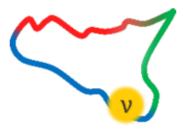
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Improving CP Measurement with THEIA and Muon Decay at Rest

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We explore the possibility of using the recently proposed THEIA detector to measure the $\bar{\nu}_{\mu} \rightarrow \bar{\nu}_{e}$ oscillation with neutrinos from a muon decay at rest (μ DAR) source to improve the leptonic CP phase measurement. Due to its intrinsic low-energy beam, this μ THEIA configuration (μ DAR neutrinos at THEIA) is only sensitive to the genuine leptonic CP phase δ_D and not contaminated by the matter effect. With detailed study of neutrino energy reconstruction and backgrounds at the THEIA detector, we find that the combination with the highenergy DUNE can significantly reduce the CP uncertainty, especially around the maximal CP violation cases $\delta_D = \pm 90^{\circ}$. Both the μ THEIA-25 with 17 kt and μ THEIA-100 with 70 kt fiducial volumes are considered. For DUNE + μ THEIA-100, the CP uncertainty can be better than 8°.

Primary authors: KONG, Chui-Fan (Tsung-Dao Lee Institute / Shanghai Jiao Tong University); Prof. GE, Shao-Feng (Tsung-Dao Lee Institute (TDLI), Shanghai Jiao Tong University); Dr PASQUINI, Pedro (Tsung-Dao Lee Institute / Shanghai Jiao Tong University)

Presenter: KONG, Chui-Fan (Tsung-Dao Lee Institute / Shanghai Jiao Tong University)

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