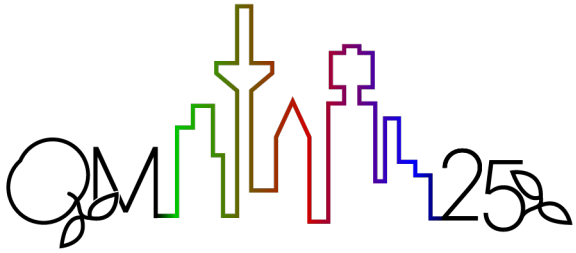

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Probing dynamical magnetic field lifetime and chiral symmetry restoration with beam energy dependence of CME observables

The chiral magnetic effect (CME) is a novel transport phenomenon that offers the unique opportunity for experimental observation of transitions between different vacuum topological sectors of QCD. A measurement of the CME signal also helps probe the dynamical magnetic field as well as chiral symmetry restoration, which are key ingredients of the phenomenon. Significant efforts have been made to search for the CME in heavy ion collisions at both RHIC and the LHC. Very recently (2024) the STAR Collaboration reported interesting new measurements from Beam Energy Scan II (BES-II) data and extracted CME signals over a broad energy range. The results show a strong signal (~3 sigma) around the intermediate energy range which approaches zero at both low and high energy. Such a highly nontrivial pattern calls for theoretical understanding. This talk presents much-needed calculations aimed at deciphering the interpretations of these new data, based on an improved event-by-event anomalous-viscous fluid dynamics (EBE-AVFD) framework that is suitable for BES-II energies and well-calibrated with experimental data on bulk properties. At each specific beam energy, we then generate a large sample of EBE-AVFD simulation events and compute the inclusive correlation observables as well as the background-removed signal contributions. We further utilize Bayesian analysis to extract the key parameters, such as magnetic field lifetime and initial axial charge, from the latest experimental measurements. This allows us to map out the beam energy dependence of those key parameters. Finally, we discuss the implications of our findings for how the dynamical magnetic field lifetime as well as the chiral symmetry restoration evolve with beam energy in heavy ion collisions.

Category

Theory

Collaboration (if applicable)

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