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Stochastic processes on multiple scales: averaging, decimation and beyond. STEFANO BO, Nordita, KTH Royal Institute of Technology and Stockholm University, ANTONIO CELANI, The Abdus Salam International Centre for Theoretical Physics (ICTP) — The recent advances in handling microscopic systems are increasingly motivating stochastic modeling in a large number of physical, chemical and biological phenomena. Relevant processes often take place on widely separated time scales. In order to simplify the description, one usually focuses on the slower degrees of freedom and only the average effect of the fast ones is retained. It is then fundamental to eliminate such fast variables in a controlled fashion, carefully accounting for their net effect on the slower dynamics. We shall present how this can be done by either decimating or coarse-graining the fast processes and discuss applications to physical, biological and chemical examples. With the same tools we will address the fate of functionals of the stochastic trajectories (such as residence times, counting statistics, fluxes, entropy production, etc.) upon elimination of the fast variables. In general, for functionals, such elimination can present additional difficulties. In some cases, it is not possible to express them in terms of the effective trajectories on the slow degrees of freedom but additional details of the fast processes must be retained. We will focus on such cases and show how naive procedures can lead to inconsistent results.

Stefano Bo
Nordita, KTH Royal Institute of Technology and Stockholm University

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