Abstract Submitted
for the DAMOP11 Meeting of
The American Physical Society

Suppression of collisional shifts via strong inter-atomic interactions in a ^{87}Sr optical lattice clock[1] MICHAEL MARTIN, MATTHEW SWALLOWS, MICHAEL BISHOF, YIGE LIN, SEBASTIAN BLATT, ANA MARIA REY, JUN YE, JILA/NIST, University of Colorado — Optical lattice clocks based on ensembles of neutral atoms have the potential to operate at the highest levels of stability due to the parallel interrogation of many atoms. However, the control of systematic shifts in these systems is correspondingly difficult due to the potential of collisional shifts. Clocks based on ultracold fermionic ensembles still exhibit these density-dependent shifts due to a loss of indistinguishability during the clock excitation process, limiting clock accuracy.[2] By tightly confining samples of ultracold fermionic ^{87}Sr atoms in a two-dimensional optical lattice, as opposed to the conventional one-dimensional geometry, we increase the collisional interaction energy to be the largest relevant energy scale, thus entering the strongly interacting regime of clock operation. We show both theoretically and experimentally that this increase in interaction energy results in a paradoxical decrease in the collisional shift, reducing this key systematic to the 10^{-17} level.[3]

[1]This work was supported by the ARO with funding from the DARPA OLE program, NIST, NSF, and AFOSR.
[2]G. K. Campbell *et al.,* Science, **324**(5925) pp. 360- 363, 2009.
[3]M D. Swallows *et al.* Science, 10.1126/science.1196442, 2011

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Date submitted: 04 Feb 2011 Electronic form version 1.4