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Building one Molecule from a Reservoir of Two Atoms[1] LEE LIU, JONATHAN HOOD, YICHAO YU, JESSIE ZHANG, Department of Physics, Harvard University, NICHOLAS HUTZLER, Division of Physics, Mathematics, and Astronomy, California Institute of Technology, TILL ROSENBAND, Department of Physics, Harvard University, KANG-KUEN NI, Department of Chemistry and Chemical Biology, Harvard University — We demonstrate building a single molecule from 2 atoms in an optical tweezer. We begin by trapping a single Cs and single Na atom in separate optical tweezers, then merging them into the same tweezer. The tightly trapped ultracold sample of precisely two atoms allows discovery of previously unseen resonances near the molecular dissociation threshold and the measurement of collision rates, providing a valuable tool for studies of chemical reactions in the single-atom limit. In addition, cold atoms trapped in an array of tight optical tweezers have allowed for single site manipulation and formation of defect-free crystals. Combining this with long range, anisotropic dipole dipole interactions and a myriad of possible long-lived pseudospin states afforded by polar molecules would provide an unprecedented resource for quantum simulation and quantum information processing.

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