

# Bound-spectra predictions in exotic muonic atoms through advanced numerical solutions of the Dirac Equations

Recently, appreciably sensitive experiments operating in frontier muon facilities at J-PARC in Tokio, PSI in Switzerland, Fermilab in USA, RCNP in Osaka, etc., provide ultra-high-precision measurements in muon physics for open problems in muon-nucleus processes and purely leptonic atomic systems [1,2]. A plethora of such processes are well analyzed and described by theories falling within (SM) and beyond the Standard Model (BSM) of the electroweak interactions and they constitute promising tests of the quantum electrodynamics (QED) and several BSM physical theories. Up to the present, the muon hyperfine spectroscopy [1], the muonic-atoms [3] etc., played essential role in understanding atomic, nuclear and particle physics.

Our main aim in this work is to provide systematic predictions coming out of advanced numerical solutions of the fundamental differential equations (Dirac-Coulomb-Breit, Dirac-Breit-Darwin, etc.) entering the description of structure and reactions appearing in exotic purely leptonic atoms as the Muonium ( $\mu^+e^-$ ), the Muonium ion ( $\mu^+e^-e^-$ ) etc., in muon to  $e^-$  (or to  $e^+$ ) conversion in nuclei [1], and others [2,3,4]. The structureless Muonium leptonic atom is promising for testing QED and BSM theories and for testing fundamental physical laws as the lepton number conservation in experiments searching for Muonium to anti-Muonium transition) [1,2].

## References

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