Quantum Matter, Cocks, and Fundamental Physics

 $J YE^1$

¹ JILA, National Institute of Standards and Technology and University of Colorado, Boulder CO, USA Contact Email: Ye@JILA.colorado.edu

Precise quantum state engineering, many-body physics, and innovative laser technology are revolutionizing the performance of atomic clocks and metrology, providing opportunities to explore emerging phenomena and probe fundamental physics. Recent advances include precise control of many-body interactions to achieve high accuracy, measurement of gravitation time dilation across a few hundred micrometers, and employment of spin squeezing for clock comparison.