

Abstract: The cutoff phenomenon is an abrupt transition from out of equilibrium to equilibrium undergone by certain Markov processes in the limit where the size of the state space tends to infinity: instead of decaying gradually over time, their distance to equilibrium remains close to its maximal value for a while and suddenly drops to zero as the time parameter reaches a critical threshold. Discovered four decades ago in the context of card shuffling, this surprising phenomenon has since then been observed in a variety of models, from random walks on groups or complex networks to interacting particle systems. It is now believed to be universal among fast-mixing high-dimensional processes. Yet, current proofs are heavily model-dependent, and identifying the general conditions that trigger a cutoff remains one of the biggest challenges in the quantitative analysis of finite Markov chains. The purpose of this mini-course is to provide a self-contained introduction to this fascinating question, and to describe its recently uncovered relations with entropy, curvature and concentration.