XeSAT2022 - International Workshop on Applications of Noble Gas Xenon to Science and Technology



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Liquid xenon for nuclear medical imaging: outlooks on instrumentation

The Light only Liquid Xenon (LoLX) collaboration is a multidisciplinary R&D effort aiming to finely characterize LXe's properties and that of modern photosensors adapted to its short scintillation wavelength. The end target is to provide in-depth information on this radiation detection medium and modern instrumentation for their application in several fields such as astroparticle physics experiments and medical imaging devices. Positron emission tomography (PET) is one such application, where LXe's appealing properties include an excellent light yield coupled to very fast decay time when compared to most commercial, room temperature scintillation crystals used in PET. While the slow charge drift time in TPC configurations significantly diminishes the counting rate, this acquisition channel coupled with scintillation readout makes it possible to achieve sub-mm 3D position resolution of the gamma interactions, a feat not yet achieved with scintillation crystals. Furthermore, LXe is transparent to the full Cherenkov spectrum, a potential path to reach 10 ps timing resolution in PET, and thus direct image reconstruction.

The talk will begin by an overview of LXe systems in nuclear medical imaging and compare them with recent research and commercial PET scanners. The review will highlight challenges in instrumentation common to both future LXe and room-temperature scanners, and highlight the LoLX efforts to experimentally determine if LXe can achieve the 10-ps time resolution goal for time-of-flight PET.

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