

A Fisher matrix code for population analysis of gravitational-wave events

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We develop a modular and user-friendly python code based on the Fisher information matrix formalism to perform population analysis of gravitational-wave events and to make population-level predictions for third-generation detectors. This project is based on the work of [Gair et al (2021) MNRAS 519 2736] who derived a Fisher Matrix formalism to estimate the hyperparameters that characterize a population of gravitational-wave events assuming Gaussian noise and taking into account selection effects. We apply this Fisher formalism to realistic population models, such as those exploited by the LIGO-Virgo-Kagra collaboration for masses, spins and redshift for both black-hole and neutron-star binaries. As a validation test, we compute the Fisher Matrix for the population of 90 events published in third gravitational-wave transient catalog (GWTC-3) to prove the effectiveness of the formalism for the observed catalog and to compare our results with the ones obtained through the state-of-the-art hierarchical Bayesian analysis.

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