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Optical lattice clock: towards 10^{-17} uncertainty NATHAN HINKLEY, University of Colorado, Department of Physics, JEFF SHERMAN, National Institute of Standards and Technology, NATHAN LEMKE, University of Colorado, Department of Physics, KYLE BELOY, National Institute of Standards and Technology, MARCO PIZZOCARO, Politecnico di Torino, Italy, JAVIER VON STECHER, GOULVEN QUEMENER, ANA REY, University of Colorado, Department of Physics, RICHARD FOX, CHRIS OATES, ANDREW LUDLOW, National Institute of Standards and Technology — Ultracold alkaine-earth atoms confined in an optical lattice are strong candidates for high-accuracy frequency standards and precision timekeepers. When last evaluated, the ytterbium optical lattice clock fractional uncertainty was 3.4×10^{-16}. Principle contributions to this uncertainty were the blackbody Stark effect, atomic cold-collisions, and lattice ac-Stark shifts not canceled at the magic wavelength balancing scalar Stark shifts in clock states $^1S_0$ and $^3P_0$. We report significant advances in these areas, paving the way toward a total uncertainty near the 10^{-17} level. We have since measured the clock static polarizability, reducing the blackbody Stark shift uncertainty to 3×10^{-17}, now limited by thermal environment uncertainty. Ultracold collisions between fermionic ^{171}Yb atoms are dominated by p-wave interactions between $^1S_0$ and $^3P_0$ states. Ramsey spectroscopy with $\approx 50\%$ excitation cancels density-dependent shifts at the 5×10^{-18} level. We report progress measuring residual lattice ac-Stark shifts: polarizability away from the magic wavelength ($\propto I$, the lattice intensity), hyperpolarizability ($\propto I^2$) and multipole (M1-E2) effects ($\propto \sqrt{I}$).

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