Abstract Submitted
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Preparing and probing few-atom number states with an atom interferometer[1] BENJAMIN BROWN, JENNIFER SEBBY-STRABLEY, MARCO ANDERLINI, PATRICIA LEE, JQI/NIST, PHILIP JOHNSON, American University and NIST, WILLIAM PHILLIPS, TREY PORTO, JQI/NIST — We describe the controlled loading and measurement of number-squeezed states and Poisson states of atoms in individual sites of a double-well optical lattice. These states are input to an atom interferometer that is realized by symmetrically splitting individual lattice sites into double-wells, allowing atoms in individual sites to evolve independently. The two paths then interfere, creating a matter-wave double-slit diffraction pattern. The time evolution of the double-slit diffraction pattern is used to measure the number statistics of the input state. We present investigations of three distinct site occupation distributions: predominantly $N = 1$ atom per site, a Poisson distribution with $\langle N \rangle \approx 1$, and predominantly $N = 2$ atoms per site. Each of these cases exhibits qualitatively distinct features. The flexibility of our double-well lattice also provides a means to detect impurity in ensemble state preparation, and specifically the presence of empty lattice sites, an important and so far unmeasured factor in determining the purity of a Mott state.

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