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Magnetic Field Induced chiral magnetic current and polarization difference between Hyperons and Anti-hyperons

Summary

We calculate the electromagnetic current with a more realistic approach in the RHIC and LHC energy regions. The maximum electromagnetic current and the time-integrated current are two important characteristics of the chiral magnetic effect (CME), which can characterize the intensity and duration of fluctuations of CME. We consider the finite frequency response of CME to a time-varying magnetic field, find a significant impact from QGP medium feedback, and estimate the generated electromagnetic current as a function of time, beam energy and impact parameter.

Recent STAR measurements suggest a difference in the global spin polarization between hyperons and anti-hyperons, especially at relatively low collision beam energy. One possible cause of this difference is the potential presence of in-medium magnetic field.We find that such difference is very sensitive to the lifetime of the magnetic field and also mildly dependent on the precise form of magnetic field time dependence. Assuming magnetic polarization as the mechanism to enhance anti-hyperon signal while suppress hyperon signal, we phenomenologically extract an upper limit on the needed magnetic field lifetime in order to account for the experimental data.

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