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Rekindling s-Wave Dark Matter Annihilation Below 10 GeV with Breit-Wigner Effects

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Thermal Dark Matter (DM) below the GeV scale faces strong cosmological and astrophysical constraints, with Cosmic Microwave Background (CMB) observations excluding s-wave annihilation cross-sections for thermal DM below 10 GeV. Such limits can be evaded with velocity dependent cross-sections, for example when DM annihilates near a narrow resonance. In this work, we explore the impact of resonance effects on DM relic formation using a model-independent approach. We then derive constraints on s-wave annihilation models from CMB data and indirect detection observations, highlighting the viability and limitations of resonant production.

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