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Physics potential of THEIA: a hybrid optical neutrino experiment

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The combination of recent developments in liquid scintillator, photodetection technology, and reconstruction techniques have made possible the concept of a large-scale neutrino detector that can distinguish Cherenkov and scintillation light. THEIA is a proposed multi-kton experiment that would be pioneering in exploiting the innovative concept of hybrid optical detectors, with the potential to pursue an extremely broad physics program.
If placed at SURF, THEIA will be complementary to DUNE in constraining the oscillation parameters using a different detector technology and target nucleus. The expected sensitivity of THEIA to both $_{CP}$ and to the neutrino mass ordering is comparable to that of a single DUNE module under the assumption of a similar geometry. At the same time, the low energy threshold and efficient neutron tagging provided by the scintillator target expands the physics reach of THEIA to cover solar and supernova neutrinos. The excellent background discrimination potential makes it even possible to search for neutrinoless $\beta\beta$ decay by loading several tons of a candidate isotope into the detector, in a self-contained inner volume.

Collaboration name

THEIA Proto-Collaboration

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