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In-Situ and Ex-Situ Observations of an Extremely Long-lived Tail in TPB Fluorescence Under Alpha Excitation in DEAP-3600

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In rare event searches, minimizing backgrounds is essential to obtaining high sensitivity. Many Weakly Interacting Massive Particle (WIMP) detectors employ powerful tools such as pulse shape discrimination to differeniate between electronic recoils and nuclear recoils; since WIMPs are expected to produce nuclear recoils, the total background rate can be drastically reduced. Liquid argon-based detectors such as DEAP-3600 use pulse shape discrimination to efficiently reject electronic recoils. However, radon is naturally occuring in the air, and it may deposit its progeny on the inner surfaces of detector materials. When these isotopes alpha decay, they may send either an alpha particle or a recoiling nucleus into the sensitive volume of the detector to produce a nuclear recoil, which can mimic a WIMP event near the surface. Extremely long-lived scintillation light tail in TPB–a wavelength shifter commonly evaporated onto the inner surfaces of argon-based detectors–may provide a powerful signature for tagging such surface backgrounds. I will discuss the in-situ observation of this signature in the DEAP-3600 detector, compare with a set of a set of ex-situ measurements and show how we can use it to help characterize the surface backgrounds in the experiment.

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