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Separating Gravitational Wave Signals from Instrument Artifacts
TYSON LITTENBERG, NEIL CORNISH, Montana State University — Central to the gravitational wave detection problem is the challenge of distinguishing features in the data caused by the instrument from those caused by astrophysical sources. This capability has been demonstrated for Gaussian noise, however, transient noise excursions, or "glitches," remain problematic. While detector diagnostics and coincidence tests can reject most glitches which may be considered gravitational wave events, a procedure that robustly differentiates the two is desirable. We have developed an approach for coherently fitting to noise excursions without degrading the underlying gravitational wave signal. The principal feature is the use of wavelets as "glitch templates" to match the non-Gaussian components of the noise, the number of which is determined by a trans-dimensional Markov chain Monte Carlo. We demonstrate the method's effectiveness on simulated data containing low amplitude gravitational wave signals from in-spiraling binary black hole systems, Gaussian noise in accordance with the LIGO/Virgo network of detectors, and injected glitches of various amplitude, prevalence, and variety.

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