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Photon Recoil Readout in a Two-Ion Crystal of Ba<sup>+</sup> and AlH<sup>+1</sup> JAMES DRAGAN, QIMING WU, GREG RABELO, BRIAN ODOM, Northwestern University — By entangling the internal quantum state of a target ion to the motional state of another logic ion, the Quantum Logic Spectroscopy (QLS) scheme has been used to make precision measurements of narrow atomic transitions, most notably in the NIST Al<sup>+</sup> clock. As a first step towards implementation of molecular QLS, we present our progress towards Photon Recoil Readout (PRR). Using PRR we excite motion in a two-ion crystal, AlH<sup>+</sup> (m = 28 amu) and Ba<sup>+</sup> (m = 138 amu), by driving repeated molecular photon recoil events at a rate equal to the axial out-of-phase mode. Scattering at this resonant frequency, we expect that only 10 recoil events are sufficient to excite the ion pair to n = 1 stretch mode. Although specific to the choice of molecular ion, PRR is easier than QLS to implement experimentally since it relaxes the constraints of the required light-matter coherence times and narrow laser linewidth.

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