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Twin Higgs Portal Dark Matter

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Many minimal models of dark matter (DM) or canonical solutions to the hierarchy problem are either excluded or severely constrained by LHC and direct detection null results. In particular, Higgs Portal Dark Matter (HPDM) features a singlet scalar minimally coupled to the Higgs, and because the same coupling mediates both thermal freeze out and direct detection the measured dark matter relic abundance leads to definite predictions for direct detection experiments that are now almost entirely excluded. The Twin Higgs solves the little hierarchy problem without coloured top partners by introducing a twin sector related to the Standard Model by a discrete symmetry. In this talk we generalize HPDM to arbitrary Twin Higgs models and introduce Twin Higgs Portal Dark Matter (THPDM), which features a scalar dark matter candidate with an $SU(4)$-invariant quartic coupling to the Twin Higgs scalar sector. Loop corrections motivate the DM mass to be near the Twin Higgs scale, which means DM annihilation proceeds through the unsuppressed Twin Higgs portal coupling while direct detection is suppressed by the pNGB nature of the 125 GeV Higgs. For a standard cosmological history, this mismatch results in a predicted direct detection signal for THPDM that is orders of magnitude below the HPDM prediction with very little dependence on the precise details of the twin sector. Many Twin Higgs models additionally feature asymmetric reheating mechanisms in order to suppress unobserved twin radiation contributions to ΔN_{eff}. These mechanisms dilute the DM relic abundance, further reducing the expected direct detection signatures to near or below the neutrino floor.

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