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Chasing dark matter with pulsar experiments

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Pulsars are rapidly rotating, highly-magnetized neutron stars which emit electromagnetic radiation in the form of highly collimated beams, mainly observed in the radio wavelength regime. Pulsars can be instrumental in solving the puzzle, which has perplexed the minds of the scientific community for almost a century – dark matter. The ultralight scalar field dark matter (also known as "fuzzy" dark matter), consisting of bosons with extremely low masses of m ~ 10^(−22) eV, is one of the compelling dark matter candidates, which solves some of the problems of the conventional cold dark matter hypothesis. It was shown by Khmelnitsky and Rubakov that "fuzzy" dark matter in the Milky Way induces oscillating gravitational potentials, leaving characteristic imprints in the time of arrivals of radio pulses from pulsars. Fuzzy dark matter in the Galaxy are searched in the latest European Pulsar Timing Array dataset that contains the times of arrival of 25 pulsars regularly monitored for more than two decades. The results and obtained limits will be summarized in the talk. Other possible ways of constraining dark matter with pulsar experiments as well as prospects of dark matter detection with future radio astronomical facilities are discussed.

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