

Abstract Submitted  
for the MAR16 Meeting of  
The American Physical Society

**A matrix product algorithm for stochastic dynamics on locally tree-like graphs** THOMAS BARTHEL, Duke University, Department of Physics, CATERINA DE BACCO, SILVIO FRANZ, Université Paris-Sud, LPTMS — In this talk, I describe a novel algorithm for the efficient simulation of generic stochastic dynamics of classical degrees of freedom defined on the vertices of locally tree-like graphs. Such models correspond for example to spin-glass systems, Boolean networks, neural networks, or other technological, biological, and social networks. Building upon the cavity method and ideas from quantum many-body theory, the algorithm is based on a matrix product approximation of the so-called edge messages – conditional probabilities of vertex variable trajectories. The matrix product edge messages (MPEM) are constructed recursively. Computation costs and accuracy can be tuned by controlling the matrix dimensions of the MPEM in truncations. In contrast to Monte Carlo simulations, the approach has a better error scaling and works for both, single instances as well as the thermodynamic limit. Due to the absence of cancellation effects, observables with small expectation values can be evaluated accurately, allowing for the study of decay processes and temporal correlations with unprecedented accuracy. The method is demonstrated for the prototypical non-equilibrium Glauber dynamics of an Ising spin system. Reference: arXiv:1508.03295.

Thomas Barthel  
Duke University, Department of Physics

Date submitted: 05 Nov 2015

Electronic form version 1.4