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# Quantum features from classical entropies

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Local quantum entropies are of utmost interest in characterizing quantum fields, many-body systems, and gravity. Despite their importance, being nonlinear functionals of the underlying quantum state hinders their theoretical as well as experimental accessibility. Here, we show that suitably chosen classical entropies of standard measurement distributions capture many features of their quantum analogs while remaining accessible even in high-dimensional Hilbert spaces. We demonstrate the presence of the celebrated area law for classical entropies of typical states, such as ground and excited states of a scalar quantum field. Further, we consider the post-quench dynamics of a Bose-Einstein condensate from an initial product state, in which case we observe the dynamical build-up of quantum correlations signaled by the area law, as well as local thermalization indicated by a transition to a volume law – both in regimes characterized by non-Gaussian quantum states and small sample numbers. With the classical entropy method, we set out a novel paradigm for describing local information in quantum many-body systems and analyzing experimental data beyond correlation functions.References: arXiv:2404.12320, 2404.12321, 2404.12323.

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