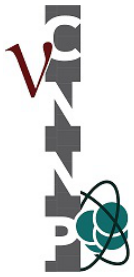

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Revealing the Effect of Individual Fission Products in the Antineutrino Spectra from Nuclear Reactors

The Inverse Beta Decay antineutrino spectrum generated by nuclear reactors is calculated using the summation methods with the highest fidelity nuclear databases to date to understand deviations from the smooth Huber-Mueller model due to the decay of individual fission products. Several numerical methods were explored, and concluded that plotting the ratio of two adjacent spectra points can effectively reveal these deviations. We obtain that for binning energies of 0.1 MeV or lower, abrupt changes in the spectra due to the jagged nature of the individual antineutrino spectra could be observed for highly precise experiments. Surprisingly, our calculations also reveal a peak-like feature in the adjacent points ratio plot at 4.5 MeV even with a 0.25 MeV binning interval, which we find is present in the IBD spectrum published by Daya Bay in 2016 as well as the RENO spectrum published in 2018. We show that this 4.5 MeV feature is caused by the contributions of just four fission products, 95Y, 98,101Nb and 102Tc. This would be the first evidence of the decay of a few fission products in the IBD antineutrino spectrum from a nuclear reactor. The same technique is applied to the electron spectra measured at ILL, which allows us to additionally identify 96Y and 92Rb. The significance of this finding for short baseline experiments will be discussed.

Primary authors: SONZOGNI, Alejandro (Brookhaven National Laboratory); MCCUTCHAN, Elizabeth (Brookhaven National Laboratory)

Presenter: SONZOGNI, Alejandro (Brookhaven National Laboratory)

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