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First forbidden transitions in the reactor antineutrino anomaly

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Fueled by the reactor antineutrino anomaly and its link to possible sterile neutrinos, several very short baseline experiments have come online over the past few years. Despite high quality data, theoretical predictions have not able been able to line up with experimental results, requiring a reevaluated theoretical input. The central element in the latter is an accurate calculation of the antineutrino spectrum shape, for which up to now severe approximations have been employed. We report on the role of forbidden, (non-)unique transitions in the so-called summation approach. Using large-scale shell model calculations, we explicitly determine the shape factor for a large sample of dominant forbidden transitions. We show the influence on the cumulative spectral shape and its role in the so-called reactor 5 MeV bump. We discuss a proposed parametrisation of all non-unique forbidden transitions and a Monte Carlo analysis for a realistic uncertainty estimate.

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