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Phenomenology: Glitch systematics on the observation of massive black-hole binaries with LISA

Monday, September 4, 2023 4:00 PM (15 minutes)

Detecting and coherently characterizing thousands of gravitational-wave signals is a core data-analysis challenge for the Laser Interferometer Space Antenna (LISA).Transient artifacts, or "glitches", with disparate morphologies are expected to be present in the data, potentially affecting the scientific return of the mission. We present the first joint reconstruction of short-lived astrophysical signals and noise artifacts. Our analysis is inspired by glitches observed by the LISA Pathfinder mission, including both acceleration and fast displacement transients. We perform full Bayesian inference using LISA time-delay interferometric data and gravitational waveforms describing mergers of massive black holes. We focus on a representative binary with a detector-frame total mass of
$6 \times 10^7 M_\odot$ at redshift 5, yielding a signal lasting ~ 30 h in the LISA sensitivity band. We explore two glitch models of different flexibility, namely a fixed parametric family and a shapelet decomposition. In the most challenging scenario, we report a complete loss of the gravitational-wave signal if the glitch is ignored; more modest glitches induce biases on the black-hole parameters. On the other hand, a joint inference approach fully sanitizes the reconstruction of both the astrophysical and the glitch signal. We also inject a variety of glitch morphologies in isolation, without a superimposed gravitational signal, and show we can identify the correct transient model. Our analysis is an important stepping stone toward a realistic treatment of LISA data in the context of the highly sought-after "global fit".

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