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Consistency of Perfect Fluidity and Jet Quenching in semi-Quark-Gluon Monopole Plasmas

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We utilize a new framework, CUJET3.0, to deduce the energy and temperature dependence of the jet quenching parameter, $\hat{q}(E > 10\ \mathrm{GeV}, T)$, from a combined analysis of available data on the nuclear modification factor and azimuthal asymmetry of high p_T light hadrons and open heavy flavors in high-energy A+A collisions at RHIC and LHC. Extending a previous perturbative QCD based jet energy loss model (known as CUJET2.0) with (2+1)D viscous hydrodynamic backgrounds, this new framework includes three novel features of nonperturbative physics origin: (1) the Polyakov loop suppression of color-electric scatterings and (2) the enhancement of the jet scattering due to emergent chromomagnetic monopoles near T_c and (3) thermodynamic properties constrained by lattice QCD data. CUJET3.0 reduces to CUJET2.0 at high temperatures $T > 400$ MeV, but greatly enhances $\hat{q}$ near the QCD deconfinement transition temperature. This enhancement accounts well for the observed elliptic harmonics of jets with $p_T > 10$ GeV. Extrapolating our data-constrained $\hat{q}$ down to thermal energy scales, $E \sim 2$ GeV, we find for the first time a remarkable consistency between the high energy jet quenching and bulk perfect fluidity with $\eta/s \sim T^3/\hat{q} \sim 0.1$ near T_c.

References

[1] Jiechen Xu, Jinfeng Liao, Miklos Gyulassy, arXiv:1411.3673 [hep-ph].

[2] Jiechen Xu, Alessandro Buzzatti, Miklos Gyulassy, JHEP 1408, 063 (2014).

Primary author: XU, Jiechen (Columbia University)

Co-authors: Prof. LIAO, Jinfeng (Indiana University); Prof. GYULASSY, Miklos (Columbia University)

Presenter: XU, Jiechen (Columbia University)

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