THE RATIO OF RETROGRADE TO PROGRADE ORBITS: A UNIQUE WAY TO TEST KUIPER BELT BINARY FORMATION THEORIES.
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Introduction: The discovery that a substantial fraction of Kuiper Belt objects (KBOs) exists in binaries with wide separations and roughly equal masses, has motivated a variety of new theories explaining their formation.

Two formation scenarios were suggested by Goldreich et al. (2002): In the first, dynamical friction that is generated by the sea of small bodies enables a transient binary to become bound (L^2s mechanism); in the second, a transient binary gets bound by an encounter with a third body (L^3 mechanism).

Results: We show that the L^2s mechanism dominates binary formation for sub-Hill KBO velocities ($v << v_H$) whereas the L^3 mechanism becomes the primary channel for binary formation if super-Hill velocities prevail ($v >> v_H$) [2].

These two different binary formation scenarios leave their own unique signatures in the relative abundance of prograde to retrograde binary orbits. This signature is due to stable retrograde orbits that exist much further out in the Hill sphere than prograde orbits. It provides an excellent opportunity to distinguish between the different binary formation scenarios observationally [3]. We predict that if binary formation proceeded while sub-Hill velocities prevailed, the vast majority of all comparable mass ratio binaries have retrograde orbits. This dominance of retrograde binary orbits is a result of binary formation via the L^2s mechanism, or any other mechanism that dissipates energy in a smooth and gradual manner. For super-Hill velocities binary formation proceeds via the L^3 mechanism which produces a roughly equal number of prograde and retrograde binaries [3].

References: [1] Goldreich P. et al. (2002) *Nature*, 420, 643-646. [2] Schlichting H. E. and Sari R. (2008) *ApJ.*, 673, 1218-1224. [3] Schlichting H. E. and Sari R. (2008) *astro-ph*, arXiv0803.0329.