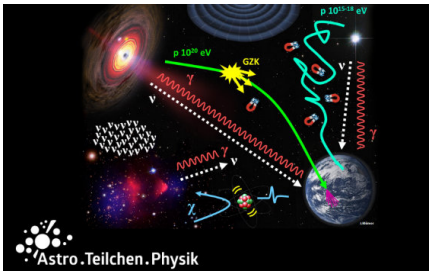

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A New Approach to Neutrino Detection and the Search for the Neutrinoless Double Beta Decay: Slow Scintillation Media and Hybrid Cherenkov/Scintillation Techniques

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One of the most promising approaches for the next generation of neutrino experiments is the development of large hybrid Cherenkov/scintillation detectors, made possible by recent advancements in photodetection technology and liquid scintillator chemistry. This poster discusses the development of a potential future detector liquid with notably slow light emission. The properties of this cocktail—such as scintillation efficiency, transparency, and light emission time profile—are compared to those of liquid scintillators currently used in large-scale neutrino detectors. Additionally, we present the optimization of wavelength shifter admixtures for a scintillator with particularly high light emission. Furthermore, we studied the pulse-shape discrimination capabilities of the novel medium using a pulsed particle accelerator-driven neutron source. Moreover, purification methods based on column chromatography and fractional vacuum distillation for the co-solvent DIN (Diisopropylnaphthalene) are discussed. The scintillation cocktails were also successfully loaded with Te-diols, resulting in a potentially suitable medium for the effective search for the neutrinoless double-beta decay of Te-130. Separately, a setup called the Munich Scintillation Cherenkov Separator (MSCS) was realized, commissioned, and tested. This setup achieved the separation of Cherenkov and scintillation light in both slow scintillation media and conventional fast organic liquid scintillators. All these new developments will be introduced, discussed, and summarized in this poster.

Summary

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