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Physical Signatures of Fermion-Coupled Axions

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While there is an abundance of experiments searching for axion dark matter (DM) via its electromagnetic coupling, there are fewer utilizing its derivative coupling to electrons and nucleons. This direct coupling generates dynamical effects through the fermion spin, and therefore spin-polarized targets are a naturally useful target. We propose using spin-polarized or magnetized analogs of layered dielectric haloscopes, which are sensitive to axions through their coupling to electrons. These novel techniques can be powerful probes at both radio frequencies, with sensitivity to currently unexplored parameter space, and optical frequencies, with sensitivity comparable to current astrophysical bounds.

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