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Search for axion dark matter with ultracold neutrons

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Axion-like particles (ALPs) are good candidates for cold dark matter. They would form a galactic-scale classical field, which on local scales undergoes coherent oscillations. Through their coupling to gluons these particles would induce oscillating electric dipole moments (EDMs) in nucleons and atoms [1,2]. We analyse data of two neutron EDM experiments: ILL, Grenoble, France (1998-2002) and PSI, Villigen, Switzerland (2015-16), explicitly looking for an oscillating neutron EDM signal [3,4]. Our analysis is the first direct laboratory search for the ALP-gluon coupling, with improved sensitivity over indirect bounds from BBN and supernovae observations. Our search also covers the cosmologically interesting range of dark matter particle masses 1e-24 eV < m < 1e-20 eV, which can resolve several long-standing "small-scale crises" of the cold DM model [5].

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