

# Thermal Gravitino Production due to Bremsstrahlung and Annihilation Processes

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In a theory in which (local) supersymmetry is spontaneously broken for temperatures  $T \ll M_{\text{pl}}$ , where  $M_{\text{pl}}$  is the Planck mass, gravitinos couple to MSSM particles via the supercurrent. Thermal gravitino production rate per unit volume due to the strongly interacting sector of the theory can be calculated perturbatively, and to leading order in the QCD coupling  $\alpha_s(T)$ , is of order  $\alpha_s(T) \left(\frac{T}{M_{\text{pl}}}\right)^2 T^4$ . The contribution from  $2 \rightarrow 2$  scatterings of plasma particles with each other has already been calculated. There are, however, additional processes that contribute at the same order which have been overlooked in the literature: bremsstrahlung of gravitinos by quarks, squarks, gluons and gluinos in the thermal bath, and annihilation of these particles to gravitinos. A consistent treatment of these  $N+1 \rightarrow N+2$  processes requires that Landau-Pomeranchuk-Migdal effect be incorporated in the calculation.

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