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Joint parameter estimation on overlapping gravitational wave signals from coalescing compact binaries with Einstein Telescope and Cosmic Explorer

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Current parameter estimation techniques for coalescence of compact binaries assume just one event in the data stream. With the low detection rate of current interferometers, it has not been a problem so far, as overlapping signals are highly improbable. This will change with the next generation (3G) of detectors, like Cosmic Explorer and Einstein Telescope, with hundreds of overlaps per year. Previous work has shown that not accounting for them can lead to bias in parameter estimation.

In our work we tackle this problem by performing joint parameter estimation –modeling multiple sources in the data at once. Previously, this technique was too computationally expensive to use with long duration signals expected in 3G detectors, but we have combined it with likelihood approximation known as relative binning, making the analysis feasible. For comparison, we also perform hierarchical subtraction, where we model one signal at a time, subtract it from data and analyze again.

We consider different classes of overlapping signal scenarios like two binary black hole signals, two neutron star signals, and three overlapping signals. Using the joint parameter estimation we are able to accurately estimate the parameters, mitigating the bias observed when we model just one signal at a time.

Submitted on behalf of a Collaboration?

No

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