

ASTROD optimized for Gravitational Wave detection: ASTROD-GW

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ASTROD-GW (ASTROD [Astrodynamical Space Test of Relativity using Optical Devices] optimized for Gravitation Wave detection) is an optimization of ASTROD to focus on the goal of detection of gravitation waves. The detection sensitivity is shifted 52 times toward larger wavelength compared to that of LISA. The scientific aim is focused for gravitational wave detection at low frequency. 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. After mission-orbit optimization, the changes of arm length are less than 0.0003 AU or, fractionally, less than $\pm 10^{-4}$ in ten years, and the relative Doppler velocities for the three spacecraft are less than ± 4 m/s. Both fit the LISA requirement and a number of technologies developed by LISA could be applied to ASTROD-GW. In this paper, we present an overview of the scientific aims, payloads and spacecraft, the orbit optimization, estimation of spurious disturbances, cosmic ray charging simulation, and drag-free control. The science goals are detection of Gravitational Waves (GWs) from (i) Supermassive Black Holes; (ii) Intermediate-Mass Black Holes; (iii) Extreme-Mass-Ratio Black Hole Inspirals; (iv) Galactic Compact Binaries; and (v) Primordial Gravitational Wave Sources, Strings, Boson Stars etc. For the purpose of primordial GW detection, 6-S/C formation will be used for correlated detection of stochastic GWs. A brief discussion of 6-S/C orbit optimization will also be presented.