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Probing conversion-driven freeze-out at the LHC

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Conversion-driven freeze-out is an appealing mechanism to explain the observed relic density while naturally accommodating the null-results from direct and indirect detection due to a very weak dark matter coupling. Interestingly, the scenario predicts long-lived particles decaying into dark matter with lifetimes favorably coinciding with the range that can be resolved at the LHC. However, the small mass splitting between the long-lived particle and dark matter renders the decay products soft, challenging current search strategies. We consider four different classes of searches covering the entire range of lifetimes: heavy stable charge particles, disappearing tracks, displaced vertices, and missing energy searches. We discuss the applicability of these searches to conversion-driven freeze-out and derive current constraints highlighting their complementarity. For the displaced vertices search, we demonstrate how a slight modification of the current analysis significantly improves its sensitivity to the scenario.

Title of the Poster/Talk

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