

Electromagnetic Field Evolution in Relativistic Heavy Ion Collision and its Effect on Flow of Particles

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Understanding the Quark Gluon Plasma (QGP), whose existence was known from the combination of three observations; is the central goal of high energy physics. All the three observations came from studying elliptic flow: how the energy; momentum and number of created particles are not uniform with direction. Any elliptic flow related studies have the chance to clear the road of understanding QGP well and answering what affects elliptic flow is part of the journey. This includes quantifying the created electromagnetic field during heavy ion collisions; which is ignored by the hydrodynamic models; and investigating its contribution to the flow of particles. So; the purpose of this research was to investigate the effect of electromagnetic field evolution created in relativistic heavy ion collision on the flow of identified particles. In order to address these problems; our model set-up followed three basic steps: describe the full relativistic viscous hydrodynamics of the considered heavy ions collision using the well known iEBE-VISHNU frame work; calculate the electromagnetic field created by the system with the possible drifting velocity sparked by it and finally investigate the change it brought to the final flow of those particles after injecting the drift velocities. The evolution of the electromagnetic fields calculated was found to play a role on the bending of flow. Beside the nature of created particles; the field evolution was affected by the electrical conductivity of the evolved system. The field arouse flow at lower transverse momentum and suppress it at higher. This change in flow is larger for heavier particles than the lighter ones during the early evolution time. Finally we found that; even flow harmonics are affected than the odds. This study definitively answers the question on whether elliptic flow is affected by the evolved electromagnetic field or not. Further study by softening many of the crude assumptions we made and a full event by event viscous hydrodynamic simulation, keeping the functionality of parameters we took as constant, is needed to establish a better ground on understanding the effect of electromagnetic field well and see from there what new things we can learn about the QGP.

Abstract Category

Nuclear Physics

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