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Light and Charge Calorimetry for Enhanced CP Violation and Mass Hierarchy Sensitivities in DUNE

We explore the potential of light calorimetry in liquid argon time projection chambers (LArTPCs) and its intrinsic self-compensation properties, highlighting its merits alongside established charge calorimetry. We find that light calorimetry can achieve energy resolution on par with advanced charge-based methods, utilising GeV neutrinos as a benchmark. We also examine how the independent use of light calorimetry is complementary to charge calorimetry for precise measurement of standard unknowns, mainly CP violation and mass hierarchy sensitivities in the Deep Underground Neutrino Experiment (DUNE). Advanced charge imaging calorimetry shows marked improvement in CP resolution over light calorimetry, while light calorimetry itself shows significant insights on CP violation and mass hierarchy sensitivities. Moreover, the CP violation sensitivity with exposure reveals that 5σ sensitivity can be achieved earlier in charge calorimetry compared to light calorimetry.

Field of contribution

Phenomenology

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