ID de Contribution: **56** Type: **Non spécifié**

Study of particle emissions following after β-decays and muon captures

Nuclei can be at an excited state by beta decays and muon captures. If the excitation energy is above particle threshold energies, the nuclei emit particles competing with the gamma deexcitation. The typical examples are neutron emissions after beta decays and muon captures. In addition, it is known that proton and alpha particle emissions occur for highly excited neutron deficient nuclei. The information is important not only for estimating delayed neutrons that play an important role for a stable operation of reactors, but also for evaluating radioactivities, soft errors of semiconductors, and nucleosynthesis in stars. Although experimental data of the particle emissions following beta decays and muon captures have been reproduced with some phenomenological models, the detailed mechanism with respect to the nuclear structure is still unclear. In particular, experimentally measured neutron spectra after muon capture cannot be reproduced well with a nuclear structure model. In this work, we go into the investigation on this issue with a microscopic approach of proton neutron random phase approximation and particle evaporation models considering pre-equilibrium and compound process.

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