Abstract Submitted
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A Fermi-degenerate three-dimensional optical lattice clock ROSS HUTSON, SARA CAMPBELL, EDWARD MARTI, AKIHISA GOBAN, WEI ZHANG, JOHN ROBINSON, LINDSAY SONDERHOUSE, JUN YE, JILA, NIST and University of Colorado Boulder — Ongoing advances in atomic clocks enable table top searches of dark matter and other physics beyond the Standard Model. Currently the most accurate and stable clocks are based on alkaline-earth(-like) neutral atoms confined to one-dimensional optical lattices. A major obstacle in improving clock stability and accuracy is mitigating density-dependent frequency shifts due to contact interactions. We overcome this limitation by loading a two spin component degenerate Fermi gas of strontium atoms into a three-dimensional optical lattice. By tuning the thermal, kinetic, and interaction energy scales, we operate in the half-filled Mott insulating regime that suppresses atomic collisions and leaves and any residual contact interactions spectroscopically resolvable. Additionally, we demonstrate control of the scalar, vector, and tensor components of the three-dimensional lattice induced ac Stark shifts, enabling the observation of a 6 second atom-light coherence time.

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