

Equilibria in large Lotka-Volterra systems of ODE coupled by large random matrices 2/2

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Large Lotka-Volterra (LV) systems of coupled ODE are a popular model for complex systems in interaction, in particular large ecological systems. Since the « real » coupling between the differential equations is in general out of reach, a coupling based on the realization of a large random matrix is often used in practice. Within this framework, we shall discuss the existence of an equilibrium, its stability and its statistical properties, such as the proportion of non-vanishing components of the equilibrium, etc. We will focus on non-Hermitian random matrix models such as Ginibre and elliptic matrices and will show how techniques borrowed from Approximate Message Passing (AMP) enable us to capture the statistical properties of the equilibria.

Here are subjects we intend to cover during these lectures

Basic properties of non-hermitian matrix models (circular law, elliptic model)

Approximate Message Passing for elliptic matrix models

A specific AMP algorithm to compute the equilibrium of a large LV system.

Joint work with I. Akjouj, Y. Gueddari, W. Hachem, M. Maïda (and others!).

<https://arxiv.org/abs/2302.07820>

<https://arxiv.org/abs/2402.08271>

<https://arxiv.org/abs/2212.06136>

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