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Machine Learning Identification of Strongly Lensed Gravitational Waves Events

Wednesday, 23 October 2024 16:00 (30 minutes)

I will review the physics of gravitational lensing and its impact on the propagation of gravitational wave (GW) signals. I will discuss the current methods for identifying strongly lensed GW events, including posterior overlap integral estimation.

I will then introduce a new machine learning-based approach designed to distinguish strongly lensed GW events from independent signals. Given the high noise levels in GW detectors, data compression and parameter space analysis are essential to test the strong lensing hypothesis. To address the significant non-Gaussian nature of parameter posterior distributions, I employ normalizing flows to model the difference distribution of parameters between events. This technique allows us to statistically quantify the significance of potential lensed event pairs.

I will demonstrate the application of this method and present the results of the analysis on both simulated catalogs and real events from the Ligo-Virgo-Kagra O3 catalog.

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