An In-Situ Formation Model for Systems of Tightly-Packed Inner Planets

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However, the conditions required for oligarchic growth are hard to satisfy in the innermost regions of planet-forming disks where many STIPs lie.

To fully understand this process, we follow the growth and evolution of one million self-interacting, colliding planetesimals distributed in a smooth disk.

We find that a non-oligarchic growth region develops in the inner disk and two distinctly different, co-evolving populations of planetary embryos emerge.

The remaining embryos and planetesimals are then evolved through the giant impact phase under a migration-free model.

To date, all N-body models of terrestrial planet formation begin with a set of fully-formed, evenly spaced planetary embryos.

These embryos are assumed to have grown from planetesimals through a process known as oligarchic growth (Kokubo + Ida 1998).

Despite similar initial conditions, we find that two out of the five systems simulated experience a series of catastrophic collisions near the inner edge of the disk during the giant impact phase.

This dichotomy, which emerges naturally from our in-situ model could naturally explain why some stars (including the sun) do not host any short-period planets.

References:
Menon, H., Wesolowski, L., & Zheng, G. e. a. 2015, Computational Astrophysics and Cosmology, 2, 1