Kinetic Description of Viral Self-assembly Using Mesoscopic Nonequilibrium Thermodynamics

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One of the key steps in the replication cycle of viruses is the assembly of their protective shell, also named capsid, from multiple copies of the capsid proteins. For most viruses this process is spontaneous and ends up forming a spherical or tubular shell with well-defined size and structure. Although the architectural principles and the equilibrium aspects of viral assembly are starting to be unveiled, the kinetics of the assembly process is not yet fully understood.

In this contribution, we explain how mesoscopic nonequilibrium thermodynamics can be used to describe the kinetics of viral assembly. Combining theory and simulations, we will explore how the interplay between the different energetic contributions and the kinetics dictates the shape and size of the resulting viral shell. We will analyze the possibility to alter kinetically the size of the resulting capsid and explore the possibility to induce misassembly as a potential route to hinder viral infections.