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Transition magnetic moments of the baryons in hot and dense matter

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The investigation of in-medium transition magnetic moments between spin-3/2 and spin-1/2 baryons offers a powerful tool to explore the modifications in hadronic properties under extreme conditions, such as those which exist within neutron stars and heavy-ion collisions. In the current work, we have studied the electromagnetic transition magnetic moments for baryonic decays of the type \(B^*{3/2} \rightarrow B{1/2} + \gamma \), incorporating the effects of a hot and dense nuclear medium. The effective masses of quarks and baryons in the hot and dense nuclear medium are obtained self-consistently within the framework of chiral SU(3) quark mean field model, which accounts not only for spontaneous chiral symmetry breaking but also for the influence of scalar and vector meson fields. The magnetic moments of the constituent quarks, adjusted to reflect in-medium effective masses, are then used within the SU(4) constituent quark model to compute the modified transition magnetic moments. Our results show a significant impact on the transition moments with the changes in the density and temperature of the medium, showing the significant deviations from their vacuum values. These findings provide valuable insights into the structure of baryons in dense matter and are relevant for understanding electromagnetic processes in astrophysical and heavy-ion collision environments.

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