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M. Vaglio: Parameter estimation on boson-star binary signals with a model-based coherent inspiral template

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Compact boson star solutions can be constructed on such a scale that binary systems emit gravitational waves in the same frequency range of stellar-mass black hole binaries. Nonetheless, already at the inspiral stage, the resulting signal is significantly different due to tidal and spin-induced effects which affect the waveform. We constructed a post-Newtonian expanded template for the inspiral of boson star binaries, coherently including beyond-point-particle finite size corrections to the orbital dynamics and gravitational emission, as functions of the component masses and spins and of a single parameter of the model. We performed Bayesian parameter estimation on simulated signals, which show that future facilities will have the sensitivity to disentangle these exotic sources from black holes and to infer constraints on the parameter space of the scalar field theory. The analysis also confirms the validity of our template and our choice of parametrization, showing that including model-based dependence of tidal and spin-induced effects from the stars'first two moments, results in a more accurate recovery of all the parameters.

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