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Short Path Length Energy Loss in the Quark Gluon Plasma

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Abstract content
   (Max 300 words)
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High Energy Particle Physics collider experiments at the Relativistic Heavy Ion Collider (RHIC) in the USA and the Large Hadron Collider (LHC) in Geneva, Switzerland, are probing the most fundamental properties of matter by accelerating a range of particles, from protons to Lead nuclei, to relativistic speeds and causing them to collide. The decay products of these violent collisions can be studied in detail and have revealed that a new state of matter in which the constituents of nucleons, quarks and gluons, exist in a deconfined state, creating what appears to be a perfect fluid called the Quark Gluon Plasma (QGP). The QGP only exists for a few femto seconds and is therefore extremely difficult to characterize. The manner in which a highly energetic particle loses energy as it traverses the QGP has proven to be an effective probe of the QGP, but recent results in smaller colliding systems such as proton-lead (pPb) have brought into question our understanding of perturbative Quantum Chromodynamical (pQCD) descriptions of energy loss, particularly in small systems of QGP. We present a short separation distance correction to the well-known (static scattering centre) DGLV (Djordjevic, Gyulassy, Levai, Vitev) pQCD energy loss calculation, revealing a number of shortcomings and problematic assumptions. We also investigate the feasibility of a similar small system correction in the (dynamical scattering centre) thermal field theory formalism.

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William A. Horowitz, University of Cape Town

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