

Towards Global EMRI Search with the f -Function

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The Laser Interferometer Space Antenna (LISA) will open a new observational window into the millihertz gravitational wave sky, enabling observations of sources previously inaccessible to ground-based detectors. One of the most anticipated is the detection of Extreme Mass Ratio Inspiral (EMRI) systems, in which a stellar-mass compact object completes at least tens of thousands of orbits around a massive black hole before plunging. The resulting gravitational waveforms carry rich harmonic structure that enables precision studies of black holes and further tests of general relativity.

However, EMRIs pose a persistent search challenge: the likelihood surface is plagued with non-local degeneracies, in which physically distinct sources can produce nearly identical waveforms, causing standard search algorithms (such as MCMC) to converge on misleading solutions far from the true parameters. In this work, we investigate the f -function introduced by Chua (2022) as an alternative objective function for EMRI searches, designed to exponentially suppress these false solutions. We report results that show convergence near the injected parameters for a near-threshold 2-year EMRI signal searched over a shorter window.

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