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Radar Observations of Near-Earth Asteroids

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The recent upgrade of the Arecibo planetary radar system, combined with the huge increase in the near-Earth asteroid (NEA) discovery rate by large survey programs, has greatly increased our ability to observe these objects with radar. Radar provides size, shape, rotation, and trajectory information, and in most cases is the only ground-based technique that spatially resolves near-Earth objects. While the resolution of radar images (typically 7.5m) is not as high as for the very best spacecraft images, spacecraft can visit only a few such objects, and radar observations greatly increase our understanding of the diversity of near-Earth objects, at orders of magnitude lower cost. The single clearest result of these observations is the great variety of near-Earth objects, with binary systems, very fast and very slow rotations, spheres, "bifurcated" objects, and "shards", suggesting that a similar variety of production and delivery mechanisms deliver these objects to near-Earth orbit. Spacecraft mission planning should take into account this variety, and concentrate on broad coverage of a wide range of objects.