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Single-Atom Indexing of Quantum State Superpositions[1]
CHRISTOPHER R. MOON, Stanford University, C. P. LUTZ, IBM Almaden, D. M. EIGLER, IBM Almaden, H. C. MANOHARAN, Stanford University — The ultimate miniaturization of electronic devices will likely require the local control of single-electron wavefunctions. One system where this may be accomplished consists of two-dimensional metallic electron states confined within atomically engineered nanostructures. Here we describe experiments showing that an individual atom inside a 44-atom quantum corral can index arbitrary coherent superpositions of spatial quantum states. We demonstrate how the quantum mirage effect can be harnessed to image the resulting quantum superposition. We also present a straightforward method for determining the appropriate atom location for any desired superposition. The atom provides a real-space handle for an abstract Hilbert space, providing a simple, novel technique for coherently manipulating quantum states.

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