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Nuclear processes and effective weak couplings

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The axial-type of weak couplings seem to be renormalized in medium-heavy and heavy nuclei as suggested by analyses of nuclear beta and double beta decays, nuclear muon capture, charge-exchange reactions and low-energy neutrino-nucleus scattering [1]. Also some calculations suggest that also the vector-type of couplings could attain effective values in nuclei [2,3]. The possible variation of the values of weak couplings as functions of the nuclear mass number affects the information deduced from the possible future measurements of the half-lives of neutrinoless double beta ($0\nu\beta\beta$) decays [4],
nuclear muon captures, electron and antineutrino spectra of medium-mass fission fragments in nuclear reactors, etc. In particular, there could be direct effects on the reactor antineutrino anomaly and the Gallium anomaly [1].

Studies of the $0\nu\beta\beta$ decays of nuclei are of paramount importance in order to learn about the basic properties of the neutrino. An appealing way to probe this decay rather directly is the nuclear muon capture, since it operates in the same momentum-exchange region as the $0\nu\beta\beta$ decays. Recent results on the muon capture rate on ^{100}Mo [5] indicate that the muon-capture calculations are able to reproduce the measured capture strength function in a quite satisfactory way.

In my contribution I present an overview of the problem of effective weak couplings and discuss the relation of the nuclear muon capture to $0\nu\beta\beta$ processes.

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