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Continuous wave search with Einstein Telescope: impact of an astrophysical background from coalescing binaries.

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The search for continuous gravitational waves (CWs) with the third-generation detector Einstein Telescope (ET) will face new challenges due to the increased presence of coalescing binary signals. Indeed, thanks to the improved sensitivity, ET will detect O(1e5) compact object coalescences per year. Moreover, its extended frequency range, reaching down to nearly 5 Hz, will allow the detection of a significant portion of the inspiral phase of the binaries before they merge. As a result, overlapping inspiral signals will form an astrophysical background that could impact CW searches.
To investigate this effect, we simulate the spectrum of coalescence signals in the [2-256] Hz range, where their contribution is expected to be most significant. We perform CW signal injection studies in the ET framework using the Frequency Hough pipeline, currently used in the LIGO-Virgo-KAGRA CW searches, with and without the simulated coalescence background in the ET instrumental noise. By analyzing the differences in CW detection efficiency between these cases, we aim to quantify the impact of this background on CW searches and explore possible mitigation strategies for future analyses.

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