EPSC Abstracts
Vol. 9, EPSC2014-22-1, 2014
European Planetary Science Congress 2014


# The Detection of Collisional and Scattering Processes in the Asteroid-Meteoroid Continuum

H.R. Lai (1), M. Connors (2), **C.T. Russell** (1), H. Y. Wei (1)
(1) University of California, Los Angeles, Earth and Space Sciences, USA; (2) Athabasca University, Athabasca, Canada
(hlai@igpp.ucla.edu / Fax: 310-206-8042)

## Abstract

Optical and radar observations have enabled the compilation of a useful inventory of near-Earth objects down to a diameter of approximately 500m, but at smaller diameters the catalogue is sparse. This is unacceptable for several reasons. First, the most hazardous size range based on damage per impact on Earth times expected impact rate is near 50m and second, we do not know if either the spatial distribution of objects or their behavior is similar to that of the larger objects. We have reason to believe they are importantly different.

Near Earth Objects evolve due to collisions with other objects. Disruptive collisions of large objects say 200m in diameter are rare because such objects are “rare” and the impactors that could disrupt a 200m class object are rare. However, near the Earth, collisions are expected to occur at relative velocities of near 20 km/sec and such a speed could disrupt a body $10^6$ times more massive (100 times larger diameter). Our studies show that collisions that can produce objects in the range 10 to 100m in diameter are “frequent” in near-Earth space. Our studies of the asteroid 2201 Oljato at Venus and asteroid 138175 near Earth indicates that both asteroids have co-orbital debris clouds presumably caused by a past non-disruptive but debris-producing collision. This has the effect of spreading the hazardous material out of the known orbit so that a false sense of security is had when the parent body is safely past the Earth.

We can detect a subset of the debris trail by their destructive impacts because they create a cloud of charged nanoscale dust which in turn creates a magnetic “cloud” that enables the dust cloud to be weighed and its location roughly identified. This shows spreading in longitude, latitude, and heliocentric radius from the parent on a time scale of decades. This is much faster than some modelers have expected and over a broader range, suggesting that the debris trail receives more of the impactor momentum than anticipated. This possibly depends on the elasticity of the target asteroid. In any event, we now have a new qualitative method of tracking debris tails of hazardous materials using existing assets in space.