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Fission yields of isomers in antineutrino calculations

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Isomeric states have been observed in about 150 of the hundreds of isotopes that can be produced in the fission of major actinides. These isomers can be populated directly through fission, and the isomeric yield ratio (IYR) represents the relative population of the excited state(s) and the ground state (GS) independent yield.

In this work, we present a comprehensive study of the extent to which IYRs affect the antineutrino flux predictions with the summation method using two different approaches. First, we estimated how a set of newly evaluated recommended IYRs change the antineutrino spectra of all major actinides of interest for reactor antineutrino spectra (^{235,238}U,^{239,241}Pu). Then we individually looked at the contribution of each fission product with a known isomer, and studied how a different IYR value would affect the calculated antineutrino spectra.

While essentially no effect on the antineutrino spectrum is observed below 5 MeV, changes on the order of 1%-2% for each fuel type become evident between 5 and 7 MeV. These grow to as much as 30% above 7 MeV. The changes show consistently an increase in the antineutrino yield when the newly evaluated isomeric yields are used, compared to the values included in evaluated Fission Yields libraries.

Abstract title

Fission yields of isomers in antineutrino calculations

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