Contribution ID: **644** Type: **Poster**

Collective evolution of a parton in the vacuum: search for the ultimate partonic "droplet"

Wednesday 6 April 2022 17:50 (4 minutes)

We postulate that non-perturbative QCD evolution of a single parton in the vacuum will develop the long-range QCD collective effects of a multi-parton system, reminiscent of those observed in high-energy hadronic or nuclear interactions with large final-state particle multiplicity final-state particles [1]. Proton-Proton collisions at the Large Hadron Collider showed surprising signatures of a strongly interacting, thermalized quark-gluon plasma (QGP), which was thought only to form in collisions of large nuclear systems. Another puzzle observed earlier in electron-position collisions is that production yields of various hadron species appear to follow a thermal-like distribution with a common temperature. We propose searches for thermal and collective properties of a single parton propagating in (or "colliding into") the vacuum using high multiplicity jets in high-energy elementary collisions, using a new frame with the jet direction defined as the beam z axis. In this single jet frame, a series of observables relevant to signatures of QGP are studied using the PYTHIA 8 Monte Carlo event generator in pp collisions at LHC energies. Experimental observation of collective and thermal effects in such single parton systems will offer a new view of non-perturbative QCD dynamics of multi-parton systems at the smallest scales. Absence of any collective effect may offer new insights into the role of quantum entanglement in the observed thermal behavior of particle production in high energy collisions. Opportunities for additional studies at future facilities, such as the EIC or a proposed muon-ion collider, future circular collider (FCC) are also discussed..

[1] https://arxiv.org/abs/2104.11735

Primary authors: BATY, Austin Alan (Rice University (US)); LI, Wei (Rice University (US)); GARDNER, Parker (Rice University (US))

Presenters: BATY, Austin Alan (Rice University (US)); LI, Wei (Rice University (US)); GARDNER, Parker (Rice University (US))

Session Classification: Poster Session 1 T05_2

Track Classification: QGP in small and medium systems