2 papers, 5 abstracts of presentations.

Publications by Richard Greenberg (Supported by NASA Planetary Astronomy)

Greenberg, R.: Particle Properties and the Large-scale Structure of Planetary Rings. Icarus, in press, 1988.

Lebofsky, L.A., et al.: Infrared Lightcurves of Asteroids 532 Herculina and 45 Eugenia: Proof of the absence of Significant Albedo Markings, Icarus, in press, 1988.

Millis, R.L., et al.: Observations of the 8 December 1987 Occultation by 324 Bamberga, at "Asteroids II" conference, Tucson, March, 1988.

Drummond, J., et al.: The Mysterious Case of 532 Herculina, at "Asteroids II" conference, Tucson, March, 1988.

Greenberg, R.: Particle Properties and the Structure of Planetary Rings. AAS/DPS Meeting. Bull. Amer. Astron. Soc. **19**, 892, 1987.

Greenberg, R.: Viscosity of Planetary Rings. AAS/Div. Dyn. Astron. Meeting. Bull. Amer. Astron. Soc. **19**, 913, 1987.

Greenberg, R.: Viscosity and the Physical Properties of Particles, invited presentation at workshop "Kinetic Theories for Planetary Rings", Cornell Univ., 1987.