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Constraining dark energy scalar fields using atom interferometry VICTORIA XU, MATT JAFFE, PHILIPP HASLINGER, Univ of California - Berkeley, PAUL HAMILTON, Univ of California - Los Angeles, AMOL UPADHYE, University of Wisconsin - Madison, BENJAMIN ELDER, JUSTIN KHOURY, Univ of Pennsylvania, HOLGER MUELLER, Univ of California - Berkeley — Atom interferometry has proven to be a technique capable of making precise gravitational measurements. Typically however, these measurements probe the gravitational forces of large source masses, such as the Earth. We perform atom interferometry in an optical cavity near a centimeter-sized, in-vacuum source mass. By observing the gravitational attraction between a 190 gram miniature source mass and atoms for the first time, our measurement is sensitive to a wide class of screened scalar fields which would manifest as a fifth-force with a matter coupling as weak as gravity, a natural lower bound for fundamental forces. In particular, we improve our previous limits on "screened" scalar field theories which can reproduce the observed cosmic acceleration by over two orders of magnitude.

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