Highlights of Astronomy, Vol. 13
International Astronomical Union, 2003
O. Engvold, ed.

Orbital Evolution of the Kuiper Belt

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Abstract. The observed distribution of trans-Neptunian objects (TNOs) implies that they originally orbited in a narrow ring of radius 41 AU. The mass of the largest TNO was around $1 - 4 \times 10^{26}$ g.

Scattering by the largest TNO forms the stable low inclination ($i \lesssim 8°$) population (Fig 1a). However, most TNOs remain in the 40-42 AU unstable zone or are scattered into the chaotic fringes of the 2:3 Neptune resonance, where their inclinations and eccentricities fluctuate increasingly until they are scattered by Neptune (Fig 1b). Thus 2 distinct populations emerge from the initial ring. The 2:3 resonance is the main route to the Neptune scattered population. Stabilization of a small fraction of the TNOs passing through gives the Plutinos.

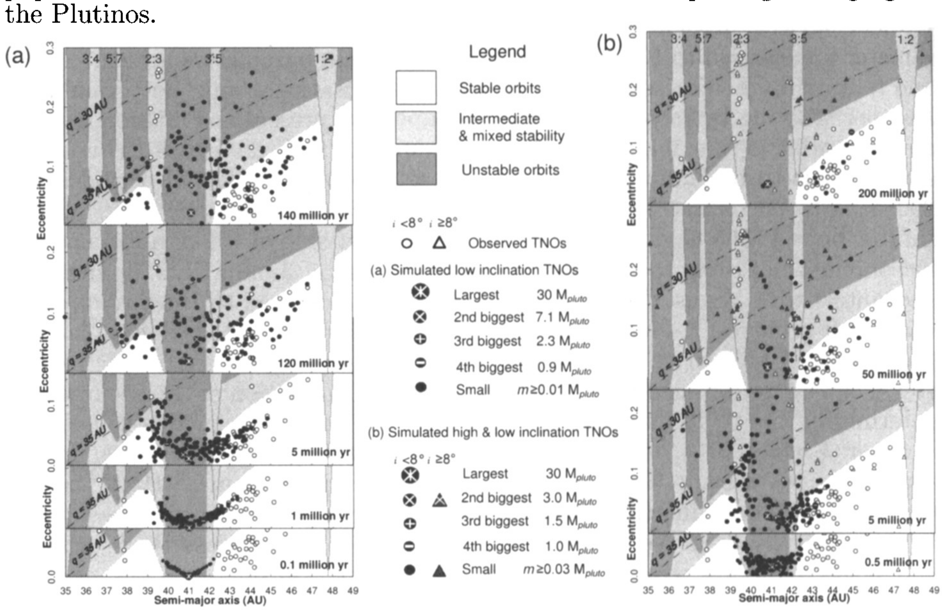

Figure 1. (a) Simulated development of the classical ($i \leq 8°$) population with weak planetary perturbation. The 1:2 resonance would limit expansion. (b) Real planetary perturbation gives both high and low inclination populations. The orbital stability map is adapted from Duncan, Levison, & Budd (1995) and Malhotra (1996).

References

Duncan, M., Levison, H., & Budd M. 1995 AJ, 110, 3073
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