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Testing fundamental physics with PTA and astrometry measurements of stochastic gravitational wave background

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The detection of gravitational waves from the LIGO/Virgo collaboration provides an excellent probe for the fundamental physics of gravity, and the recent pulsar timing arrays (PTA) detections of stochastic gravitational wave background (SGWB) open a new window due to their different frequency sensitivity (nHz band). We explore the possibility of testing gravity using PTA signals by studying the impact of modified gravity on the angular correlation of the overlap reduction function (in GR it is approximated by the Hellings-Downs curve). We find a distinct signature, a shift in the minimal angle of the angular distribution, and demonstrate that this shift is quantitatively sensitive to any change in the phase velocity.
On the other hand, astrometry also holds the potential to detect SGWB by precisely measuring the stellar positions. We explore the feasibility of using astrometry for the identification of parity-violating signals which is not possible in PTA measurements. This is achieved by defining and quantifying a non-vanishing EB correlation function within astrometric correlation functions, and investigating how one might estimate the detectability of such signals.
(The talk is mainly based on https://arxiv.org/abs/2308.16183 and https://arxiv.org/abs/2309.16666)

Primary author: LIN, Meng-Xiang (University of Pennsylvania)

Co-authors: Prof. TRODDEN, Mark (University of Pennsylvania); Dr LIANG, Qiuyue (Kavli IPMU); Prof. WONG, Sam (City University of Hong Kong)

Presenter: LIN, Meng-Xiang (University of Pennsylvania)

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