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NASA'S NEO OBSERVATION PROGRAM

Abstract

Since being established in 1998, NASA's near-Earth object (NEO) observation program has discovered approximately 98% of all new NEO discoveries. Since the program's inception, NASA has funded several universities and space institutes to upgrade and operate existing 1-meter class telescopes to conduct the search for NEOs. Of critical importance to the effort is the Minor Planet Center (MPC) of the Smithsonian Astrophysical Observatory, where automated systems process [in near real-time] observations produced by the search teams. The NEO Program Office at the Jet Propulsion Laboratory (JPL) determines precise orbits for the objects. Both JPL and the MPC utilize processes and procedures for NEO orbit determination and prediction that are sanctioned and monitored by the International Astronomical Union (IAU) and produce data catalogues on small bodies in the Solar System that are utilized world-wide by the astronomical community. Today, NASA funds three primary ground-based capabilities: the Lincoln Near-Earth Asteroid Research (LINEAR) project, the Catalina Sky Survey (CSS), and the Panoramic Survey Telescope and Rapid Reporting System (Pan-STARRS).

As essential as initial discovery is, further follow-up observations with visible and infrared telescopes refine the astrometric positions of an NEO, photometric observations obtain detailed light curve information [thereby constraining NEO shapes and spin state], and collect albedo and spectral data on basic physical properties.

Ground-based radar is also a very useful follow-up tool. If an NEO has a relatively close approach to the Earth, the Arecibo and Goldstone planetary radars are able to refine the orbit of the object with great precision and even "image" the small primitive body. These planetary radars can image these bodies with resolutions as fine as several meters (depending upon the proximity of the passage to Earth) to reveal the basic shape of the object and, in turn, determine size, spin orientation, whether it was part of a multiple system (i.e., with binary or tertiary companion bodies – 'moonlets'), as well as large-scale surface characteristics (i.e., boulders, craters, etc.).

Most recently, the *Wide-field Infrared Survey Explorer* (*WISE*) was reactivated with an emphasis on detecting NEOs. *WISE* is in Sun-synchronous, near-polar inclination (97.5) orbit around the Earth. The NEOWISE project continues to utilize *WISE* in 'warm mode' (i.e., at 3.4 and 4.6 μm) and in conjunction with ground-based follow-up, this unique dataset has set limits on population statistics, orbital parameters, approximate sizes, and initial compositional knowledge of the asteroid population.