

DETECTING MAIN BELT ASTEROID COLLISIONS IN REAL-TIME WITH PAN-STARRS

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The catastrophic disruption rate of main belt asteroids larger than a few tens of meters in diameter is expected to be on the order of one per day while an asteroid larger than 100 meters in diameter is destroyed roughly every year (bottke, 2005). These disruptions will produce expanding dust clouds of debris that should be detectable from the Earth as long as their optical depth is > 1 and they reach a diameter equivalent to the size of an asteroid detectable with a telescope system. Thus, the next generation of large aperture synoptic surveys may be capable of detecting the aftermath of these collisions. The possibility of identifying the collision products offers an opportunity for confirming the size-distribution and collision rate at asteroid sizes too small to be observed directly and, with rapid photometric or spectrographic follow-up, the tantalizing option of physical characterization of their bulk properties.

The Pan-STARRS collaboration at the University of Hawaii's Institute for Astronomy is nearing completion of a prototype 1.8m diameter wide-field surveying telescope (PS1) on Haleakala, Maui. This telescope, and the eventual full Pan-STARRS system consisting of 4 similar telescopes working in tandem (PS4), will be capable of imaging the entire night sky in three or four nights. The PS1 system will be capable of detecting 1 km diameter asteroids, or the 1 km diameter dust cloud resulting from the catastrophic collision of smaller asteroids, out to a heliocentric distance of about 2.7 AU while the PS4 system will be complete through the main belt to this size.

I will discuss the use of the Pan-STARRS telescope systems for identifying real-time main belt asteroid collisions, the signatures of the collisions in the Pan-STARRS data, and the requirements for rapid follow-up of new discoveries.

References

Bottke, W. F., Durda, D. D., Nesvorný, D., Jedicke, R., Morbidelli, A., Vokrouhlický, D., Levison, H. F., 2005; Icarus 179, 63-94.