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Measuring Alpha Scintillation Quenching Factors in Argon Using the Argon-1 Detector

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The detection of dark matter is currently one of the leading challenges in particle physics. The DEAP-3600 experiment, the largest argon dark matter detector in the world, uses 3.3 tonnes of liquid argon and 255 photomultiplier tubes to detect scintillation light produced by a dark matter particle scattering on an argon nucleus. Since the interaction of dark matter scattering on argon is such a rare process, having a well understood background model plays a critical role in rejecting events that may mimic a dark matter signal.
Alpha particles produce a reduced scintillation signal compared to electrons of the same energy, an effect known as "quenching", which is in general energy dependent. While typical decays producing alpha radiation are much too high in energy to mimic a dark matter signal, alpha particles traversing through detector materials will have their energy degraded, which may cause them to reconstruct in the dark matter search region. As such, understanding alpha particle quenching in liquid argon, particularly at low energy, is important in generating a well understood background model. In this talk, we discuss progress made in measuring alpha scintillation quenching in liquid argon using Argon-1, a modular detector instrumented with two silicon photomultipliers located at Carleton University.

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