Asteroid Radar Astronomy

S J Ostro (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91 109; 818-354-3173; email: ostro@echo.jpl.nasa.gov)

Radar measurements can provide otherwise unavailable information about an asteroid's physical properties -- size, shape, rotation, multiplicity, and surface characteristics. Measurements of the distribution of echo power in time delay (range) and Doppler frequency (radial velocity) constitute two-dimensional images that provide spatial resolution as fine as 10 meters. Radar wavelengths are sensitive to near-surface bulk density, so echoes can be used to constrain the surface material's porosity and metal-to-silicate ratio. F..hocs from 37 mainbelt asteroids (MBAs) and 34 near-Earth asteroids (NEAs) have provided new information about these objects' physical properties. Asteroid radar astronomy will expand dramatically upon completion of the upgrading of the Arecibo telescope.

With the echo strength and orientational coverage that is available for increasing numbers of NEAs, radar images can be used to construct geologically detailed three-dimensional models, to define the rotation state precisely, and to constrain the object's internal density distribution. Accurate shape models of asteroids open the door to a wide variety of theoretical investigations that previously have been impossible or have used simplistic models (spheres or ellipsoids). For example, with detailed models of an asteroid, it is possible to explore the evolution and stability of close orbits around the object, with direct application to studies of retention and redistribution of impact ejecta, questions about the origin and lifetimes of asteroidal satellites, and the design of spacecraft rendezvous and landing missions. Such models also allow realistic investigations of the effects of collisions in various energy regimes on the object's rotation state, surface topography, regolith, and internal structure.

Bibliography (abstracts in press in *Bull. Am. Astron. Sot. 27):*
Mitchell, D. L., et *al.:* Radar observations of Ceres, Pallas, and Vesta.
Ostro, S. J., *et al.:* Asteroid 1991 JX: the 1995 Goldstone radar experiment.
Hudson, R. S., and S. J. Ostro: Radar-based physical models of Earth-crossing asteroids.
Scheeres, D. J., *et al.*: Orbits around asteroid 4179 Toutatis.
Asphaug, E. *et al.:* Disruptive impacts into an Earth-crossing asteroid.

1. 1995 Fall Meeting

2. 000543010

3. (a) S J Ostro
300-233
Jet Propulsion Lab
Pasadena, CA 91109-8099

(b) Tel: 818-354-3173

(c) fax: 818-354-9476

4. u

5. (a) U03 Pettengill
(b) 6055 surfaces
6094 techniques
6205 asteroids

6---

7. -100920, various

8. $50 check enclosed

9. I (by Session Conveners, I. Shapiro&S. Ostro)

10---

11. No.