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Hunting for WIMP Minimal Dark Matter and New Charged Particles at a Future Muon Collider

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A multi-TeV muon collider proves to be very efficient not only for the search for new heavy neutral particles, but also for the discovery of charged bosons of the W' type. We find that, by analyzing the associated production with a Standard Model W , charged resonances can be probed directly up to multi-TeV mass values close to the collision energy, and for very small couplings with the SM fermions, of the order of 10^{-10}

times the SM weak coupling. This would mark an unprecedented level of sensitivity for a direct search. Furthermore, the channel offers a very efficient and alternative way to probe the WIMP scenario for the very special and compelling case of Minimal Dark Matter (MDM) in the 5-plet EW representation, by allowing the direct detection of the charged component of the MDM bound state. The reach on the WIMP 5-plet thermal target is found to be much higher than those of mono-X, missing-mass and disappearing tracks signatures.

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