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Zeroing in on the initial state - tomography combining bulk, jet and electromagnetic observables

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One of the unsolved problems in the current 'standard model' of heavy ion physics is the apparent rapid thermalization of QCD matter in the pre-equilibrium stage. While it is challenging to probe this mechanism directly, there are now several observables available which allow tomographic imaging of the initial state geometry, which is expected to carry remnant information of the equilibration mechanism. On the fluid dynamics side, scaled fluctuations in the momentum space anisotropy parameters v_n image the initial eccentricity fluctuations epsilon_n almost directly with only a weak dependence on fluid dynamics. From a different direction, due to the strong non-linear dependence of their emission rates on temperature, thermal photons and their v_n are very sensitive to the initial state graininess. Finally, the v_2 and v_3 of high P_T hadrons coming from hard processes reflect the attenuation pattern of partons propagating through the inhomogeneous matter density after some fluid dynamical evolution. Combining information from all these channels does not yet lead to a fully consistent picture, however intriguing trends pointing towards non-trivial initial state dynamics emerge. I review efforts to constrain the initial state by looking at all three classes of observables.

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