Abstract Submitted
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Towards the next decades of precision and accuracy in a ^{87}Sr optical lattice clock[1] MICHAEL MARTIN, YIGE LIN, MATTHEW SWALLOWS, MICHAEL BISHOF, SEBASTIAN BLATT, CRAIG BENKO, LICHENG CHEN, TAKAKO HIROKAWA, 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 potential collisional atomic interactions. 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.[2] We also present work towards next- generation ultrastable lasers to attain quantum-limited clock operation, potentially enhancing clock precision by an order of magnitude.

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[2]M D. Swallows *et al.* Science, 10.1126/science.1196442, 2011

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