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Dynamical simulation of integrable and non-integrable models in the Heisenberg picture[1] DOMINIK MUTH, RAZMIK UNANYAN, MICHAEL FLEISCHHAUER, Fachbereich Physik und Forschungszentrum OPTIMAS, Technische Universitaet Kaiserslautern, D-67663 Kaiserslautern, Germany — The numerical simulation of quantum many-body dynamics is typically limited by the linear growth of entanglement with time. Recently numerical studies have shown, however, that for 1D Bethe-integrable models the simulation of local operators in the Heisenberg picture can be efficient as the corresponding operator-space entanglement grows only logarithmically. Using the spin-1/2 XX chain as generic example of an integrable model that can be mapped to free particles, we here provide a simple explanation for this. We show furthermore that the same reduction of complexity applies to operators that have a high-temperature auto correlation function which decays slower than exponential, i.e., with a power law. This is amongst others the case for models where the Blombergen-De Gennes conjecture of high-temperature diffusive dynamics holds. Thus efficient simulability may already be implied by a single conservation law (like that of total magnetization), as we will illustrate numerically for the spin-1 XXZ model.

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Dominik Muth
Fachbereich Physik und Forschungszentrum OPTIMAS,
Technische Universitaet Kaiserslautern, D-67663 Kaiserslautern, Germany

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