

The Background and Beyond: Landscape and Methods of Single Source Low Frequency Gravitational Wave Searches

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The pulsar timing array (PTA) community has found evidence for a correlated signal following the Hellings-Downs pattern indicative of a stochastic background of nanohertz gravitational waves (GWB). The dominant source in this frequency band is expected to be a population of supermassive black hole binaries. One of the next major milestones for PTA experiments, as more data is collected, is the detection of continuous gravitational waves from individual supermassive black hole binaries, which would be of great importance for multimessenger studies. Searching for these single continuous wave sources adds additional computational complexity to an already time- and resource-strained analysis — increasing the already large parameter space and introducing strong covariance into the model between binaries emitting at low frequencies and the GWB. In this talk we highlight the current status of nanohertz gravitational wave science and present both the challenges as well as the recent development efforts towards performing joint Bayesian analyses of both the GWB and single sources. We end by discussing the Laser Interferometer Space Antenna and the ways in which this work is being extended to aid future detections of millihertz frequency gravitational wave sources.