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Time Delay Interferometry in space-based gravitational wave detection

The space-based gravitational wave detector will open a new window in the frequency range of 0.1 mHz to 1 Hz, which cannot be covered by ground-based gravitational wave detectors. This is of great significance for studying the formation and evolution of the universe. However, detecting gravitational wave signals in space is a significant challenge. One of the main obstacles is the high level of laser frequency noise and clock noise, which can be several orders of magnitude higher than typical gravitational wave signals. These noise sources can greatly interfere with the detection of gravitational waves. To address this, our group has been conducting theoretical research on the Time Delay Interferometry (TDI) technique. TDI is a powerful method for suppressing the effects of laser frequency noise and clock noise on gravitational wave detection in data post-processing. In this talk, we focus on various aspects of TDI. This includes exploring both algebraic and geometric methods for constructing TDI combinations, developing algorithm for suppressing clock noise, and calculating sensitivity functions to optimize the performance of the detector.

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