Abstract Submitted
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Al^+ Spectroscopy via Sympathetic Cooling and Quantum Information Transfer using Be^+ T. ROSENBAND, P. O. SCHMIDT, Y. KOBAYASHI[1], C. LANGER, W. M. ITANO, S. A. DIDDAMS, J. C. BERGQUIST, D. J. WINELAND, NIST, Boulder — A single $^9Be^+$ ion and a single $^{27}Al^+$ ion are simultaneously trapped in order to perform optical spectroscopy on the Al^+ ion. The ion pair is cooled near its motional ground state by laser-cooling the Be^+ ion. We then apply spectroscopy pulses to interrogate the cold Al^+ ion. The effect of these pulses is measured by transferring the Al^+ internal quantum state to the Be^+ hyperfine state with motional sideband laser pulses, where it is detected with high efficiency. This two-ion technique allows laser spectroscopy on cold ions that do not possess suitable transitions for laser cooling or state detection. We present results that demonstrate the effectiveness of this intra-species quantum information transfer. As a first application of the technique we have measured the $^{27}Al^+$ $^1S_0 \rightarrow {}^3P_1(F = 7/2)$ transition frequency to be $1,122,842,857,335(1)$kHz, which represents an improvement in accuracy over previous measurements by six orders of magnitude. * This work was supported by ONR and NIST

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