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Study the collectivity and electromagnetic emissivity in a small quark-gluon droplet

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Signatures associated with collective behaviour has been observed in the hadronic measurements of high multiplicity proton+lead collisions at the Large Hadron Collider (LHC), as well as in (proton, deuteron, helium-3)+gold collisions at the Relativistic Heavy-Ion Collider (RHIC). To better understand the evolution dynamics and the strongly-coupled properties of the matter created in these small systems, we present a systematic study of the hadronic observables as well as electromagnetic radiation from these collisions using a hydrodynamic framework. The validity of the hydrodynamic description is quantified using the Knudsen and the inverse Reynold's numbers. Quantitative agreement is found between theoretical calculations and existing experimental measurements. Predictions of higher order anisotropic flow coefficients, Hanbury Brown and Twiss (HBT) radii, and signals of thermal photon enhancement are proposed. They can serve as additional signatures to hunt for the existence of a hot quark-gluon plasma (QGP) during the evolution of these small collision systems. Quantitative comparisons with future experimental measurements can further constrain the extraction of the transport properties of the QGP.

Author: Dr SHEN, Chun (McGill University)

Co-authors: Prof. GALE, Charles (McGill University); DENICOL, Gabriel (McGill University); PAQUET, Jean-Francois (McGill University); JEON, Sangyong (McGill University)

Presenter: Dr SHEN, Chun (McGill University)

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