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Design and evaluation of ASTROD-GW mission orbit with inclined configurations

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ASTROD-GW is designed to observe gravitational waves in the micro-Hz frequency band, employing three spacecraft near the Sun–Earth Lagrange points L3, L4, and L5 to form triangular interferometers with a 2.6 AU arm length. Benefiting from the relative gravitational stabilities of the Lagrange points in 30 years, the mission orbit can remain stable for more than 10 years. The antenna pattern of interferometer will remain (largely) constant to a source if the orbits of three spacecraft stay in the ecliptic plane. To improve the angular resolution to the sources, we twist the orbital formation to be slightly inclined with ecliptic plane, resulting in a half-year precession antenna pattern.

In this talk, we report a set of 10-year ASTROD-GW mission orbits obtained from numerical ephemeris framework which including cases with inclination angles of 0° (no inclination), 0.5° , 1.0° , 1.5° , 2.0° , 2.5° , and 3.0° . Additionally, we calculate the path mismatches of the first- and second-generation time delay interferometry configurations for the different inclinations and compare their capabilities for suppressing laser frequency noise.

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