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Gravitino dark matter and high reheating temperature

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Supersymmetry breaking mediated by gauge interactions is regarded an attractive option due to the lack of new sources of flavor changing neutral currents other than those already present in the Standard Model. In models with gauge mediated supersymmetry breaking (GMSB), the dark matter particle is the gravitino. It is produced both thermally in scatterings in the hot plasma and non-thermally from decays of the next to lightest supersymmetric particle (NLSP). If the NLSP is sufficiently abundant during Big Bang Nucleosynthesis (BBN), these decays can alter the abundances of light elements. This, in turn, gives constraints on the gravitino mass and, for the observed dark matter abundance, on the reheating temperature of the Universe. Since sufficiently high reheating temperature is crucial for thermal leptogenesis, one obtains constraints on viable models with GMSB, consistent with thermal leptogenesis.

We study the interplay of these constraints within a recently introduced and interesting class of models with GMSB, known as models with general gauge mediation (GGM). We study the possibility that the NLSP is a stau or a sneutrino in these models. We determine whether it is possible to achieve 'compressed' spectra of supersymmetric particles in which gluino is not much heavier than the NLSP, which alleviates the constraints imposed by requiring successful thermal leptogenesis. We study regions of the parameter space of models with GGM and identify regions in which one achieves radiative breaking of electroweak symmetry, satisfies the higgs mass bounds, gravitinos make up the observed amount of dark matter and the reheating temperature is high enough for leptogenesis.

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