Abstract Submitted
for the DAMOP11 Meeting of
The American Physical Society

Optical Feshbach Resonances in ^{88}Sr TRAVIS NICHOLSON, SEBASTIAN BLATT, BENJAMIN BLOOM, JASON WILLIAMS, JUN YE, JILA, PAUL JULIENNE, JQI — We recently demonstrated that the accuracy and precision of strontium-based optical lattice clocks can be improved by an order of magnitude with control over many-body physics [1]. Greater many-body control via Feshbach resonances is desired, but magnetic Feshbach resonances do not exist in the strontium ground state. However, optical Feshbach resonances have been indirectly observed through atom loss spectra [2]. To date most optical Feshbach resonance theory has approximated photoassociation lines as isolated [3]. For large detunings from these lines, this theory predicts big scattering length changes with minimal inelastic losses—yet we did not experimentally observe elastic effects at large detunings [4]. We present new optical Feshbach resonance calculations that do not make the isolated resonance approximation, showing that this approximation is valid near a photoassociation line but not at large detunings. In the context of this new theory, a systematic experimental study of optical Feshbach resonances will be also presented, including detailed measurements of the Sr+Sr dimer structure and the first direct observation of light-induced thermodynamics. [1] M.D. Swallows et al., Science, 3 Feb 2011 (10.1126/science.1196442) [2] G. Thalhammer et al., Phys Rev A **71**, 033403 (2005) [3] J.L. Bohn and P.S. Julienne, Phys Rev A **60**, 414 1999 [4] R. Ciurylo et al., Phys Rev A **71**, 030701 2005

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Date submitted: 04 Feb 2011 Electronic form version 1.4