Quantum Logic Spectroscopy for Single Trapped Molecular Ions

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The application of quantum techniques to the spectroscopy of single trapped particles has enabled the determination of atomic properties at unprecedented levels of precision. “Quantum-logic spectroscopy” (QLS) has enabled the next generation of atomic clocks and new precision tests of fundamental physical theories[1]. Thus, we wish to extend the scope of quantum techniques to spectroscopically probe the properties of single isolated molecular ions[2]. We also intend to establish a quantum toolbox for the non-destructive interrogation of single molecules by coupling to a single atom. These developments will pave the way for molecular precision spectroscopic measurements to study, e.g., a possible time variation of particle masses[3-5] with N_2^+ which has been identified as a promising candidate system[3]. We will report our recent progress towards these goals.

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