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P3.042 **The physics of antineutrinos in DUNE and resolution of octant degeneracy**

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We study the proficiency of the DUNE experiment, which will be the first beam based experiment to use a baseline longer than 1000 km and a wide band flux profile, to unmask the octant of the leptonic mixing angle θ_{23} i.e., to find out if θ_{23} is < $\pi/4$ or > $\pi/4$. The probability channels relevant for octant study are the muon neutrino survival probability $P_{\mu\mu}$ and the electron neutrino appearance probability $P_{\mu e}$. The first one is mainly responsible for the precision measurement but suffers from an inherent degeneracy between θ_{23} and $\pi/2 - \theta_{23}$ for baselines < 1000 km due to less matter effect. The appearance probability on the other hand contains octant sensitive terms to the leading order but the lack of knowledge of hierarchy and the CP phase δ_{CP} gives rise to degenerate solutions, affecting the sensitivity. It has been realized, in the context of the off-axis experiments T2K and NOνA with baselines < 1000 km, that since for $P_{\mu\mu}$ and $P_{\bar{u}\bar{e}}$ the octant-δ_{CP} degeneracy occurs at different values of δ_{CP}, combination of equal neutrino and antineutrino runs can help to resolve this. However, in regions where neutrinos do not have octant degeneracy, adding antineutrino runs spoil the octant sensitivity. In this work we examine in detail if, due to the broad-band beam and comparatively longer baseline of DUNE, the above conclusions are altered and how does that affect the octant sensitivity. We find that for the DUNE baseline of 1300 km, due to enhanced matter effect, the neutrino and antineutrino probabilities are different which creates a tension in the case of combined runs because of which (i) octant sensitivity can also come from disappearance channel (ii) addition of antineutrinos improve octant sensitivity even in the parameter space where neutrinos do not suffer from octant degeneracy. Thus in this case the equal amount of neutrino and antineutrino run may not turn out as the optimal combination. In view of this we study the physics of antineutrinos in DUNE and investigate the best combination of neutrinoantineutrino run that is required to resolve octant degeneracy at specific confidence levels. We study this for two detector configurations – (i) a 10 kt detector and (ii) a 34 kt detector and for different true values of θ_{23} and δ_{CP} and determine the ranges of parameters for which octant degeneracy can be resolved.