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Direct photon production and jet quenching in small systems

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Signatures usually associated with hydrodynamic behavior have been recently observed in high and intermediary multiplicity proton-nucleus (pA) collisions at the LHC. Even though these signals suggest the creation of a strongly coupled quark-gluon plasma (QGP) in such collisions, they do not represent concrete proof. In order to better address this problem, other signals must be investigated.

In this work we calculate the thermal photon radiation produced by a small and rapidly expanding QGP droplet [1] and evaluate how much energy jets can loose when penetrating through such a small system. We find that a significant amount of thermal radiation is produced in proton-nucleus collisions, with thermal photons accounting for ˜50% of the direct photons produced in high multiplicity pA collisions at low p_T. Furthermore, we show that despite the small system size, jets still loose a significant fraction of their initial energy, leading to a charged hadron Raa of 0.7–0.8 at a transverse momentum of ˜10 GeV. If these two signatures can be accessed by the experiments, they will serve as additional evidence that a strongly coupled QGP is being produced in proton-nucleus collisions at the LHC. To complete the analysis, we study direct photon production and jet quenching in other small systems, such as d-Au and He-Au collisions at RHIC energies.

[1] C. Shen, J.-F. Paquet, G. S. Denicol, S. Jeon and C. Gale, arXiv:1504.07989 [nucl-th].

On behalf of collaboration:

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