

NO 10014

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
RESEARCH AND TECHNOLOGY RESUME

TITLE

Speckle Interferometry of Asteroids

PERFORMING ORGANIZATION

Steward Observatory
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Tucson, Arizona 85721

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. Strategy: By studying the image two-dimensional power spectra or autocorrelations projected by an asteroid as it rotates, it is possible to locate its rotational pole and derive its three axes dimensions through speckle interferometry under certain assumptions of uniform, geometric scattering, and triaxial ellipsoid shape. However, in cases where images can be reconstructed, the need for making the assumptions is obviated. Furthermore, the ultimate goal for speckle interferometry of image reconstruction will lead to mapping albedo features (if they exist) as impact areas or geological units.

b. Accomplishments: The first glimpses of the surface of an asteroid have been obtained from images of 4 Vesta reconstructed from speckle interferometric observations. These images reveal that Vesta is quite Moon-like in having large hemispheric-scale albedo features. All of its lightcurves can be produced from a simple model developed from the images. Although undoubtedly more intricate than the model, Vesta's lightcurves can be matched by a model with three dark and four bright 'spots'. The dark areas so dominate one hemisphere that a lightcurve minimum occurs when the maximum cross-section area is visible. The triaxial ellipsoid shape derived for Vesta is not consistent with the notion that the asteroid has an equilibrium shape in spite of its having apparently been differentiated.

c. Future goals: Ten images of Vesta were reconstructed from data obtained with the PAPA detector in 1983. Some 65 observations were made with the MAMA detector in 1986, and have been reduced to power spectra and phases. The immediate goal of the program at Steward Observatory is to identify the optimal image reconstruction algorithm, produce better images of Vesta from the newer data, to verify the first set of images, and to make similar observations and images of other asteroids. However, further progress toward this goal must await funding, since the speckle program at Steward Observatory has no federal, state, or local financial support for astronomy.

d. Publications:

Drummond, J.D., Eckart, A., and Hege, E.K. (1988). Speckle interferometry of asteroids. IV. Reconstructed images of 4 Vesta. *Icarus* **73**, 1-14.

Drummond, J.D., Weidenschilling, S.J., Chapman, C.R., and Davis, D.R. (1988). Photometric geodesy of main belt asteroids. II. Analysis of lightcurves for poles, periods, and shapes. *Icarus*, In press.

Gehrels, T., Drummond, J.D., and Levenson, N.A. (1987). The absence of satellites of asteroids. *Icarus* **70**, 257-263.

Taylor, R. C., Birch, P.V., Drummond, J.D., Pospieszalska-Surdej, A., and Surdej, J. (1987). Asteroid 532 Herculina: lightcurves, pole orientation and a model. *Icarus* **69**, 354-369.