Abstract Submitted
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An Aluminum Ion Optical Clock Using Quantum Logic[1] T. ROSENBAND, P.O. SCHMIDT, D.B. HUME, T.M. FORTIER, W.H. OSKAY, J.C.J. KOELEMEIJ, K. KIM, W.M. ITANO, S.A. DIDDAMS, J.C. BERGQUIST, R.E. DRULLINGER, D.J. WINELAND, National Institute of Standards and Technology — The 267 nm $^1S_0 \rightarrow ^3P_0$ transition in $^{27}Al^+$ combines several attractive characteristics as an atomic reference for an optical clock with high stability and accuracy. Its sharp clock transition (7 mHz natural linewidth) has a very small electric quadrupole moment, a low quadratic Zeeman coefficient (0.7 Hz/gauss^2), as well as a small room temperature blackbody shift ($\Delta\nu/\nu < 10^{-17}$). We have used quantum logic based spectroscopy[a,b] to operate an Al^+ optical frequency standard in which a stable laser oscillator at 534 nm is doubled and locked to the Al^+ $^1S_0 \rightarrow ^3P_0$ transition. The frequency of this optical standard was compared to the NIST $^{199}Hg^+$ optical frequency standard using a femtosecond frequency comb, resulting in a frequency ratio measurement with $\Delta\nu/\nu < 10^{-16}$ statistical uncertainty. The systematic uncertainty in the Al^+ clock frequency has a similar magnitude, and is dominated by second order Doppler shifts due to secular motion and micromotion.
[a] D. J. Wineland *et al.*, Proc. 6th Symp. on Freq. Standards and Metrology, 361 (2002)
[b] P. O. Schmidt *et al.*, Science **309**, 749 (2005)

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Till Rosenband
National Institute of Standards and Technology

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