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Probing Dark Matter Substructure with Pulsar Timing Arrays

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Pulsar timing arrays (PTAs) are a powerful tool to study dark matter (DM) substructure. Transiting lumps of DM can induce shift in pulsar timings due to Doppler and Shapiro effects. In this talk we first briefly review the principle of DM detection with PTAs. We then show the projected reach using the projected subhalo mass function and density profile of DM substructure from various models. We also discuss constraints on DM substructure obtained using pulsar timing data from the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) and the corresponding Bayesian analysis framework. Finally, we discuss constraints on a Yukawa fifth force interaction between DM and baryons derived from both PTA, and observation of the coldest known neutron star, which limits the interaction strength due to kinetic capture and heating of DM by the neutron star.

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