Abstract Submitted
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**Full quantum-state control of two different atoms in an optical tweezer**[1] KENNETH WANG, LEE R. LIU, YICHAO YU, LEWIS R. B. PICARD, JONATHAN D. HOOD, TILL ROSENBAND, KANG-KUEN NI, Harvard University — Ultracold polar molecules trapped in optical tweezers have emerged as a candidate for a scalable quantum computer. To controllably create a molecule in an optical tweezer, we will assemble it from single atoms. We demonstrate full quantum state control of individual Na and Cs atoms trapped in optical tweezers. We cool both atoms in their respective tweezers to the three-dimensional motional ground state and then merge them adiabatically into a single tweezer. After merging the atoms, we will perform fully coherent, all optical transfer to the ground molecular bound state. To this end, we first demonstrate fully coherent manipulation of the single atoms. We perform spectroscopy of the NaCs molecular states, and study collisional properties of the single atoms extracting scattering lengths from interaction shifts.

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