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Issues Related to Matter Effect in DUNE

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Due to its long baseline, DUNE provides an excellent avenue to probe Earth's matter effect and associated degeneracies. We study in detail the performance of DUNE to validate matter oscillation by excluding the vacuum scenario. Whatever be the values of oscillation parameters, we find that DUNE can feel Earth's matter at more than 2σ confidence level. The relative 1σ precision in the measurement of line-averaged constant Earth matter density ($\rho_{\rm avg}$) for maximal CP-violating choices of $\delta_{\rm CP}$ is around 10 to 15% depending on the choice of neutrino mass ordering. If the CP phase turns out to be around -90 or 90, DUNE can measure $\rho_{\rm avg}$ with a precision better than other atmospheric and long-baseline experiments. We also observe new interesting degeneracies among $\rho_{\rm avg}$-$\delta_{\rm CP}$-θ_{23}. A detailed understanding of these degeneracies is essential to correctly assess the outcome of DUNE.

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