Trends in characteristics of small NEA and MB binaries

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An abundant population of binary systems has been found among asteroids in the size range 0.3 to 10 km in heliocentric orbits from near-Earth to the main belt. Their size range is exactly the same as that where there is observed the cohesionless spin barrier. It does not appear to be a mere coincidence, but the two things actually appear related. Primaries of binary systems concentrate at fast spin rates (periods 2-3 h) and low amplitudes, i.e., in a pile up just below the cohesionless spin barrier. They have a total angular momentum very close to, but not generally exceeding, the critical limit for a single body in a gravity regime. This suggests that they formed from parent bodies spinning at the critical rate (at the gravity spin limit for asteroids in the size range) by some sort of fission or mass shedding. The YORP effect is a candidate to be the dominant source of spin-up to instability. Gravitational interaction during close approaches to the terrestrial planets cannot be a primary mechanism of formation of the binaries, but it may affect properties of the NEA part of the binary population. For example, the estimated short lifetime and its strong dependence on semi-major axis of the NEA binaries, together with the strength of the YORP effect being inversely proportional to the square of diameter, may be a reason that binaries in near-Earth orbits concentrate among NEAs smaller than 2 km in diameter and that the fraction of binaries decreases significantly among larger NEAs, as well as for their tendency to smaller relative separations (shorter periods) in comparison with main belt members of the binary population.