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A test for LISA foregrounds Gaussianity and stationarity. II. Extreme-mass-ratio inspirals

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Extreme Mass Ratio Inspirals (EMRIs) are key targets expected to be observed by the Laser Interferometer Space Antenna (LISA) mission. Unresolvable EMRI signals contribute to forming a gravitational wave background (GWB).

Characterizing the statistical features of the GWB from EMRIs is of great importance, as EMRIs will ubiquitously affect large segments of the inference scheme.

In this work, we apply a frequentist test for GWB Gaussianity and stationarity, exploring three astrophysically-motivated EMRI populations. We construct the resulting signal by combining state-of-the-art EMRI waveforms and a detailed description of the LISA response with first-generation time-delay interferometry variables.

Depending on the brightness of the GWB, our analysis demonstrates that the resultant EMRI foregrounds show varying degrees of departure from the usual statistical assumptions that the GWBs are both Gaussian and Stationary.

If the GWB background is non-stationary with non-Gaussian features, this will challenge the robustness of Gaussian-likelihood model, when applied to global inference results, e.g. foreground estimation, background detection, and individual-source parameters reconstruction.

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