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Exact Polarization of Particles of Any Spin at Global Equilibrium

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The polarization of the Λ particle offers the unique opportunity to study the hydrodynamic gradients in the Quark-Gluon Plasma formed in heavy-ion collisions. However, the theoretical formula commonly used to calculate polarization is only a linear order expansion in thermal vorticity and neglects higher-order terms. Here, we present an exact calculation at all orders in (constant) thermal vorticity at global equilibrium. We resum the series and obtain the analytic form of the spin density matrix and the polarization vector for massive and massless particles of any spin or helicity. Finally, we extend our results to local equilibrium, where we evaluate their impact by numerically calculating polarization in a 3+1 hydrodynamic simulation for different collision systems.

Category

Theory

Collaboration (if applicable)

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