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Nuclear effects in direct photon and Drell-Yan production at the LHC

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Using the color dipole formalism we study production of direct photons and Drell-Yan pairs in proton-nucleus interactions in the kinematic region corresponding to LHC experiments. Real photons and lepton pairs produced in a hard scattering are not accompanied with any final state interaction, either energy loss or absorption. Consequently, such observables as transverse momentum pT and rapidity distributions of real photons and lepton pairs at low and high dilepton invariant masses M may, therefore, serve as more efficient and cleaner probes for nuclear modification effects than inclusive hadron production.

We have shown that shadowing effects in production of lepton pairs coming from the coherence are suppressed at large invariant masses and at very large pT at mid-rapidities. So naively one should not expect any nuclear effects is this kinematical regime. Contrary to this expectation, we found a significant large-pT suppression which was already observed by PHENIX experiment in d+Au and central Au+Au collisions, as well as by fixed-target FNAL E772 and E866 experiments at large Feynman xF. This new effect can be treated as an effective energy loss proportional to the initial energy and is universally induced by multiple initial state interactions.

Besides, we present a systematic analysis of the nuclear effects in production of real photons and Drell-Yan pairs in p+Pb interaction at the LHC. We perform predictions for nuclear suppression as a function of pT, rapidity and dilepton invariant mass that can be verified by the LHC experiments. We include and analyze also a contribution of coherent effects associated with gluon shadowing affecting the observables predominantly at small and medium-high pT.

On behalf of collaboration:

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