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A Framework For Rapid Parameter Inference of Kilonova Light Curves: Bayesian-Machine Learning Approach

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The coalescence of binary neutron star (BNS) in the event GW170817, leading to the generation of gravitational waves (GW) and accompanied by kilonova (KNe), the electromagnetic (EM) counterpart, has been a prime topic of interest for the Astronomy community in recent times as it provided much insight into multi-messenger astronomy. Since its discovery in 2017, several research teams have put forward models to describe the light curves and the parameters of the observed KNe. Here we propose a technique for parameter estimation where we utilize the strength and flexibility of conditional variational autoencoder (CVAE). Publicly available physical parameters corresponding to single light curves are used as training data. Once the training has concluded, we are able to perform parameter inferences with accuracy. Since this approach is likelihood-free, it provides relatively quicker results. We have demonstrated that the total time, from training until the parameter inference, is under 3 hours. In this work, we show that for a given KNe light curve, we can rapidly perform parameter inference based on the required model.

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