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Quantum metrology and computing using microscopically-controlled arrays of alkaline-earths

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Abstract

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 enables scalable 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 type of atom - two-electron atoms - for optical tweezer trapping and manipulation. While the increased complexity of these atoms leads to challenges, they also offer new scientific opportunities by virtue of their rich internal degrees of freedom. Accordingly, they have impacted multiple areas in quantum science, ranging from quantum information processing to quantum metrology, and intersections therein. I will report on my group's progress in these areas.