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Extracting gravitational-wave backgrounds in noise of unknown spectral shape

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Measuring stochastic gravitational-wave backgrounds (SGWBs), particularly primordial ones, is one of LISA's most hoped-for outcomes. However, this task is difficult with a single flying detector because it requires an accurate characterisation of the instrumental noise. Assuming that its shape is known or highly constrained is a dangerous bet. In order to make any discovery possible, it is necessary to have a robust criterion for distinguishing gravitational-wave signals and instrumental stochastic processes. We address this problem by presenting a flexible approach based on two ingredients: a matrix formulation of both SGWB and noise transfer functions and a generic B-splines model of the interferometers'noise spectra. We show that the detection of power-law SGWBs is possible within this framework, with a threshold corresponding to scale-independent energy densities of about 2×10^{-13}.

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