Contribution ID: **83** Type: **not specified**

Anisotropy in magnetized quark matter

We study the characteristics of quark matter under the influence of a background magnetic field with anomalous magnetic moment (AMM) of quarks at finite temperature and quark chemical potential in the framework of Polyakov loop extended Nambu Jona-Lasinio (PNJL) model, which is relevant for the physical scenario of non-central relativistic heavy ion collisions (HICs). It is observed that the presence of AMM lowers the transition temperature from the chirally broken phase to the restored phase indicating inverse Magnetic catalysis (IMC). In contrast, without AMM, the transition temperature rises showing Magnetic catalysis (MC). Another important finding is the anisotropy which is created due to the presence
of magnetic field in various thermodynamic quantities such as speed of sound, isothermal compressibility dividing into parallel and perpendicular components with respect to the direction of the background magnetic field. Though the qualitative nature of parallel and perpendicular components of squared speed of sound appear similar, they differ in magnitude at lower values of temperature. The parallel and perpendicular components of isothermal compressibility decrease with increasing temperature, indicating a trend towards increased incompressible strongly interacting matter. On inclusion of the AMM of quarks, the perpendicular component of isothermal compressibility becomes greater than the parallel component. Additionally, we investigate the quark number susceptibility normalized by its value at zero magnetic field, which may indicate the presence of magnetic fields in the system.

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Track Classification: 1. QCD Phase Diagram, criticality and fluctuations