

Generating template banks for gravitational waves searches in exotic binary black hole regions

Friday, 4 November 2022 15:50 (20 minutes)

We introduce a novel method to generate a bank of gravitational-waveform templates of binary black hole (BBH) coalescences for matched-filter searches in LIGO and Virgo data. Unlike the standard approach, our method relies on a numerical metric approximation of the distance between templates, which makes the template placement orders of magnitude faster than with existing techniques.

Our method applies to a variety of different manifolds of signals and is particularly suitable for covering high dimensional spaces, such as those associated with precessing and/or eccentric waveforms.

We compare our method with the state-of-the-art stochastic placement code and we find that our code slightly overcovers the space, while achieving similar efficiency in recovering signals.

We use our publicly released code `mbank` to generate a precessing and an eccentric bank ready for production, both covering interesting and yet unexplored regions of the BBH parameter space. These two ready-to-use banks will facilitate the next generation searches for gravitational waves, hitherto unfeasible due to the prohibitive cost of bank generation.

We also discuss future improvements of our method using a Normalizing Flow model.

Primary author: SCHMIDT, Stefano

Co-authors: CAUDILL, Sarah; GADRE, Bhooshan (GRASP, Utrecht University)

Presenter: SCHMIDT, Stefano

Session Classification: Parallel