CAUSAL RELATIVISTIC HYDRODYNAMICS FOR VISCOUS FLUIDS

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We compute the differential elliptic flow $v_2(p_T)$ of pions, kaons and protons in non-central relativistic heavy-ion collisions, using a (2+1)-dimensional code with longitudinal boost-invariance to simulate viscous fluid dynamics in the causal Israel-Stewart formulation [1]. We explore the effects of shear viscosity on the time evolution of the spatial eccentricity and momentum anisotropy of the collision fireball, on the final hadron spectra, and on their elliptic flow, using two different equations of state and two sets of initial conditions. We show that even "minimal" shear viscosity $\eta/s = \hbar/(4\pi)$ leads to a large reduction of elliptic flow compared to ideal fluid dynamics, raising questions about the interpretation of recent experimental data from the Relativistic Heavy Ion Collider [2]. We also explore the validity of v_2/ϵ_x scaling with the transverse areal density $(1/S)(dN_{\mathrm{ch}}/dy)$, in both ideal and viscous hydrodynamics, by studying Cu+Cu and Au+Au collisions at a variety of impact parameters and collision energies [3].

References

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