1154-65-555 **Benjamin Peherstorfer***, Courant Institute, New York University, New York City, NY 10012.
Learning reduced dynamical-system models from data.

This work introduces a method for learning low-dimensional models from data of high-dimensional black-box dynamical systems. The novelty is that the learned models are exactly the reduced models that are traditionally constructed with model reduction techniques that require full knowledge of governing equations and operators of the high-dimensional systems. Thus, the learned models are guaranteed to inherit the well-studied properties of reduced models from traditional model reduction. The key ingredient is a new data sampling scheme to obtain re-projected trajectories of high-dimensional systems that correspond to Markovian dynamics in low-dimensional subspaces. The exact recovery of reduced models from these re-projected trajectories is guaranteed pre-asymptotically under certain conditions for finite amounts of data and for a large class of systems with polynomial nonlinear terms. Numerical results demonstrate that the low-dimensional models learned with the proposed approach match reduced models from traditional model reduction up to numerical errors in practice. The numerical results further indicate that models fitted to re-projected trajectories are predictive even in situations where models fitted to trajectories without re-projection are inaccurate and unstable. (Received September 06, 2019)