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The Pan-STARRS1 search for Near-Earth Asteroids — present status and future plans

Richard Wainscoat, Larry Denneau, Robert Jedicke, Peter Veres, Bryce Bolin
University of Hawaii, Institute for Astronomy
2680 Woodlawn Drive, Honolulu, HI 96822, USA
rjw@ifa.hawaii.edu
denneau@ifa.hawaii.edu
jedicke@ifa.hawaii.edu
veres@ifa.hawaii.edu
bolin@ifa.hawaii.edu

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ABSTRACT

The Pan-STARRS1 (PS1) telescope on Haleakala in Maui, Hawaii discovered its first Near Earth Asteroid in September 2010. After a slow start, the rate of discovery of Near Earth Asteroids by PS1 has steadily increased. The amount of observing time dedicated to searching for NEOs has increased from 5% in 2010 and 2011 to 6.5% in the first part of 2012, and to 11% from November 2012. Poor weather since the increase to 11% has masked the full impact on the discovery rate that this much larger amount of dedicated observing time will have. The dedicated NEO survey observations have been exclusively obtained using a custom designed wide “w” filter that is as wide as the normal g, r, and i filters combined. Since the beginning of the survey, our software has been significantly improved and refined, and our sensitivity has increased.

Pan-STARRS1 relies heavily on other telescopes to recover NEO candidates that it discovers. NEO candidates are typically posted on the Minor Planet Center NEO Confirmation Page within 12 hours of discovery. Most high scoring NEO candidates are recovered, but some of the smaller faster moving NEO candidates are lost because their positional uncertainties become very large quickly.

Approximately one third of the NEO discoveries from Pan-STARRS have come from the PS1 3pi survey of the entire sky north of declination -30. This is a multipurpose grizy survey not specifically optimized for NEO discovery. Some of 3pi observations have been obtained in the form of quads — four observations separated by approximately 20 minutes — and these are well suited to detection of NEOs. Other observations have been observed as pairs. Carefully screened pair observations have been submitted to the Minor Planet Center and have yielded discoveries of

NEOs including some PHAs.

The present survey strategy will be discussed in detail. We have found that some more exotic directions, away from the traditionally surveyed opposition area, have been very productive. The sweet spots have been very productive in excellent observing conditions, but less effective in mediocre conditions when our sensitivity is less due to poor seeing. The southern sky, slightly easier to reach from Hawaii than from Arizona, has been neglected by the major NEO surveys, and is rich in undiscovered NEOs.

Pan-STARRS produces excellent photometry and astrometry, and the present quality of the astrometry and photometry will be described.

Future plans will be discussed. These include an increase in the fraction of dedicated observing time. A second Pan-STARRS telescope is nearing completion at a factory in Belgium, and will soon be shipped to Hawaii. This telescope will be installed in a dome adjacent to PS1. Commissioning of the second Pan-STARRS telescope will commence in 2013. The new telescope is expected to have better optics and a better camera, so should prove to be an excellent tool for discovery of NEOs. When both telescopes are available, we plan to use them together for simultaneous imaging in the sweet spots to increase sensitivity. However, for most other NEO surveying, we anticipate operating them independently so that the area of the sky surveyed is increased. With an increased amount of NEO survey time, we expect that Pan-STARRS will need to do some of its own NEO candidate recovery. and therefore expect to need to cover the surveyed area more than once per month.