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A framework for Bayesian inference of gamma-ray burst afterglow properties

Ever since the joint discovery of GW170817 and GRB170817A, neutron star mergers and their associated gamma-ray burst events have been a focus of study in the field of multi-messenger astronomy. While Bayesian inference is an effective method for performing model comparison and parameter inference, its application is limited by the computational cost of evaluating the likelihood function of any given physical system. In this work, we perform quick parameter estimation on simulated gamma-ray burst X-ray light curves using an interpolated physical gamma-ray burst model, providing a ~90x speed-up per likelihood evaluation. This is achieved by generating a grid of gamma-ray burst afterglow light curves across the parameter space and replacing the likelihood function with a high-dimensional interpolated simulated grid of light curves. I will discuss how this can be used in future work to perform multimessenger Bayesian analysis where the X-ray observations are analysed in conjunction with the gravitational wave strain and the prompt gamma-ray burst emission.

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