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Messenger inflation in gauge mediation and superWIMP dark matter

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We discuss phenomenological viability of a novel inflationary model in the minimal gauge mediated supersymmetry breaking scenario.

In this model, cosmic inflation is realized in the flat direction along the messenger supermultiplets and a natural dark matter candidate is the gravitino from the out-of-equilibrium decay of the bino-like neutralino at late times, which is called the superWIMP scenario.

The produced gravitino is warmish and can have a large free-streaming length; thus the cusp anomaly in the small scale structure formation may be mitigated.

We show that the requirement of the Standard Model Higgs boson mass to be $m_{h_0} = 125.1$ GeV gives a relation between the spectrum of the cosmic microwave background and the messenger mass M .

We find, for the e-folding number $N_e = 60$, the Planck 2018 constraints (TT, TE, EE+lowE+lensing+BK15+BAO, 68% confidence level) give

$$M > 3.64 \times 10^7 \text{ GeV}.$$

The gravitino dark matter mass is $m_{3/2} < 5.8$ GeV and the supersymmetry breaking scale Λ is found to be in the range

$$(1.28 - 1.33) \times 10^6 \text{ GeV}.$$

Future CMB observation is expected to give tighter constraints on these parameters.

Summary

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