THE GENESIS TRAJECTORY AND HETEROCLINIC CONNECTIONS

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Genesis will be NASA's first robotic sample return mission. The purpose of this mission is to collect solar wind samples for two years in an L1 halo orbit and return them to the Utah Test and Training Range (UTTR) for mid-air retrieval by helicopters. To do this, the Genesis spacecraft makes an excursion into the region around L2. This transfer between L1 and L2 requires no deterministic maneuvers and is provided by the existence of heteroclinic cycles designed below. The Genesis trajectory was designed with the knowledge of the conjectured existence of these heteroclinic cycles. We now have provided the first systematic, semi-analytic construction of such cycles. The heteroclinic cycle provides several interesting applications for future missions. First, it provides a rapid low-energy dynamical channel between L1 and L2 such as used by the Genesis Discovery Mission. Second, it provides a dynamical mechanism for the temporary capture of objects around a planet without propulsion. Third, interactions with the Moon. Here we speak of the interactions of the Sun-Earth Lagrange point dynamics with the Earth-Moon Lagrange point dynamics. We motivate the discussion using Jupiter comet orbits as examples. By studying the natural dynamics of the Solar System, we enhance current and future space mission design.