THE SHORT DETECTABILITY OF NEA FAMILIES CREATED BY TIDAL DISRUPTIONS DURING CLOSE PLANETARY ENCOUNTERS. E. Schunova, K. J. Walsh[2], M. Granvik, R. Jedicke, R. J. Wainscoat [1] Comenius University in Bratislava, current address: Institute for Astronomy, 2680 Woodlawn Drive, Honolulu, HI 96822, USA, schunova@ifa.hawaii.edu, [2] Southwest Research Institute, 1050 Walnut St, Suite 300, Boulder, CO 80302, USA, kwalsh@boulder.swri.edu

Introduction: We present the results of a quantitative study of the detectability of near-Earth asteroid (NEA) families that formed by tidal disruption during a close encounter with terrestrial planets. This study combines simulations of the parent NEA's planetary encounters with the subsequent numerical integration of the members in each tidally disrupted family. This is followed an analysis of their long-term orbital evolution and detectability as a family. The tidal disruption simulations model the parent body as a gravitational aggregate; a `rubble pile'. Tidal disruptions are only likely during encounters with Earth and Mars due to the combination of the encounter velocities, encounter distances, spins, elongations and spin axis directions [1] that determine the disruption probability. NEA encounter velocities with Mercury and Venus are high enough to make tidal disruption events very low probability events. We used the method of [2] to identify the synthetic NEA families as a function of time. It has been shown to be capable of finding associations of asteroids based on their orbital similarity with a minimal number of background interlopers. We found that the dissipation of family members is extremely rapid compared to main belt asteroid families. Families that originated in a close encounter with Mars are detectable for up to ~1 Myr but the lifetime of families created by Earth's tidal forces is an order of magnitude shorter. The average lifetime of families created in a close passage by the Earth is approximately 50 Kyr with only a small fraction of families surviving longer than 100 Kyr. The fragments of families created at Mars have a high collision rate with the terrestrial planets - ~8% of them hit either Earth, Venus, or Mars during the subsequent million years. On the other hand, families that originate near Earth have an equivalent collision rate of only 0.04%, while the most likely end state of fragments during the family lifetime is either ejection beyond the orbit of Saturn (~9\%), or collision with Sun ~1%.

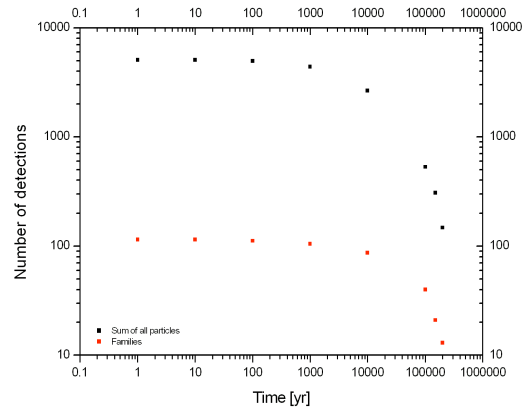

Figure 1: Detectability of 109 NEA families, which originated by tidal disruption of their parent bodies during a close encounter with Earth. The sum of all detected fragments from all families and the number of families detected is dropping, as the family members are being dispersed by gravitational effects and fraction of them leaves the NEA region. The maximum family lifetime is 200 Kyr, which is an order of magnitude shorter than detectability of similar families created by Mars' tidal forces. This detectability analysis doesn't include observational bias.

References:

[1] Walsh K. J., Richardson D. C. (2006). *Icarus 180*, 201-216.

[2] Fu H. et al. (2005). *Icarus 178*, 2, 434-449.