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We propose a laboratory experiment to detect the fifth force mediated by a new light scalar field. The symmetron is a light scalar field which couples quadratically to matter, with a symmetry-breaking potential that takes the form of a symmetric double-well. As the characteristic phase transition of the symmetron field occurs, topological defects or 'domain walls' can form. It is hoped that by designing and manufacturing a topologically-tailored vacuum chamber, we can ensure that these domain walls are long-lived by pinning them to the interior of the chamber. A good vacuum will result in a very low density environment in which the symmetron can couple with gravitational strength, and the effects of the scalar field on a matter particle are potentially observable via a particle experiment involving cold atoms. As a cloud of cold atoms approaches the domain wall, it will experience the fifth force mediated by the scalar field and will be deflected or reflected off the domain wall. This deflection or reflection is a signature of the fifth force and could constrain some previously unconstrained parts of the dark sector.

Poster Abstract

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