

L16b 準惑星ハウメア衝突族の軌道進化: カイパーベルトの歴史への影響

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Recently, the first collisional family was identified in the trans-neptunian belt, thus revealing the importance of collisions between trans-neptunian objects (TNOs). The family consists of the dwarf planet Haumea and at least nine other ~ 100 km-sized TNOs. Here, we modeled the long term orbital evolution of an ensemble of family fragments over 4 Gyr. First, we obtained collisional families that reproduced the currently known Haumea's family. In particular, ninety percent of the fragments survived the integrations concentrated in wide regions of orbital elements: $\Delta a \sim 6-12$ AU, $\Delta e \sim 0.1-0.15$ and $\Delta i \sim 7-10^\circ$. Most of the survivors populated the so called classical and detached regions of the trans-neptunian belt, whilst a minor fraction entered the scattered disk reservoir ($<1\%$) or was captured in Neptunian resonances ($<10\%$). In addition, the great majority of fragments displayed negligible long term orbital variations. This implies that the orbital distribution of the intrinsic Haumea's family can constrain the orbital conditions and physics of the collision that created the family billions of years ago. Finally, $\sim 30-40\%$ of the original Haumea family was lost due to planetary ejections or collisions over 4 Gyr.