Mathematical Analysis of an Effective Negative Mass Rocket Propulsion System Along a Linear Trajectory to Mars

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Current rocket trajectories to Mars take nine months and follow the Hohmann Transfer. This project calculates a linear trajectory from Earth to Mars with effective negative mass as its propulsion to shorten travel time without requiring excessive amounts of fuel. To do so, a program was developed that manipulated Kepler's Laws to determine Earth and Mars' true anomaly functions. These equations' accuracy can be verified by comparing them to the actual time taken for one revolution: Mars' calculated orbital function deviated by 0.0539%, and Earth's deviated by 0.0123%. After establishing a trajectory duration of 30 days, linear position of the rocket was found as a function of time as well. Using these equations, the magnitude of the net force exerted by Earth and Mars on a rocket traveling along a linear trajectory between them was determined. Traditional fuel would be insufficient because the forces from Earth and Mars reach extremely large magnitudes at the trajectory's endpoints. Recent experiments have induced spin-orbit coupling to create a superfluid with the properties of negative mass – accelerating in the opposite direction of a force applied on it. An interaction between negative and positive masses of equal magnitudes through a spring system would produce an energy-efficient, high-magnitude acceleration. During time t (days): [0, 0.003] and [28.836, 30] a negative mass system is necessary because the gravitational forces exerted on the rocket are of too large a magnitude to be counteracted by traditional systems, as their maximum rate of fuel expulsion is exceeded during this interval. This project's orbital mechanics research combined with recent discoveries regarding negative mass are the first step towards Mars travel in 11% of the current time.