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Polynomial search for continuous gravitational waves from neutron stars in binary systems

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Summary

Deformed neutron stars are a prime candidate for the emittance of continuous gravitational waves. Since the signals are weak, long integration times are needed. However, due to the Doppler shifts and amplitude variations introduced by the detector movement, the coherence time is limited already for solitary neutron stars. Several hierarchical search strategies exist, either based on the power in frequency domain or on a search with optimal filters. These searches require lots of computing resources already for solitary neutron stars and are not readily extendable to neutron stars in binary systems. Most of the neutron stars with spin frequencies above 10 Hz are located in binary systems. In order to fully exploit the capability of the advanced LIGO and Virgo detectors and future third-generation detectors like the Einstein telescope, a new analysis strategy has been developed and implemented, in which a search is performed for signals with a polynomial phase dependence in time domain. With this search strategy, also signals with additional Doppler shifts from the binary motion can be found. We will present out strategy with simulated data, compare it to possible power-based strategies, and give inferred detection limits for classes of sources for the proposed Einstein Telescope.

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