

CHAOTIC CAPTURE OF KUIPER BELT BINARIES

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The discovery that many trans-Neptunian objects are binaries is invaluable for shedding light on the formation, evolution and structure of the outer Solar system, e.g., the dynamics of debris disks. More than 20 Kuiper-belt binaries (KBBs) are now known. These relics from the primordial Solar System differ in several key ways from other known populations of binary objects, e.g., most KBBs consist of similarly-sized partners which are following large, eccentric mutual orbits. It is proposed that chaos played a significant role in the formation of KBBs and that the fingerprint of chaos is visible in the orbital and physical properties of these objects.

Our calculations suggest that binaries are produced through the following chain of events. Initially, long-lived quasi-bound binaries form when two bodies get caught-up in thin layers of dynamical chaos produced by solar tides. Gravitational scattering then stabilizes and hardens the binary. Predictions of the model and comparison with recent observations will be made.

Extensions of this mechanism to other problems of interest in the outer Solar System and to problems in atomic and molecular physics will be discussed.