Use of the Bayes Factor to Improve the Detection of Binary Black Hole Systems

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Abstract

On September 14th, 2015, aLIGO detected the first gravitational wave with a very large Signal-to-Noise Ratio (SNR). In contrast, there are several candidate events with low SNR values which fall within the background distribution. This paper investigates an alternative detection statistic to SNR, known as the 'Bayes Factor.' The Bayes Factor is the ratio between the probability of that the strain data contains a gravitational wave signal plus Gaussian noise, to the probability that strain data contains only Gaussian noise. In contrast the SNR is a maximum likelihood estimator, while the Bayes factor takes into consideration all possible binary configurations, including spin orientations and magnitudes. Hence the Bayes factor might prove to be more robust than SNR. This study focuses only on binary black hole systems.

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