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Searching for axion-like dark matter with ensembles of nuclear spins

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Nuclear magnetic resonance is one of the promising approaches in searching for axion-like dark matter. We report the first science results of the CASPEr-electric search for the EDM and the gradient couplings of axion-like dark matter to nuclear spins in the mass range of 162 neV to 166 neV. The experiment employs an ensemble of ²⁰⁷Pb nuclear spins inside a polarized ferroelectric solid PMN-PT crystal. We also demonstrate how the relaxation properties of this spin ensemble can be controlled using transient light-induced paramagnetic centers. Such spin ensemble engineering is necessary to achieve the sensitivity at the level of the QCD axion EDM coupling in the kHz to MHz frequency band.

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