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Novel opaque scintillator technology for antineutrino detection

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Scintillator detectors have been used for antineutrino detection since the 1950s when Cowan and Reines used them to discover the neutrino. Modern experiments still use scintillators to study neutrino physics. Scintillators convert the energy released in a neutrino interaction into light, which photosensors can detect. Traditional scintillator detectors are transparent, allowing light to reach the photosensors. However, this transparency also limits the ability to image the neutrino interaction. Scintillator detectors can be segmented to improve their imaging, which introduces additional challenges in building and operating the detector. This talk will detail LiquidO, a new and counterintuitive opaque scintillator detector. We achieve the opacity with short scattering length materials for the scintillation light. The opaque scintillator is traversed by wavelength-shifting fibres, which collect and transport the light to the photosensors. This arrangement allows for high-resolution imaging, enabling highly efficient particle identification from the MeV to GeV scale and many applications. We will show how LiquidO can discriminate signal from backgrounds with high significance when measuring reactor antineutrinos at the surface without an underground facility. Finally, we will present prototype results demonstrating the LiquidO technique and the plans for constructing a 5-ton demonstrator close to France's Chooz nuclear power plant.

Abstract title

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