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(Z,A) Dependence of Coherent Muon-to-Electron Conversion

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Should muon-to-electron conversion in the field of a nucleus be found in the current generation of experiments, the measurement of the atomic
number dependence of the process will become an important experimental goal. We present a new treatment of the (Z,A) dependence of coherent muon-to-electron conversion in 236 isotopes. Our approach differs from earlier work in several ways. Firstly, we include the effect of permanent quadrupole deformation on the charged lepton flavor violating matrix elements, using the method of Barrett moments. This method also enables the addition of muonic X-ray nuclear size and shape determinations of the charge distribution to the electron scattering results used previously. Secondly, we employ a Hartree-Bogoliubov model to calculate neutron-related matrix elements for even-even nuclei, instead of a simplistic scaling of the proton distribution by N/Z done previously. This takes into account the fact that neutrons are, in general, in different shell model orbits that protons. The calculated conversion rate differ from previous calculations, particularly in the region of large permanent quadrupole deformation. Finally, we introduce an alternative normalization of the muon-to-electron conversion rate, which relates more closely to what a given experiment actually measures, and better separate lepton physics from nuclear physics effects.

Working Group

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Primary author: BORREL, Leo (California Institute of Technology)

Co-authors: HITLIN, David (Caltech); MIDDLETON, Sophie (Caltech)

Presenter: BORREL, Leo (California Institute of Technology)

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