

Studying astrophysics with Pulsar Timing Arrays

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Pulsar Timing Arrays (PTAs) are entering a new era of nano-Hertz gravitational wave (GW) astronomy with evidence for a GW signal found in several PTA data sets, CPTA, EPTA, InPTA, NANOGrav, PPTA and MPTA. They are working together in the IPTA to combine the data sets and analyze the truly best upcoming global PTA data set, IPTA DR3, to be able to conclusively confirm the detection of nano-Hertz GWs. In addition, the GammaPTA project is also advancing and offers a complementary observing frequency range to radio PTAs. In my presentation I will focus on tackling the challenge of the identification and characterization of the source of the GWs.

One of the main targets are super massive black hole binaries (SMBHBs), which are formed when two galaxies merge. Several processes will drive the evolution of the binary orbit. Measurements of a GW background can help to address the question on how SMBHBs evolve over a cosmic time scale. Given that direct observations in the electromagnetic spectrum are difficult, we can turn to cosmological simulations for further tests. Finding an individual SMBHB as a GW source will not only allow for the possibility to distinguish different population models of SMBHBs, but also for multi-messenger astrophysics. I will attempt to review the current status of astrophysical interpretation efforts from the PTA community and how we will move forward into the post-detection era.

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