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Toward Remote Entanglement with $^{138}Ba^{+1}$ CAROLYN AUCHTER, THOMAS W. NOEL, CHEN KUAN CHOU, BORIS B. BLINOV, University of Washington — We present work toward remote ion entanglement using systems of singly trapped $^{138}Ba^{+}$ ions. Remote ion entanglement will be achieved through photon mediated entanglement swapping using spontaneously emitted 493 nm photons.[2] This scheme is an excellent candidate for a "loophole-free" Bell Inequality test due to the low decoherence and capability for fast control and detection of the $^{138}Ba^{+}$ qubit and the suitability of the relatively long wavelength of the emitted photons for fiber optic transmission. In order to improve the future rate of remote ion entanglement generation, we present work on employing ultrafast pulses from a mode-locked Ti:Sapphire laser to increase the rate of ion-photon entanglement and improve fidelity. Progress toward ion-ion entanglement of ions in adjacent traps will be reported.

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[2]C. Simon and W. T. M. Irvine, Phys. Rev. Lett. **91**, 110405 (2003)

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