

Strong dark matter constraints on GMSB models

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We reconsider the dark matter problem in supersymmetric models with gauge mediated supersymmetry breaking, with and without R-parity breaking. In these classes of models, a light gravitino forms the dark matter. Consistency with the experimental data, in particular the dark matter abundance and the small-scale power spectrum, requires additional entropy production after the decoupling of the gravitino from the thermal bath. We demonstrate that the usual mechanism via messenger number violating interactions does not work in models where the messenger belongs to $SU(5)$ representations. This is mainly a consequence of two facts: (i) there are at least two different types of lightest messenger particles and (ii) the lightest messenger particle with $SU(2)$ quantum numbers decays dominantly into vector bosons once messenger number is broken, a feature which has been overlooked so far. In case of $SO(10)$ messenger multiplets we find scenarios which work if the SM gauge singlet component is rather light.

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