Contribution ID: **45** Type: **Poster**

Effect of Coriolis forces on the transport coefficients of rotating nuclear matter

In off-central heavy ion collisions (HIC), an appreciable amount of initial orbital angular momentum (OAM) of the colliding heavy nuclei can be transferred to the participants and subsequently to the nuclear medium formed [1]. This transferred OAM can give rise to local vorticity in the created matter. The transport coefficients of the matter formed in HIC give ample information about the medium formed and the underlying interactions. The transport properties, such as electrical conductivity, viscosities, and thermal conductivity of quantum chromodynamic (QCD) medium modifies in a rotating frame. By breaking the rotational symmetry of the medium, transport coefficients become anisotropic in a rotating frame. Similar to the Lorentz force in the presence of magnetic fields, the Coriolis force plays the equivalent role in a system with finite angular momentum. In a non-relativistic formulation, we have to introduce the Coriolis force in the Boltzmann transport equation (BTE) as an external force. However, considering the relativistic equation of motion in a rotating frame, Coriolis force comes naturally in BTE at leading order in angular velocity. Here, we discuss how electrical conductivity [2,3] and the shear viscosity [4] of the quark-gluon plasma (QGP) and hadronic gas are modified in a rotating frame due to the influence of Coriolis force. The transport coefficients are evaluated with the help of covariant BTE in the relaxation time approximation (RTA). The QGP is modeled with a massless gas of light quarks and gluons rotating with a constant angular velocity Ω. Similarly, the hadronic gas is modeled by the ideal hadron resonance gas (IHRG) in a rotating frame, with the relaxation time calculated in a hard sphere-type scattering, treating the hard sphere scattering length as a tuning parameter. At first, we tune the relaxation time for electrical conductivity and shear viscosity in the QGP and hadronic phases without rotation (Ω=0). After the calibration of relaxation time, we show the variation of perpendicular, parallel, and Hall-type components of viscosity and conductivity as a function of angular velocity and temperature for both rotating QGP and IHRG.

References:

1. Strongly Interacting Matter under Rotation, Francesco Becattini, Jinfeng Liao, Michael Lisa, Lecture Notes in Physics, https://doi.org/10.1007/978-3-030-71427-7
2. Effect of Coriolis force on the electrical conductivity of quark matter: a non-relativistic description, Ashutosh Dwibedi, Cho Win Aung, Jayanta Dey, and Sabyasachi Ghosh, Phys.Rev.C 109, 034914 (2024)
3. Effect of Coriolis Force on Electrical Conductivity Tensor for Rotating Hadron Resonance Gas, Nandita Padhan, Ashutosh Dwibedi, Arghya Chatterjee, and Sabyasachi Ghosh, Phys.Rev.C 110, 024904 (2024)
4. Effect of Coriolis force on the shear viscosity of quark matter: A nonrelativistic description, Cho Win Aung, Ashutosh Dwibedi, Jayanta Dey, and Sabyasachi Ghosh, Phys. Rev. C 109, 034913 (2024)

Category

Theory

Collaboration (if applicable)

Author: Mr DWIBEDI, Ashutosh (Indian Institute of Technology Bhilai (IIT Bhilai))

Co-authors: Mr WIN AUNG, Cho (IIT Bhilai); Dr DEY, Jayanta (IIT Bhilai); Ms PADHAN, Nandita (NIT Durgapur); Dr CHATTERJEE, Arghya (NIT Durgapur); Dr GHOSH, Sabyasachi (IIT Bhilai)

Presenter: Mr DWIBEDI, Ashutosh (Indian Institute of Technology Bhilai (IIT Bhilai))

Session Classification: Poster session 1

Track Classification: Chirality