

Reggeized scattering, entanglement and chaos using AdS/CFT

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ABSTRACT:

The eikonalized parton-parton scattering amplitude at large energy and large impact parameter, is dominated by the exchange of a hyperbolic surface in walled AdS. Its analytical continuation yields a worldsheet instanton that is at the origin of the Reggeization of the amplitude and a thermal-like quantum entropy. I will construct the entangled density matrix following from the exchanged surface, and show that its von-Neumann entanglement entropy coincides with its thermal-like entropy. The ratio of the entanglement entropy to the transverse growth of the exchanged surface is similar to the Bekenstein entropy ratio for a black-hole, with a natural definition of saturation and the on-set of chaos in high energy collisions. The largest eigenvalues of the entangled density matrix obey a cascade equation in rapidity, reminiscent of non-linear QCD evolution of wee-dipoles at low- x and weak coupling. We suggest that the largest eigenvalues describe the probability distributions of wee-quanta at low- x and strong coupling that maybe measurable at present and future hadron-hadron and lepton-hadron colliders.