Abstract Submitted
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Astrophysics Milestones for PTAs NIHAN POL, STEPHEN TAYLOR, Vanderbilt University, LUKE KELLEY, Northwestern University, SARAH VIGELAND, University of Wisconsin, Milwaukee, JOSEPH SIMON, University of Colorado, Boulder, SIYUAN CHEN, Universite dOrleans, NANOGRAV COLLABORATION — The NANOGrav Collaboration found strong Bayesian evidence for a common-spectrum stochastic process in its 12.5-yr pulsar timing array (PTA) dataset. However, evidence for the quadrupolar Hellings & Downs interpulsar correlations was not yet significant. We emulate and extend the NANOGrav dataset, injecting a wide range of stochastic gravitational wave background (GWB) signals that encompass a variety of amplitudes and spectral shapes. We then apply our standard detection pipeline and explore three key astrophysical milestones: (I) robust detection of the GWB; (II) determination of the source of the GWB; and (III) measurement of the properties of the GWB spectrum. Given the amplitude measured in the 12.5 yr analysis and assuming this signal is a GWB, we expect to accumulate robust evidence of an interpulsar-correlated GWB signal with 15–17 yrs of data, i.e., an additional 2-5 yrs from the 12.5 yr dataset. At the initial detection, the achieved fractional uncertainty should be sufficient to distinguish a SMBHB source for the background from other, more exotic, sources. We also show that it is possible to distinguish power-law models from those with a spectral turn-over with 20 yrs of data. Finally, with the IPTA data combination, these milestones will be achieved much earlier.

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