A COMMON ORIGIN FOR DYNAMICALLY ASSOCIATED NEAR-EARTH ASTEROID PAIRS.

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Introduction: Though pairs of dynamically associated Main Belt asteroids have been studied for over a decade, few pairs have been identified in the near-Earth asteroid (NEA) population. Attempts to identify dynamical associations amongst NEAs have been mostly unsuccessful (e.g. [1,2]), likely due to the short coherence time of orbits in near-Earth space [3]. We present here data and analysis that supports the existence of two genetically related pairs in near-Earth space [4].

Results: Observations and dynamical analyses were performed for two NEA pair candidates: 2015 EE7 – 2015 FP124 and 2017 SN16 – 2018 RY7. The individual members of each system were found to be of the same spectral type: S- and V-type respectively, both of which are associated with volatile-poor composition. Time-series photometry did not uniquely diagnose rotation states, though we did find a preferred rotation period for 2015 EE7 of 9.586 ± 0.007 h, broadly consistent with [5].

Backwards orbital integrations were performed to investigate the possibility of convergence of the members in each system. A unique separation age was not realized for 2015 EE7 – 2015 FP124 due to large uncertainties associated with these objects' orbits. However, these integrations suggest a separation age <10 kyr for the pair 2017 SN16 – 2018 RY7 (Fig. 1).

Conclusions: Our spectral data and interpreted volatile-poor compositions suggest that cometary processes (e.g. volatile driven mass loss, sublimation) were unlikely to form these pair systems. The orbital integrations reveal stable orbits unperturbed by recent planetary encounters, suggesting that tidal disruption did not form these pairs. Our preferred interpretation implies that these two systems formed via YORP spin-up and/or dissociation of a binary precursor. The recent separation age for 2017 SN16 – 2018 RY7 make these objects amongst the youngest multiple asteroid systems known to date.

Future Work: Observations planned for 2019B will extend our knowledge of these objects. As the NEA catalog continues to grow with current and future discovery surveys, it is expected that more NEA pairs will be found. New methods are needed to systematically identify candidate NEA pairs.

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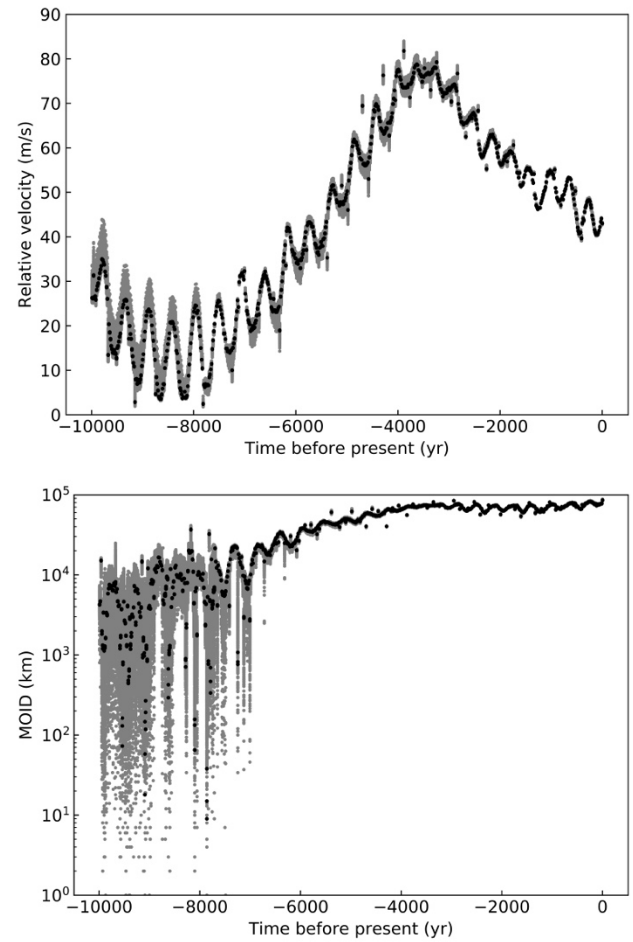

Figure 1. Relative velocity (top) and MOID (bottom) evolution for the nominal orbit of SN16 – RY7 (black) and 500 randomly selected orbital clone pairs (grey). Relative velocities were computed at the MOID configuration. Values of very low and velocity appear at times before −7000 years.