Realistic Sensitivity Curves for Pulsar Timing Arrays

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Pulsar timing arrays (PTAs) monitor the signals from millisecond pulsars as stable clocks to search for gravitational waves in the nanohertz regime. As PTAs get closer to detecting gravitational waves from supermassive black hole binaries, it is important to characterize the noise in these galactic-scale detectors and predict the sensitivity of next generation PTAs. While sensitivity curves are detailed for ground-based and space-based detectors, those for PTAs are often shown in the form of a pie wedge, only describing the white noise limitations on detection of gravitational waves, and not including the effect of the timing-model fit. In recent years our characterization of the various sources of noise in our pulsars has evolved to a point where different types of white noise and low-frequency time-correlated (red) noise can be accounted for in our gravitational-wave searches. Here we report on our investigations into constructing more realistic sensitivity curves for pulsar timing arrays by including the timing-model fit and using data from the North American Nanohertz Observatory for Gravitational Waves to more accurately represent the noise power spectral density.

References

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