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Progress in Muon Nuclear Data/ミュオン核データの進展

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The negative muon (μ^-), which is the second generation of charged lepton and has a 200 times heavier mass than an electron, forms an exotic atom with a nucleus in materials. After the atomic cascade, some of the muons are captured to the nucleus, $\mu^- + p \rightarrow n + \nu_\mu$, with competing for the decay in the atomic orbit, $\mu^- + \rightarrow e^- + \nu_\mu + \nu_e$. The nucleus absorbing a muon is in a unique excited state because the muon has a mass of 105.6 MeV/c^2 and is captured from its $1s$ state, resulting in the highly excited state being generated with low angular momentum, unlike the nuclear collision. In addition to the interest in nuclear physics, the reaction induced by the negative muon has been attracting interest in various fields of study year by year for this decade. The X-rays emitted in the atomic cascade make non-destructive elemental analysis possible, which can apply to archaeological artifacts, etc. The muon-to-nuclear capture can control the artificial transmutation of the nucleus. The basic and application studies using the negative muon are one of the major fractions in the users'programs of the muon facility in J-PARC MLF. However, the series of reactions after muon injection has not been understood comprehensively, and one has to rely on the empirical models, though it has a sort of risk like unexpected radioactivation. To promote the applications of the negative muon, the muon nuclear data is essential and under development [1]. The muon nuclear data will consist of the following four sub-libraries:

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