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Spin alignment of quarkonium in the hot medium? Dynamics and phenomenology

We use a potential model to investigate the phenomenology of quarkonium in a thermal rotating medium, where vorticity and spin density are not necessarily in equilibrium. We find that the quarkonium spin density matrix, as well as the binding energy and melting temperature, are sensitive to both the vorticity and the lack of equilibrium between vorticity and spin. This means that quarkonium spin alignment is a sensitive probe for vorticity and spin within the hydrodynamic phase.
Furthermore the melting temperature dependence provides a potential new mechanism, distillation, to polarize specifically quarkonium states (including the phi, if it can be considered as such) and potentially explain the dependence of quarkonium suppression in rapidity.
Information unequivocably pointing to spin-orbit non-equilibrium dynamics can be obtained from a combined study of quarkonium relative abundance and spin alignment, as well as experimentally obtainable off-diagonal density matrix elements.

Based on

[1] Kayman J. Goncalves,P.H. De Moura and G. Torrieri Phys.Rev.D 108 (2023) 3, 034032

Category

Experiment

Collaboration (if applicable)

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