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GeV-Scale Thermal WIMPs: Not Even Slightly Dead

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Weakly Interacting Massive Particles (WIMPs) have long reigned as one of the leading classes of dark matter candidates. The observed dark matter abundance can be naturally obtained by freezeout of weak-scale dark matter annihilations in the early universe. This "thermal WIMP" scenario makes direct predictions for the total annihilation cross section that can be tested in present-day experiments. While the dark matter mass constraint can be as high as m 100 GeV for particular annihilation channels, the constraint on the total cross section has not been determined. We construct the first model-independent limit on the WIMP total annihilation cross section, showing that allowed combinations of the annihilation-channel branching ratios considerably weaken the sensitivity. For thermal WIMPs with s-wave 2⟶2 annihilation to visible final states, we find the dark matter mass is only known to be m 20 GeV. This is the strongest largely model-independent lower limit on the mass of thermal-relic WIMPs; together with the upper limit on the mass from the unitarity bound, it defines what we call the "WIMP window". To probe the remaining mass range, we outline ways forward.

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