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Hydrodynamization Time Hierarchies Across n-Point Functions

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Significant progress, particularly in holography, has clarified how rapidly two-point functions hydrodynamize after a quench. Motivated by non-Gaussian observables relevant to the QCD critical-point program, we ask: how do higher-point functions hydrodynamize relative to two-point functions? We propose two conjectures that organize the ordering and scaling of hydrodynamization times across correlator order in large-N, strongly coupled quantum field theories with a conserved charge. Within a Schwinger–Keldysh effective theory for diffusion and its nonlinear couplings, we demonstrate that these conjectures hold for a broad class of microscopic models. We also comment on their fate in an expanding large-N QCD plasma, both far from and near the critical point.

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