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Searching for Axion Dark Matter with Atoms and Ultracold Neutrons YEVGENY STADNIK, VLADIMIR DZUBA, VICTOR FLAMBAUM, BENJAMIN ROBERTS, University of New South Wales, MICHAL RAWLIK, ETH Zurich, AND THE NEDM COLLABORATION AT PSI COLLABORATION — We propose new schemes to directly search for axion dark matter with atoms and ultracold neutrons. Axions are an excellent candidate for the observed cold dark matter; their low mass and weak-strength interactions with ordinary matter mean that axions can readily form an oscillating classical field that survives to reside in the observed galactic dark matter haloes. The oscillating nature of the axion field gives rise to a number of oscillating effects in atoms and neutrons [Stadnik and Flambaum, PRD 89, 043522 (2014); EPJC 75, 110 (2015); Roberts et al., PRL 113, 081601 (2014); PRD 90, 096005 (2014); Graham and Rajendran, PRD 84, 055013 (2011); PRD 88, 035023 (2013)], which include oscillating electric dipole moments, and the precession of polarised spins about Earth's direction of motion through galactic axions. Importantly, these effects scale as the first power of the underlying interaction constant (whereas traditionally-sought effects of dark matter scale as the second or fourth power). First-power effects may thus provide a very strong advantage, since the interaction constant is extremely small. We present an overview of ongoing efforts of the nEDM collaboration at PSI to search for axion dark matter via these effects using a dual neutron/Hg-199 co-magnetometer.

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