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Searches for ultralight dark matter

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Analysis of inter- and intra-galactic velocities indicated a mismatch between potential and kinetic energy that was removed by postulating gravitational impact of non-luminous dark matter on luminous matter. Among the various candidates that have been suggested as dark matter constituents are axions hypothetical ultra-light particles whose existence was postulated to resolve the strong CP problem in quantum chromodynamics. Up to now no interaction other than gravitation between dark and ordinary matter has been found. Recently, it was suggested that axion like dark matter couples to nuclear spins like a classical field by inducing an oscillating electric dipole or magnetic axial moment. In a static magnetic field, this interaction should add to the classical Zeeman splitting. The search for this interaction requires novel detection schemes that are sensitive to slight changes of the precession frequency of noble gas nuclei in ultra-low magnetic fields.