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NANOGrav Collaboration: The search for signs of modified gravity with PTAs

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NANOGrav (the North American Nanohertz Observatory for Gravitational Waves) exploits the high-precision timing of an array of Galactic millisecond pulsars (MSPs) in a bid to unveil timing deviations induced by gravitational waves (GWs). A GW transiting an Earth–pulsar line of sight distorts the intervening spacetime, causing pulses to arrive before or after their expected times of arrival (TOAs). Crucially, such a GW will affect all pulsars in the Galaxy, imprinting a correlated (quadrupolar) influence on the TOAs that allows NANOGrav and other pulsar timing arrays (PTAs) to effectively synthesize a kiloparsec-scale GW detector. On the other hand, modified gravity theories are expected to play an important role in these gravitational physics scenarios beyond the standard model, both in particle physics and cosmology, where through the latter scenario, they can be tested. In this paper I will present in very general lines the work that we carried out in the NANOGrav collaboration (specifically in the detection and astrophysics working groups - DWG, AWG), and also some preliminary results of the search for modified gravity signs with the Pulsar data Timing Arrays (PTA's). Finally I will give some insights about the LISA consortium and future second and third generation experiments such as Einstein Telescope (ET), DECIGO and Cosmic Explorer (CE), among others.

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