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Total binding energies and prediction of very long-lived metastable states for ion trap experiments

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The accuracy of quantum electrodynamics tests in strong fields has been tested up to now by measuring transition energies in highly-charged ions, using accelerator facilities and ion sources (see, e.g., [1] and Refs. there in). New applications like atomic mass measurements with 10-11 relative accuracy, performed using advanced ion traps, require the evaluation of total binding energy differences between the ion measured and the neutral atom for which the total mass must be provided [2, 3]. Such accurate masses can be used in a variety of applications like the measurement of the neutrino mass. This high precision also allows to detect long-lived metastable with only a few tens of eV above the ground state [4]. In my talk I'll describe the evaluation of mass differences between highly-charged ions and the corresponding neutral atom. I will also describe examples of metastable states that can be detected in ion traps and provide their lifetimes, including effects like hyperfine quenching [5], to see if one can hope measuring also their lifetimes in the trap. Such metastable states are usually the result of changes of level orders due to relativistic effects [6, 7]. Such metastable states could be the building blocks for future high-precision atomic clocks.
References

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