PDC2015
Frascati, Roma, Italy

Planetary Defense – Recent Progress & Plans
x NEO Discovery
NEO Characterization
Mitigation Techniques & Missions
Impact Effects that Inform Warning, Mitigation & Costs
Consequence Management & Education

IAA-PDC-15-02-05

Building on the NEOWISE Legacy with NEOCam, the Near-Earth Object Camera

Amy Mainzer[1], Tommy Grav[2], R. M. Cutri[3], Tim Spahr[4], James Bauer[5]
[1]*Jet Propulsion Laboratory, 4800 Oak Grove Dr. Pasadena CA 91109 USA,*
[2]*Planetary Science Institute, 1700 E. Fort Lowell Suite 106 Tucson AZ 85719 USA,*
+1 812-272-6336,
[3]*Infrared Processing and Analysis Center, California Institute of Technology, Pasadena, CA USA,*
+1 812-272-6336,
[4]*Independant, c/o T. Grav 1700 E. Fort Lowell Suite 106 Tucson AZ 85719 USA,*
[5]*Jet Propulsion Laboratory, 4800 Oak Grove Dr. Pasadena CA 91109 USA,*
+1 818-393-6200,
Keywords: *near-Earth objects, asteroids, surveys, infrared*

ABSTRACT

NASA's NEOWISE project has reinforced the ability of space infrared telescopes to discover, track, and determine physical properties for large numbers of asteroids. The NEOWISE mission began as the Wide-field Infrared Survey Explorer (WISE; Wright et al. 2010; Mainzer et al. 2011a); consequently, its design was optimized for detecting stars and galaxies, rather than moving objects. The telescope has detected >168,000 asteroids and comets in two years of operations, including ~34,000 new discoveries. About 800 of these are near-Earth objects (NEOs). The unique properties of the NEOWISE data, including equal sensitivity to bright and dark asteroids and survey uniformity, have been exploited to determine the total numbers, orbital elements, and physical properties for the near-Earth asteroids larger than 100m (Mainzer et al. 2011b; 2012a).

While NEOWISE represents significant progress in detecting and characterizing asteroid populations, the number of NEOs it can detect is intrinsically limited by its wavelength coverage, viewing geometry, and mission lifetime. To make significant progress toward the U.S. Congress' H.R. 1022 George E. Brown goal of discovering 90% of NEOs >140m, we have proposed a new survey to NASA's Discovery program that is optimized for this purpose. The Near-Earth Object Camera (NEOCam) was awarded technology development funding in the 2011 Discovery

selection to mature the infrared detectors needed to operate at 35-40K, temperatures achievable through passive cooling. NEOCam would operate at the Earth-Sun L1 Lagrange point, allowing a large fraction of near-Earth space to be instantaneously viewable. Moreover, L1 is close enough to Earth to support the high data rates necessary to downlink full-frame images, which are needed to extract faint candidate moving objects. Finally, the thermal environment at L1 allows the optics and focal planes to be cooled to their operating temperatures passively, eliminating the need for cryocoolers or cryogens.

In the NEOCam technology development program, we have produced 1024^2 HgCdTe arrays operating out to 10.7 microns at 35-40K and have shown them to be robust against radiation (McMurtry et al. 2013; Girard et al. 2014). We have also designed a cadence that supports NEO discovery by performing self-follow-up, which is necessary because many targets will be viewable only in the daytime sky from Earth. We have shown that the L1 orbit offers superior performance to interior-to-Earth orbits, even assuming that lossy data compression imposes no additional penalties to sensitivity (Mainzer et al. 2015). At the end of the NEOCam prime mission, ~75% of the potentially hazardous asteroids >140m will be discovered in five years. In total, the mission will increase the number of known NEOs by more than 200,000 new objects.

This publication makes use of data products from (1) NEOWISE, which is a project of JPL/Caltech, funded by NASA; and (2) WISE, which is a joint project of UCLA and JPL/Caltech, funded by NASA.

****