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Prospects for detection of Potentially Hazardous Asteroids in the sweet spots

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ABSTRACT

Potentially Hazardous Asteroids (PHAs) — larger asteroids with orbits that bring them close to Earth — have a different sky distribution to Near Earth Asteroids. We will show simulations of sky distributions for PHAs derived from models of NEO orbits and size distribution. The sweet spots — located between 60 and 90 degrees solar elongation — are rich sky locations for searches for PHAs. The proximity to the Sun makes these locations difficult to observe. The high airmass produces poorer seeing, higher sky brightness, and higher extinction. The phase angle at which asteroids are observed at these solar elongations makes them significantly fainter than they would appear at the same distance at opposition. The time window available to observe the sweet spots after sunset or before sunrise is short, and the moon and the Galactic plane often interfere with the observations. The prevailing wind from the northeast in Hawaii also often makes observations of the morning sweet spot difficult.

Our experience observing in the sweet spots with the Pan-STARRS1 telescope will be discussed. We have found that in excellent conditions, the sweet spots are very productive in terms of discovery of PHAs. However, in more typical conditions, the seeing is less good and the sensitivity of PS1 is less. PS1 seldom discovers NEOs in mediocre conditions in the sweet spots. Trailing losses mean that longer exposures are not an effective tool for increasing sensitivity.

Our experience with PS1, along with the modeled sky distribution of PHAs, suggests that a larger aperture telescope at a good site should be a very productive tool for discovering PHAs in the sweet spots. Telescopes with apertures larger than the 1.5 to 1.8-meter apertures of the Catalina Sky Survey and the Pan-STARRS surveys will be more effective for searches for PHAs in the sweet spots.

The second Pan-STARRS telescope is presently under construction, and commissioning is expected to start in 2013. Prospects for use of simultaneous imaging with the Pan-STARRS 1 and 2 telescopes will be described. Simultaneous imaging with the two Pan-STARRS telescopes will increase the effective collecting area by a factor two and the effective aperture to 2.5 meters. Another potential tool for searching for NEOs in the sweet spots is the Megaprime camera on the 3.6-meter Canada-France-Hawaii Telescope on Mauna Kea Hawaii. This camera has a 1 square degree field of view.

The 8-meter Subaru telescope in Hawaii is presently commissioning a very wide-field camera at its prime focus. This camera is expected to be available for use in the second half of 2013. The camera will have a field-of-view 1.5 degrees in diameter. The camera has 870 million pixels. The size of the images presents a formidable computation task in terms of searching for NEOs. Subaru's image quality is among the best of any telescope in the world. We therefore believe that Hyper Suprime-Cam on the Subaru telescope will become an extremely powerful tool for searching for PHAs. However, establishing good orbits for such faint asteroids will require extensive follow up from comparably large telescopes and obtaining adequate follow up may be challenging,