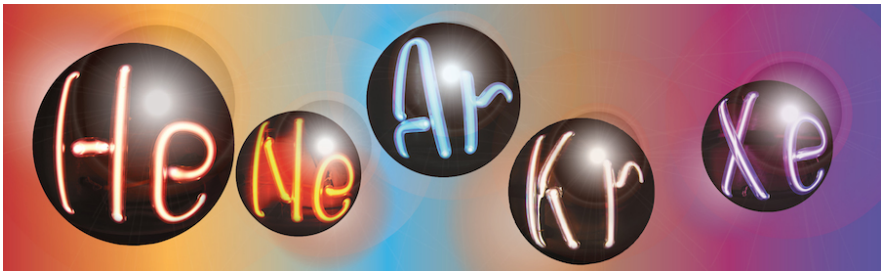

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Characterization of candidate wavelength-shifting reflectors for the LEGEND-1000 liquid argon instrumentation

Located at LNGS, LEGEND (Large Enriched Germanium Experiment for Neutrinoless ββ Decay) aims to probe the Majorana nature of the neutrino by observing the neutrinoless double beta decay in high-purity germanium crystals enriched in 76Ge and immersed in an ultrapure instrumented liquid argon (LAr) volume. The first phase, LEGEND-200, has collected data since spring 2023, while the second phase, LEGEND-1000, currently in the technical design phase, is expected to reach a discovery sensitivity to the decay half-life of 10^28 years over a 10-year data-taking period starting around 2030. The LAr instrumentation is pivotal in background rejection, by collecting the scintillation light generated by background interactions in the LAr. Wavelength-shifting reflective (WLSR) materials are employed to enhance the light collection efficiency.

A common choice of WLSR for particle physics experiments employing LAr is the reflective Tetratex® (expanded polytetrafluoroethylene, ePTFE) coupled to the wavelength-shifting tetraphenyl butadiene (TPB). Within this R&D effort, we are studying and characterizing novel WLSR materials for LEGEND-1000 that can better meet the experiment requirements in terms of light collection efficiency, radiopurity, stability and scalability. Candidate materials include crystallized polyethylene naphthalate, which acts as both wavelength-shifter and reflector, thin reflective films based on sintered PTFE, polyethylene terephthalate, and high-density polyethylene, which are candidate scattering substrates to possibly be coupled to wavelength-shifting molecules.

In this talk, we compare the relative VUV response, visible reflectance, emission spectra, and cryogenic stability of candidate materials, assessed with the Liquid Argon Setup (LArS) at the University of Zurich, against the TPB-coated Tetratex® reference used in LEGEND-200. We also present the recent upgrades performed on LArS to improve its measurement capabilities.

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