Abstract Submitted
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Development of Nondestructive Single-Molecule Spectroscopy Utilizing Photon Recoil Readout[1] JAMES DRAGAN, MARK KOKISH, GREGÓRIO MOREIRA DA SILVA, QIMING WU, VINCENT CARRAT, BRIAN ODOM, Northwestern University — The complex structure of molecules can be used in developing technologies for quantum sensing, quantum chemistry and precision measurements. To achieve this, control of the external and internal degrees of freedom of the molecule are necessary. Having previously demonstrated rovibrational ground state preparation of aluminum monohydride (AlH^+)[2] we now aim to implement an experiment to perform nondestructive state readout of AlH^+. Adapting the technique of quantum logic spectroscopy, the internal state of AlH^+ can be mapped onto the motional state of a co-trapped atomic ion, where state readout is convenient. To induce motion on the atomic ion, we drive repeated molecular photon recoil events using a broadband laser, whose excitation is dependent on the molecule being in its ground vibrational state. We can then accomplish nondestructive rovibrational spectroscopy of the molecular ion by driving transitions to metastable vibrational excited states. With the tools of state preparation, state readout and spectroscopy in hand our experiment aims to achieve coherent control and study of the AlH^+ molecule.

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[2]Lien, C.-Y. et al, Nat. Commun. 5:4783 (2014)

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