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Investigating the isolated S1 backgrounds in the LUX-ZEPLIN (LZ) experiment

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The LUX-ZEPLIN (LZ) experiment features a dual-phase xenon time projection chamber designed to detect weakly interacting massive particles (WIMPs) with unprecedented sensitivity. Among its backgrounds, scintillation-only events are particularly challenging to study due to their small size and consequential poor spatial reconstruction; yet, they play a significant role by contributing to accidental coincidence backgrounds that can obscure WIMP-like signals.

We investigate the nature of these scintillation-only events by leveraging the double photoelectron effect in vacuum ultra violet (VUV) photomultipliers. By distinguishing xenon-induced VUV light from potential non-xenon (non-VUV) sources, such as fluorescence from detector materials, we aim to identify the underlying mechanisms responsible for these events. This research not only contributes to the broader effort to refine background models, ultimately improving the reliability of the LZ experiment's search for dark matter, but will also be of fundamental importance for the design and optimisation of future detectors, paving the way for the next generation of dark matter experiments.

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