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Numerical Relativistic Magnetohydrodynamics and Related study in Heavy Ion Collisions

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Relativistic heavy-ion collisions generate a deconfined state of nuclear matter known as the quark-gluon plasma (QGP), along with extremely strong magnetic fields (˜10^{18}–10^{19} Gauss) in non-central events. These fields can significantly modify the transport properties of the QGP, such as its conductivity and viscosity. In this work, we numerically investigate the QGP evolution using the framework of Relativistic Magnetohydrodynamics (RMHD), employing the RHLLE scheme—an approximate Riemann solver—for solving the RMHD equations. Our simulations are benchmarked against standard test problems like the Balsara shock tube and include event-by-event fluctuating initial conditions to capture realistic geometry and field inhomogeneities.

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