

Quantum matter and atomic clocks

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Precise quantum state engineering of individual atoms has led to the unprecedented measurement performance for time and frequency. The use of many atoms not only enhances the counting statistics, but is also emerging as a powerful tool to protect against systematic uncertainties. At the core of the new JILA three-dimensional optical lattice clock is a quantum gas of fermionic atoms that are spatially correlated to guard against motional and collisional effects. The convolution of precision control of light and matter is helping bridge different disciplines in physics and fostering new capabilities to probe fundamental and emerging phenomena.