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A Torsion Pendulum Based Axion Search

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Despite two decades of experimental effort, the elusive axion has yet to be found. Nevertheless, for possible axion masses between $10^{-7} \mu\text{eV}$ and 10^{-5}meV , it remains a well motivated solution to the strong CP problem, and a promising dark matter candidate. Current searches use the axion-two-photon coupling to probe for axions that could be generated in the sun, remnants from the big-bang or created in the laboratory. Using techniques inspired by torsion pendulum based tests of gravity, we have constructed a new torsion pendulum experiment that looks for a macroscopic parity and time violating force mediated by virtual axions. For an axion mass of 10^{-7}meV , we have improved the limit on this force by ten orders of magnitude. In addition, we have demonstrated that one can operate a torsion pendulum in a strong magnetic field, and thus, have opened another path to look for very heavy axions.

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