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Resonance enhancement of dark matter interactions: the case for early kinetic decoupling and velocity dependent resonance width

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Motivated by the possibility of enhancing dark matter (DM) self-scattering cross-section σ self , we have revisited the issue of DM annihilation through a Breit-Wigner resonance. In this case thermally averaged annihilation cross-section has strong temperature dependence, whereas elastic scattering of DM on the thermal bath particles is suppressed. This leads to the early kinetic decoupling of DM and an interesting interplay in the evolution of DM density and temperature that can be described by a set of coupled Boltzmann equations. The standard Breit-Wigner parametrization of a resonance propagator is also corrected by including momentum dependence of the resonance width. It has been shown that this effects may change predictions of DM relic density by more than order of magnitude in some regions of the parameter space. Model independent discussion is illustrated within a theory of Abelian vector dark matter. The model assumes extra U(1) symmetry group factor and an additional complex Higgs field needed to generate a mass for the dark vector boson. We discuss gauge dependence of the Breit-Wigner propagator with energy-dependent width. The pinch technique is advocated in order to cure the gauge dependence while preserving unitarity.

Parallel Session

Cosmology and Gravitational Waves

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