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Disappearing Tracks and Forward Muons: Inert Triplet Dark Matter at Multi-TeV Muon Collider

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In this talk, I will discuss the prospects of probing the Inert Triplet Model (ITM) at future multi-TeV muon colliders. The ITM extends the Standard Model by a real $SU(2)_L$ triplet scalar stabilized by a Z_2 symmetry, yielding a neutral dark matter candidate accompanied by nearly mass-degenerate charged partners. Imposing theoretical consistency, collider bounds, and dark matter constraints selects TeV-scale benchmark points for the triplet states. A distinctive feature of this setup is the gauge-induced quartic coupling to electroweak gauge bosons, which enables efficient triplet pair production via vector boson fusion at high energy muon colliders. Owing to the compressed spectrum, the charged states are long lived and give rise to disappearing charged tracks, typically accompanied by very forward muons that characterize the VBF topology. We demonstrate that combining disappearing track signatures with forward muon tagging at the centre-of-mass energy of 6, 10 TeV and realistic luminosities can achieve discovery level sensitivity to the benchmark triplet scenarios, underlining the importance of dedicated forward tracking for dark matter searches at future muon colliders.

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