Quantum metrology in optical tweezer arrays

Prof. Adam Kaufman

Department of Physics, University of Colorado, Boulder

Quantum science with neutral atoms has seen great advances in the past two decades. Many of these advances follow from the development of new techniques for cooling, trapping, and controlling atomic samples. As one example, the technique of optical tweezer trapping of neutral atom arrays has been a powerful tool for quantum simulation and quantum information, because it naturally allows control and detection of individual atoms with switchable interactions. In this talk, I will describe ongoing work at JILA where we have explored a new direction for the optical tweezer platform: metrology. I will report our recent progress towards combining scalability and quantum coherence in a tweezer-based optical atomic clock platform, and our efforts towards using quantum information concepts and many-body dynamics to create entangled states that enhance metrological performance. Much of this technology is based in the use of tweezer-trapping of a new family of atoms, alkaline-earth atoms — I will discuss the broader outlook of this direction and new pursuits on the horizon.