

Spectral Modeling of Reactor Antineutrinos: From Mueller's Ab Initio Approach to the Huber+Mueller Hybrid Framework

Content

Reactor antineutrino flux predictions are presented for the four primary fissile isotopes (^{235}U , ^{238}U , ^{239}Pu , and ^{241}Pu) using two complementary approaches within the CONFLUX software framework: the ab-initio summation method and the conversion method. The conversion method utilizes reanalyzed reactor beta spectra provided by CONFLUX, whereas the ab-initio spectra are derived from the ENDF/B-VIII.0 and ENSDF databases. A hybrid model combining both techniques is implemented and compared against the Huber+Mueller model. The latter yields a (3.5%) upward shift in the total flux relative to the ILL+Vogel model, introducing a discrepancy with short-baseline experiments known as the Reactor Antineutrino Anomaly. Finally, this hybrid model is applied to the JUNO detector configuration—accounting for its specific reactor cores, fission fractions, and thermal powers—to estimate the expected number of inverse beta decay (IBD) events during its first (59.1) days of operation.

Summary

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