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Exploring thermoelectric Figure of Merit in QCD medium with conserved charges

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It is the goal of the RHIC BES program and the future FAIR, NICA facilities to produce baryon-rich matter. In these low-energy HIC experiments, diffusion processes of conserved charges play a vital role in dynamic evolution of dense QCD matter. Recently, thermoelectric effects such as Seebeck effect, which have been extensively studied in condensed matter materials, have also captured the attention of high-density HIC physics. Thermoelectric Figure of Merit (ZT), which reflect strong couplings among electrical conductivity, thermal conductivity, Seebeck coefficient and temperature, can be used as a common benchmark to quantify the effeciency of meterial at heat-to-electricity conversion.

We focus on the ZT in hadronic phase, where the themoelectric transports of mutiple conserved charges (the baryon number, strangeness and electric charge) are fully considered. The different transport coefficients matrices are estimated using the Boltzmann kinetic theory in Hardron Resonance Gas model with and without repulsive mean field effect. We also study the effect of magnetic field on ZT. Different to zero magnetic field, additional transverse ZT can appear at finite magnetic field, and we for the first time distinguish the calculation results of themoelectric coefficients in QCD medium under the adiabatic and isothermal condition. Finally, we establish the relations between ZT and $\sqrt{s_{NN}}$ to better exhibit the thermoelectric properties of QCD medium at different collision energies.

Category

Theory

Collaboration (if applicable)

Primary author: ZHANG, He-Xia

Presenter: ZHANG, He-Xia

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