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### **Hot QCD Matter In and Out of Equilibrium<sup>1</sup>**

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Relativistic heavy ion collision experiments at RHIC and LHC have found a hot dense QCD matter that is interacting very strongly both in and out of equilibrium. We argue that such strongly interacting nature arises when the typically well-separated scales in a weakly coupled thermal quark-gluon plasma (QGP) begin to “collapse” together. This happens in equilibrium when the coupling itself becomes strong, which is the case of the thermal QGP near QCD transition temperature. This also happens out-of-equilibrium when the phase space is maximally occupied even though the coupling is not large, which is the case of the pre-equilibrium dense gluon system (“glasma”) during the early stage of heavy ion collisions. We report progress on our understanding of both systems and discuss the important implications for the observed matter properties, such as the shear viscosity, color opaqueness, as well as as well as thermalization. In particular we predict specific patterns for the evolution of these properties with collision energies from RHIC to LHC.

References: J. Blaizot, J. Liao and L. McLerran, arXiv:1305.2119; X. Huang and J. Liao, arXiv:1303.7214; J. Blaizot, F. Gelis, J. Liao, L. McLerran and R. Venugopalan, arXiv:1107.5296; J. Liao, arXiv:1109.0271; X. Zhang and J. Liao, arXiv:1208.6361, 1210.1245, 1202.1047.

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