THE COLLISIONAL EVOLUTION OF SMALL BODIES IN THE SOLAR SYSTEM

David P. O'Brien[1], Donald R. Davis[1], Scott J. Kenyon[2], Benjamin C. Bromley[3]

1. *Planetary Science Institute, Tucson AZ, USA.*
2. *Smithsonian Astrophysical ObservatoryUSA.*
3. *Dept. of Physics, University of Utah, USA.*

Collisions have played an important role in sculpting the populations of small Solar System bodies, namely the asteroids and trans-Neptunian objects (TNOs). Both populations were originally much more massive, and have evolved to their current state through the combined effects of dynamical and collisional evolution. There is a wealth of observational data concerning the size and orbital distributions of the asteroid belt, and there is also a reasonable understanding of its dynamical history [eg. 1,2], allowing for the development of fairly well-constrained models of its evolution [eg. 3,4,5]. These models suggest that dynamical effects, namely perturbations from massive planetary embryos, coupled with Jovian and Saturnian resonances, drove the primordial asteroid belt to its current low-mass state during the first ∼10 Myr of Solar System history. Most collisional evolution occurred early on while it was still massive.

In contrast to the asteroid belt, the size and orbital distribution of the more distant TNO population is not as well known, and much work is still being done to understand its dynamical origin. Models of its collisional evolution have generally focused on trying to grind an originally massive TNO population down to its current mass through collisional erosion [eg. 6-9]. However, new simulations that self-consistently incorporate both dynamical evolution and collisional erosion suggest that dynamical effects are primarily responsible for the mass depletion [10]. Further work, which self-consistently incorporates collisional accretion as well as collisional erosion and dynamical evolution, is necessary to better understand the relative roles of dynamics and collisions in the sculpting the TNO population [see 11 for a discussion].

This review talk will summarize the work to date on the collisional evolution of the asteroid and TNO populations, as well as other populations such as the Jupiter Trojans, in particular focusing on the interplay between dynamical and collisional evolution. I will highlight the outstanding questions and uncertainties that remain, and point out important directions for future work.

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