Abstract Submitted
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Experiments with Strontium in an Optical Lattice: Optical Clocks and Ultracold Collisions[1] MARTIN BOYD, TANYA ZELEVINSKY, ANDREW LUDLOW, SETH FOREMAN, SEBASTIAN BLATT, MARK NOTCUTT, THOMAS ZANON, TETSUYA IDO, JUN YE, JILA and the Department of Physics, National Institute of Standards and Technology and the University of Colorado, Boulder CO, 80309-0440 — We present atomic and molecular spectroscopy of ultracold strontium in an optical lattice. In one dimension, the atoms are confined in the Lamb-Dicke regime, allowing spectroscopy free of recoil and Doppler effects. In the case of Sr, the lattice can be tuned to a magic wavelength where the ac Stark shifts of the excited and ground states of interest are equal, thus allowing extremely precise and accurate spectroscopy. This has motivated experiments toward building an optical atomic clock based on the extremely narrow (<10 mHz) $^1S_0 - ^3P_0$ clock transition in ^{87}Sr. With μK strontium atoms we have performed high resolution frequency measurements of the clock transition including a detailed investigation of potential systematic errors such as shifts due to the lattice parameters, atom density, and magnetic fields. Confinement in the lattice has also enabled the first narrow-line photoassociation spectroscopy near the $\sim$7kHz $^1S_0 - ^3P_1$ transition in ^{88}Sr, allowing accurate measurements of the nine least bound molecular states. Analysis of the photoassociation lineshapes suggests that optical tuning of the ground state scattering length should be possible without significant atom losses. [1]ONR NASA NIST NSF

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