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Measuring Parity Asymmetry of Gravitational Wave Backgrounds with a Heliocentric Detector Network in the mHz Band

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We discuss exploration for isotropic gravitational wave backgrounds around 1 mHz by correlation analysis, targeting both parity odd and even polarization modes. Even though the space interferometer LISA alone cannot probe the two modes due to cancellations, the outlook is being changed drastically by the strong development of other space detectors such as Taiji. In fact, a heliocentric interferometer network holds a preferable geometrical symmetry illuminated by a virtual sphere off-center from the Sun. By utilizing an internal symmetry of data streams, we can optimally decompose the odd and even parity modes at correlation analysis. By simultaneously using LISA and Taiji for 10 years, our sensitivity to the two modes could reach $\sim 10^{-12}$ in terms of the normalized energy density.

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