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Possible resolution of the early thermalization problem in relativistic heavy-ion collisions: decoherence entropy from the Glasma

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The entropy production in the initial stage of relativistic heavy-ion collision is studied based on the classical Yang-Mills dynamics in the non-expanding plasma by constructing the corresponding (quantum) coherent state. The decoherence entropy is calculated from the distribution of the gluon occupation number given by the coherent state. We find that the importance of the fluctuations in the longitudinal direction in the initial glasma state for the onset time of the chaotic behavior and hence the entropy production; the larger the fluctuations, the fater the thermalization. We show that reasonable strengths of the initial fluctuations with respect to the amplitude of the background classical field could account for the early thermalization suggested by the phenomenological analysis based on the hydrodynamics, provided that the decoherence time is obtained.

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