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Multiresolution Gabor Regression of Transient Gravitational-wave Signals

Abstract

The analysis of a gravitational-wave transient signal embedded into a non-stationary detector noise requires the identification of time-dependent spectral components in the resulting time series. This talk presents a regression method where a stack of wavelets with different windows spanning a wide range of resolutions, is used to scan power at each time-frequency location. Such a wavelet scan (or ``wavescan'') extends the conventional multi-resolution analysis to capture the local variations of power due to the temporal and spectral leakage. To achieve the high-resolution localization, a wavelet, least affected by the leakage, is selected from the stack at each time-frequency location. The presented method is used to obtain the high-resolution time-frequency distribution of the signal power, extract signals from noise in the wavelet domain, and reconstruct the corresponding time-domain waveforms. To demonstrate the performance of the method for the detection of GW signals, the multi-resolution Gabor regression is applied to the analysis of the gravitational wave data from the LIGO detectors.