

Accidental Coincidences in Dark Matter Detectors

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XENONnT is one of the leading dark matter (DM) direct detection experiments, designed to search for weakly interacting massive particles (WIMPs), a promising dark matter candidate. Its next-generation successor, DARWIN, is being designed to comprehensively explore the accessible WIMP parameter space. As we probe certain ranges of DM masses, one significant background that increasingly impacts the sensitivity of the experiment is the accidental coincidence background. This is a combinatorial background that arises from the random pairing of two non-correlated signals, creating a false event that mimics the expected dark matter interaction. This talk presents a pioneering study that aims at modelling this background from first principles, as opposed to the conventional data-driven approach. It will delve into the potential sources of these accidental signals, and their relative contributions to this background. It will also assess the impact of this background on DARWIN's sensitivity, alongside R&D strategies to mitigate accidental coincidences more effectively. Understanding and minimising this background is essential for advancing the search for dark matter and enhancing the performance of next-generation detectors.

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