

# DPF-PHENO 2024

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## Discovering Minimal Dark Matter at Muon Colliders

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Minimal Dark Matter models extend the Standard Model by incorporating a single electroweak multiplet, with its neutral component serving as a candidate for the thermal relic dark matter in the Universe. These models predict TeV-scale particles with sub-GeV mass splittings  $\Delta$ . Collider searches aim at producing the charged member of the electroweak multiplet which then decays into dark matter and a charged particle. Traditionally, these searches involve signatures of missing energy and disappearing tracks. Due to the small size of  $\Delta$ , the transverse momentum of this charged particle is too soft to be resolved at hadron colliders. In this talk, I show that a Muon Collider is capable of detecting these soft charged decay products, providing a means to discover TeV thermal relics with an almost degenerate charged companion. Our technique also facilitates the determination of  $\Delta$ , allowing for a comprehensive characterization of the dark sector. Our results indicate that a 3 TeV muon collider will have the capability to discover the highly motivated thermal Higgsino-like dark matter candidate as well as other scenarios of Minimal Dark Matter featuring larger multiplets whose neutral component corresponds to a fraction of the total dark matter in the Universe. This study highlights the potential of a muon collider to make significant discoveries even at its early stages of operation.

### Mini Symposia (Invited Talks Only)

**Author:** CAPDEVILLA, Rodolfo (Fermi National Accelerator Laboratory)

**Co-authors:** MELONI, Federico (DESY); ZURITA, Jose (IFIC, Valencia)

**Presenter:** CAPDEVILLA, Rodolfo (Fermi National Accelerator Laboratory)

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