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Ultrarelativistic heavy-ion collisions: a theoretical review

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Experimental data on ultrarelativistic heavy-ion collisions at RHIC and LHC have provided unprecedented evidence for the formation of strongly coupled quark-gluon plasma that manifests a number of remarkable properties. The hot and dense matter exhibits a strong collective behavior during the rapid expansion shortly after its formation. It resembles that for fluid with extremely small shear viscosity that can even preserve the fluctuation in initial energy density. The dense matter is also opaque to energetic partons from initial hard scattering leading to jet quenching phenomena such as suppression of high transverse momentum hadrons and large dijet asymmetry. I will review recent theoretical advances that underpin the physical interpretation of these phenomena and phenomenological efforts to qualitatively extract physical properties of the strongly coupled quark-gluon plasma such as shear viscosity, jet transport coefficient and initial quantum fluctuations.