

# Fast reaction limits via Gamma-convergence of the Flux Rate Functional

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We consider a system of linear ODEs on a finite graph with multiple time scales, and revisit the classical problem of deriving effective equations for the evolution. If solutions of the ODEs minimise an action functional, one can study Gamma-convergence of that functional, and find the effective equations as the minimiser of the limit functional. In this work we use a natural action functional that is related to the large deviations of a random particle system; the value at each vertex can then be interpreted as a particle density. Our central idea is to study densities as well as particle fluxes through each edge. This additional information allows a full decomposition of the graph into separate components, which simplifies the Gamma-convergence considerably.