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Study of double beta decay of ^{100}Mo to the excited states of ^{100}Ru in AMoRE

Studies of double beta ($2\nu\beta\beta$) decay to various excited states in different isotopes provide valuable insights into nuclear structure models. The AMoRE, which utilizes an array of ^{100}Mo-enriched $CaMoO_4$ and Li_2MoO_4 crystal scintillators, is advantageous for investigating $2\nu\beta\beta$ decay of ^{100}Mo to the excited states of ^{100}Ru.
In the AMoRE-I phase, we measured the half-life of $2\nu\beta\beta$ transition of ^{100}Mo to the 0_1^+ state of ^{100}Ru using in total 18 crystal detectors, and the half-life value is $(6.83 \pm 0.71\ (stat) \pm 0.32\ (sys)) \times 10^{20}$ years. The half-life limit for the $2\nu\beta\beta$ transition to the 2_1^+ state of ^{100}Ru is set as 2.5×10^{21} years (90% C.I.).
A prospective study of $2\nu\beta\beta$ decay to the excited states of ^{100}Ru has been conducted for AMoRE-II. Considering the increased crystal mass and measurement time, the error-to-signal ratio for the $2\nu\beta\beta$ decay of ^{100}Mo to the 0_1^+ state is expected to decrease significantly from 6.3% to 0.3%. The half-life sensitivity to the $2\nu\beta\beta$ decay of ^{100}Mo to 2_1^+ state of ^{100}Ru in AMoRE-II is estimated as limit $T_{1/2} \sim 1.20 \times 10^{23}$ years. And the triple-crystal-hit conditions event can be measured in AMoRE-II, that will be useful for observing the pure election energy distribution.

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