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Probing Dynamical Electrical Conductivity via Dilepton Emission: A Kinetic theory approach

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Dileptons have long been recognized as a clean and penetrating probe of the Quark-Gluon Plasma (QGP) formed in high-energy heavy-ion collisions. In this work, we study the thermal dilepton spectra and their elliptic flow by analyzing the dynamical conductivity that enters the dilepton production rate. This conductivity is extracted from the trace of the spectral function, derived using relativistic kinetic theory with the collision kernel modeled via the Relaxation Time Approximation (RTA).
For the first time, we derive an analytical expression for the dilepton production rate that explicitly depends on the relaxation time. This rate is then integrated over the full spacetime volume of the QGP evolution, using the temperature and velocity profiles obtained from realistic MUSIC hydrodynamic simulations.

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