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MISSION SIMULATION OF THE ASTROD-GW FORMATION

Abstract

ASTROD-GW (Astrodynamical Space Test of Relativity using Optical Devices optimized for Gravitation Wave detection) is to focus on the goal of detection of GWs. The mission orbits of the 3 spacecraft forming a nearly equilateral triangular array are chosen to be near the Sun-Earth Lagrange points L3, L4 and L5. The 3 spacecraft range interferometrically with one another with arm length about 260 million kilometers. With 52 times longer in arm length compared to that of LISA, the strain detection sensitivity is 52 times better toward larger wavelength. The scientific aim is focused for gravitational wave detection at low frequency. The science goals include detection of GWs from MBHs, and Extreme-Mass-Ratio Black Hole Inspirals (EMRI), and using these observations to find the evolution of the equation of state of dark energy and to explore the co-evolution of massive black holes with galaxies. In this paper, we design the optimal transfer orbits of the spacecraft from the separations of the launch vehicles to the mission orbits. Each spacecraft is implemented with a high efficient separable propulsion module for large delta-V maneuvers for the transfer orbits. Each payload includes a drag-free system with micronewton thrusters in the science mode. A millinewton ion thruster is under consideration for small delta-V formation maintenance and adjustment. The differences of the arm lengths of the triangular formation are evaluated to meet the mission requirements.