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Jets in QCD media: from color coherence to decoherence

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Jet physics in hadronic collisions is one of the major achievements of perturbative QCD. However, a complete theory of jets in a hot and dense partonic environment remains to be developed. Such a theory is needed in Heavy-Ion Collisions (HIC), at RHIC and now at the LHC, in order to have a clean access to the properties of the Quark-Gluon Plasma (QGP).

To this end, we have investigated medium modification of the radiation pattern of a quark-antiquark antenna traversing a dense medium in order to understand how the QGP alters color coherence which is an important feature of the intRAjet structure in vacuum. In contrast to gluon radiation in vacuum, and unexpectedly, we find a strict geometrical separation between in-vacuum and medium-induced gluon radiation. Also, a soft logarithmic divergence appears pointing to the possibility of resuming multiple gluon branching in the cascade. Moreover, in the case of an opaque medium near the unitarity bound, a simple and intuitive physical picture arises : the interaction with the QGP leads to the gradual decoherence of the pair yielding a universal radiation pattern which does not depend on the initial color configuration of the antenna.
These results are in qualitative agreement with the recent ATLAS and CMS data and provide a starting point for further studies on in-medium jet modification.

Primary author: Dr MEHTAR-TANI, Yacine (University of Santiago de Compostela)

Co-authors: Dr SALGADO, Carlos (University of Santiago de Compostela); Dr TYWONIUK, Konrad (Lund University)

Presenter: Dr MEHTAR-TANI, Yacine (University of Santiago de Compostela)

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