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WLS Gasses for High-Pressure Xenon Detectors

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In either liquid xenon or high-pressure xenon gas, scintillation occurs in a band centered at 175 nm, a region directly accessible to PMTs, without the need for an intermediate wavelength-shifting (WLS) step. However, this generally requires a reflective surface such as teflon and directly positioning the PMTs, with all their radioactive burden, to stare directly into the active volume of rare event detectors. However, in room temperature xenon gas, it appears possible to use a fluorescent Penning molecule, such as trimathylamine (TMA), to wavelength-shift in the gas to a band centered near 300 nm, which providentially appears to be the region of maximum excitation efficiency for commercial plastic WLS materials. The entire interior surface of a large TPC may be covered in WLS plastic, maximizing optical efficiency.This may facilitate a novel approach to determine directionality in nuclear recoils for direct WIMP searches in a monolithic symmetric TPC approaching ton-scale active mass.

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