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Progress on single indium ion and single barium ion frequency references WILLIAM TRIMBLE, JEFF SHERMAN, ADAM KLECZEWSKI, WARREN NAGOURNEY, NORVAL FORTSON, University of Washington — Energy levels in laser cooled trapped ions are attractive as optical frequency standards because they can be made free of many external perturbations. We report continued development of single indium ion and barium ion rf Paul-Straubel traps and laser cooling systems. In In^+, the forbidden $^1S_0 \leftrightarrow {}^3P_0$ transition at 237 nm has a quality factor of 10^{15} and is immune to DC quadratic Stark shifts. In Ba^+, the $\tau \sim 80$ s gives the electric dipole forbidden 2051 nm $6S_{1/2} \leftrightarrow 5D_{3/2}$ transition a quality factor of 10^{16}. Further, by choosing the transition $6S_{1/2}(F = 2, m = 0) \leftrightarrow 5D_{3/2}(F' = 0, m' = 0)$ transition in $^{137}Ba^+$ (I = 3/2), the first order DC quadrupole Stark shift and 2nd order Zeeman shits can be made to vanish. We present our latest experimental probes of these transitions using 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 μm) stabilized to vertically-mounted ULE reference cavities.

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