

**Quantum Logic Spectroscopy for Single Trapped Molecular Ions**G. Hegi<sup>1</sup>, K. Najafian<sup>1</sup>, M. Sinhal<sup>1</sup>, Z. Meir<sup>1</sup>, I. Sergachev<sup>2</sup>, S. Willitsch<sup>1\*</sup><sup>1</sup>Universität Basel, <sup>2</sup>Alpes Lasers SA

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<sup>[1]</sup>. Thus, we wish to extend the scope of quantum techniques to spectroscopically probe the properties of single isolated molecular ions<sup>[2]</sup>. 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<sup>[3-5]</sup> with  $N_2^+$  which has been identified as a promising candidate system<sup>[3]</sup>. We will report our recent progress towards these goals.

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