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Search for ultralight dark matter and cosmological phase transition using pulsar timing arrays

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Pulsar timing arrays record the arrival time of radio pulses from dozens of millisecond pulsars. The pulsars of different sky locations construct a network that is sensitive to gravitational waves and dark matter signals. There are three Pulsar timing arrays in the world, PPTA, EPTA and NANOGrav, that are actively gathering pulsar timing data with very high precision. In this talk, we use the recent PPTA data to search for ultralight dark photon dark matter signal and the phase transition gravitational wave background signal. We find that in both cases, the sensitivity of the current PPTA data exceeds the current limit in the low-frequency range, and a fair amount of parameter space can therefore be probed.

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