

Abstract Submitted
for the DAMOP06 Meeting of
The American Physical Society

Progress on single trapped indium and barium ion optical frequency standards using all solid-state light sources JEFF SHERMAN, WILLIAM TRIMBLE, AMAR ANDALKAR, PETE MORCOS, WARREN NAGOURNEY, NORVAL FORTSON, University of Washington — Single trapped ions cooled to the Lamb-Dicke regime are spectroscopic systems free of many external perturbations and are therefore attractive as optical frequency standards. We report continued development of single indium ion and barium ion rf Paul-Straubel traps and laser cooling systems. The forbidden $^1S_0 \leftrightarrow ^3P_0$ transition in In^+ at 237 nm has a quality factor of 10^{15} and is immune to ~ 1 Hz quadratic Stark shifts that can limit other systems. In addition, the extraordinarily long $5D_{3/2}$ lifetime ($\tau \sim 80$ s) in a single trapped barium ion yields an electric dipole forbidden 2051 nm $6S_{1/2} \leftrightarrow 5D_{3/2}$ transition with a quality factor of 10^{16} . Further, the odd isotope $^{137}\text{Ba}^+$ ($I = 3/2$) has an excited state with total angular momentum $F' = 0$ so an optical frequency standard based on this transition also avoids significant quadratic Stark shifts. We present our latest experimental probes of these transitions using new low linewidth diode pumped solid state laser systems (a frequency quadrupled non-planar ring oscillator Nd:YAG at 946 nm and a diode pumped Tm,Ho:YLF at $2 \mu\text{m}$), new stable reference cavities, and propose a laboratory constraint on fundamental constant drift.

Jeff Sherman
University of Washington

Date submitted: 27 Jan 2006

Electronic form version 1.4