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Statistical description of the initial state and validity of mode-by-mode dynamics

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We develop a general decomposition of an ensemble of initial density profiles in terms of an average state and an orthonormal basis of modes that represent the event-by-event fluctuations of the initial state. The basis is determined such that the probability distributions of the amplitudes of different modes are uncorrelated. Based on this decomposition, we quantify the different types and probabilities of event-by-event fluctuations in Glauber and Saturation models and investigate how the various modes affect different characteristics of the initial state. We perform simulations of the dynamical evolution with KøMPøST and MUSIC to investigate the impact of the various modes on final-state observables and their correlations. By comparing results for the mode-by-mode linear response of v_n and $\langle p_t \rangle$ with event-by-event simulations, we further quantify the accuracy of mode-by-mode approaches.

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