

Planetary Astronomy

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Strategy

Our goal is to use a variety of observational techniques and instruments, and to reduce, interpret, and synthesize groundbased astronomical data concerning small bodies in the solar system -- especially the asteroids -- in order to study the compositions, physical characteristics, population properties, and evolution of these bodies.

Progress and Accomplishments

Faint Asteroid Taxonomy Survey. Our goal is to use a CCD system to characterize the spectral reflectance properties of faint asteroids (mag. 17 - 19) for purposes of taxonomy, size distributions, and other population characteristics of these important small (also dark and/or distant) asteroids. Funding cutbacks permitted only one preliminary observing run at Lowell Observatory (Nov. 1990), which nevertheless provided data on several representative faint asteroids and demonstrated the practicality of the program.

Photometric Geodesy of Main-Belt Asteroids. Our goal has been to determine shapes of a sample of main-belt asteroids and to compare them with theoretical quasi-equilibrium figures for "rubble piles." We completed publication of 107 lightcurves for 59 different asteroids (in addition to 255 lightcurves published earlier). Using lightcurve extrema, we derived or refined shapes and pole positions for 11 asteroids, supplementing earlier results. Seven of our 26 program asteroids show near-equilibrium figures, but they still must have strengths of order 1 bar. We have also made preliminary use of the Simplex algorithm to fit the entire ensemble of data for the 26 asteroids; we find small but physically significant changes to the best axial ratios determined from the extrema.

Main-Belt and NEA Synthesis Studies. Our goal has been to synthesize information on population characteristics of these two groups of asteroids to understand their relationships and evolutionary history. We have clarified some of the issues regarding the S-type asteroid controversy and pursued studies of the implications of the size distribution of NEA's for impacts on the Earth.

NEA Conference. Work has progressed on planning the International Conference on Near-Earth Asteroids (June 30 - July 3, 1991, San Juan Capistrano, CA). About 200 scientists indicate they hope to attend.

Projected Accomplishments

We will conclude our analysis of shapes, continue synthesis studies, hold the NEA Conference, and continue preliminary planning for the faint asteroid survey. However, major progress in acquiring, reducing, and interpreting new data on faint asteroids requires an adequate level of funding.

Publications

Several papers/book chapters, numerous abstracts and presentations.

J. Drummond, S.J. Weidenschilling, C.R. Chapman, and D.R. Davis (1991). Photometric Geodesy of Main-Belt Asteroids IV. An updated analysis of lightcurves for poles, periods, and shapes. *Icarus* **89**, 44-64.

S.J. Weidenschilling, C.R. Chapman, D.R. Davis, R. Greenberg, D.H. Levy, R.P. Binzel, S.M. Vail, M. Magee, and D. Spaute (1990). Photometric Geodesy of Main-Belt Asteroids III. Additional lightcurves. *Icarus* **86**, 402-447.

S.J. Weidenschilling (1990). Strengths and Shapes of "Rubble Pile" Asteroids. In *Asteroids, Comets, Meteors III*, C.I. Lagerkvist *et al.*, Eds., Uppsala University, pp. 203-206.