

# Fishing for light dark matter with pulsars (via Zoom)

*Thursday 13 March 2025 14:00 (45 minutes)*

Pulsars, which are very rapidly spinning neutron stars, can be instrumental in solving the puzzle, which has perplexed the minds of the scientific community for almost a century –dark matter (DM). In the talk I will mainly focus on the light DM candidates that can be searched for in pulsar observables. The ultralight scalar field DM (also known as “fuzzy” DM), consisting of bosons with extremely low masses of  $m \sim 10^{-22}$  eV, solves some of the problems of the conventional cold DM hypothesis. It was shown by Khmelnitsky and Rubakov (2014) that such DM in the Milky Way induces oscillating gravitational potentials, leaving characteristic imprints in the time of arrivals of radio pulses from pulsars. In addition (Ivanov et al 2019, Castillo et al. 2022), the coupling of axion-like particles to photons alters the polarization properties of light, i.e. the plane of polarization of linearly polarized beam propagating through the axion field starts to oscillate with typical frequencies of  $10^{-8} - 10^{-5}$  Hz. Searches for these two effects were performed in the data of the European Pulsar Timing Array (EPTA), and stringent constraints on the DM density and coupling constant between photons and axion-like particles have been set. In addition, traces of QCD axions with masses of around  $\sim \mu\text{eV}$  can be searched for with the spectroscopic observations of pulsars. We discuss the systematics and artifacts in pulsar data that can mimic the signal of interest and possible methods to avoid the existing biases.

**Presenter:** PORAYKO, Nataliya (SAI)

**Session Classification:** Invited talk