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Efficient algorithm to estimate the parameters of gravitational waves sources

Gravitational waves are ripples of space time typically produced by inspiraling pairs of neutron stars and/or black holes, our *sources*. Once detected by the ground-based LIGO and Virgo interferometers, the next step is to **estimate the parameters** of these sources such as their distance, localization in the sky, masses of each component etc.

This task is currently carried out by MCMC typed sampling algorithms, taking between days and several weeks to converge to the full posterior distributions of our parameters.

Thanks to improved sensitivities of the interferometers, the third run of observation -aka O3 which started on April 1st 2019- has a detection rate of ~1 event / week. This brings an obvious tension with respect to the time needed by our methods to converge.

The main purpose of my PhD is to develop an efficient sampler, the **Hamiltonian Monte Carlo** (HMC), to estimate the parameters about 10 times faster than currently used algorithms.

After a brief review of gravitational waves and sampling methods I will explain why the HMC is a promising tool in the context of gravitational waves.

Field

GW/MCMC analysis

Language

English

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