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Gravitational-wave Extraction using Independent Component Analysis

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Independent component analysis (ICA) is a method to extract a set of time-series data using "statistical independency" of each component. We applied ICA to extract gravitational wave (GW) signals directly from the detector data. Our idea is to extract a coherent signal that is included in multiple detectors and find it by shifting the data set around its arrival time. In this article, we report several tests using injected signals, and show that this method works for inspiral-wave events with a signal-to-noise ratio of > 15. We then applied the method to actual LIGO-Virgo-KAGRA O1-O3 events, and showed that the identification of the arrival time can be estimated more precisely than previously reported. This approach does not require templates of waveform, therefore it is attractive for testing theories of gravity, and for finding unknown GW.

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