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Rare events in chemical reaction systems

Chemical kinetics can usually be described by a deterministic system of ordinary differential equations. However, when the concentrations of certain species become small, stochastic fluctuations play an important role, which can be modeled by the chemical master equation (CME). For some systems, the steady state solution of the CME is a multimodal distribution with small transition rates (rare events), a situation comparable to metastable molecular conformations. In this talk we will present a mesh-free discrete Galerkin method for the solution of the CME, which allows for an efficient computation of transition rates. In particular, we will discuss the future potential of this method for the simulation of endocrinological networks.