ABUNDANCES OF GRAVITATIONAL AGGREGATES IN TRANS-NEPTUNIAN POPULATIONS

Paula G. Benavidez and Adriano Campo Bagatin

Depto. de Física, I.S.T.S., Universidad de Alicante.

Collisional events are a main process in the formation and evolution of planetary systems. In particular, the populations of Trans-Neptunian Objects is largely an outcome of collisional processes in the outer Solar System. Michel et al. (2002, 2003) has modelled that in a collision involving large bodies, fragments produced by the fragmentation process alone can actually interact gravitationally. Therefore, some reaccumulation can occur when relative speeds between fragments are below their mutual escape speeds, and can eventually lead to a distribution of large gravitational aggregates (sometimes called "rubble piles").

One interesting feature of gravitational aggregates (GAs) is that they may respond in a different way than monolithic objects to collisions. In particular they may be less efficient in delivering kinetic energy to ejected fragments.

We have developed a collisional evolution model for the different dynamical populations of TNOs, taking into account their mutual interactions as well as the velocity distributions in every population. We basically start every simulation with an initial distribution of monolithic bodies, and we take into account the evolving populations of GAs. In this way we study the dependence of the abundance of GAs (in every dynamical population) on different initial TNO environments.

On the other hand, this model also allows to test the dependence of the abundances of GAs on poorly known physical parameters, such as the fraction of kinetic energy delivered into fragments (f_{ke}), different scaling laws, potentially different responses to collisions with same energies but different momentum.

References

Michel, P.; Benz, W.; Richardson, D. C, 2003. Nature 421, 608
Michel, P.; Tanga, P.; Benz, W.; Richardson, D. C., 2002. Icarus, 160, 10
Campo Bagatin, A.; Petit, J–M.; Farinella, P., 2001, Icarus, 149, 198