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Subtraction of Merging Massive Black Hole Binary Signals in Laser Interferometer Space Antenna Data

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The Laser Interferometer Space Antenna (LISA) is poised to become a key space-based gravitational wave (GW) detector, capturing signals from various astrophysical sources, such as merging massive black hole binaries (MBHBs) and Galactic binaries (GBs). However, the presence of MBHB signals, characterized by their loud and broadband nature, poses challenges in accurately estimating the power spectral density (PSD) and detecting other signals within the LISA band.

In this study, we propose a novel approach to address this issue by employing a fast and approximate model of inspiral-merger-ringdown (IMR) to detect and subtract MBHB signals from the data down to the noise level. Our methodology relies on maximizing the likelihood function over extrinsic parameters and the time of coalescence (F-statistic), supplemented by either a mesh-refinement algorithm (Vegas) or Powell's conjugate direction optimization algorithm.

Following the subtraction of MBHB signals, the remaining data is subjected to further analysis using accurate MBHB models, enabling the detection of additional sources. We illustrate the effectiveness of our method using the LDC2a (Sangria) dataset.

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