Abstract Submitted
for the DAMOP07 Meeting of
The American Physical Society

Ultra-high resolution spectroscopy with a ^{87}Sr lattice clock GRETCHEN K. CAMPBELL, SEBASTIAN BLATT, MARTIN M. BOYD, ANDREW D. LUDLOW, TANYA ZELEVINSKY, SETH M. FOREMAN, THOMAS ZANON, JUN YE, JILA, NIST, and University of Colorado — We have performed ultra-high resolution spectroscopy using a ^{87}Sr optical lattice clock. With the addition of a small magnetic bias field, the high line Q of the $^1S_0$-$^3P_0$ clock transition has allowed us to resolve the nuclear-spin sublevels, and make a precision measurement of the differential Landé g-factor between the $^1S_0$ and $^3P_0$ states arising from hyperfine mixing of the $^3P_0$ with the $^3P_1$ and $^1P_1$ states. Breaking the nuclear-spin degeneracy allows for a better characterization of systematic errors, and we have made measurements of these nuclear-spin related effects including the linear Zeeman shift and tensor polarizability. The ability to directly manipulate individual nuclear-spin levels also makes this an attractive system for quantum information. Recent progress towards an all optical comparison of atomic clocks, including the construction of a new strontium three-dimensional optical lattice will also be presented.

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Date submitted: 02 Feb 2007 Electronic form version 1.4