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Radar Observations of Comet Nuclei and Comae

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Nine comets have been detected with either the Arecibo (12.6 cm wavelength) or Goldstone (3.5 cm) radar systems. Included are six nucleus detections and five detections of echoes from coma grains. The radar backscatter cross sections measured for the nuclei correlate well with independent estimates of their sizes and are indicative of surface densities in the range of 0.5 to 1.0 g cm^{-3}. Like most asteroids, comets appear to have surfaces that are very rough at scales much larger than the radar wavelength. Coma echo models can explain the radar cross sections using grain size distributions that include a substantial population of cm-sized grains. A long term goal of the cometary radar program has been the high resolution imaging of a cometary nucleus. Eleven short period comets are potentially detectable over the next two decades a few of which may be suitable for imaging. We are always waiting for the arrival of a new comet with an orbit that brings it within 0.1 AU of the earth.