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Jet and photon tomography of the nuclear medium created in heavy-ion collisions

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Ultra-relativistic heavy-ions collisions performed at the Relativistic Heavy-Ion Collider (RHIC) and the Large Hadron Collider (LHC) produce a de-confined state of quarks and gluons, called quark-gluon plasma (QGP). One of the primary goals of these collisions is to learn the properties of QGP, through the modifications it imparts on jets and photons. Jets are a collimated spray of particles that have been studied extensively in electron-positron collisions, where no QGP occurs, thus making them a well-understood, calibrated, probe to study the QGP. They are initiated by a highly virtual parton, either a quark or a gluon. In the early stage, the highly virtual parton undergoes energy loss via bremsstrahlung radiation. In the later stage, multiple scatterings with the medium become the dominant mechanism of energy loss. We will use both processes to study QGP properties, with more focus given towards the early, highly virtual, part of the in-medium jet evolution. As photons can leave the QGP with negligible re-scatterings, they provide information about QGP at different stages of the evolution. We will present the scattering rates for photon production and argue that to extract the fundamental properties of the QGP, photons and jets should be used together.

Your Email

amit.kumar@uregina.ca

Affiliation

Department of Physics, University of Regina

Supervisor

Prof. Gojko Vujanovic

Supervisor Email

gojko.vujanovic@uregina.ca

Your current academic level

Postdoctoral fellow

Primary authors: KUMAR, AMIT (University of Regina); VUJANOVIC, Gojko (University of Regina)

Presenter: KUMAR, AMIT (University of Regina)

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