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Estimating the Hubble Constant by combining posteriors from Multi-Messenger Kilonovae Observations

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Multi-Messenger observations of kilonovae can be used to measure the Hubble Constant by combining distance posteriors from the gravitational wave observations with a redshift measurement of the source's host galaxy. There is a significant discrepancy between two existing, prominent estimates of the Hubble constant: Planck, utilizing cosmic microwave background radiation and lambda cold dark matter (ΛCDM) cosmology, and SH0ES which uses supernovae as standard candles. Observations of gravitational waves and the associated kilonovae emitted from compact binary mergers also show promise for estimating the Hubble Constant. Here, we devise a framework to estimate the Hubble constant using simulated observations of neutron star mergers. We obtain a probability distribution of Hubble constant values for each event using Kernel Density Estimation (KDE) and Bayes'Theorem. We then tested various methods of KDE combination to arrive at our final model. We hope to put this framework into use with future observations in the current observing run and beyond, to arrive at an accurate measurement of the Hubble Constant.

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