

# Interacting Diffusions on Random Graphs: the role of sparsity

## Application to Kuramoto Model

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Consider a system of diffusions with interactions given by a graph. Suppose that this graph is a Erdos-Renyi random graph. First we consider the regime when the mean degree goes to infinity. In this case we prove a large deviation of a typical particle around the McKean-Vlasov equation. We prove this large deviation using previous results about the mean-field interactions. Suppose now that the mean degree of the random graph is constant. We prove a weak law of large number for a typical particle. The limit in this case is related to a infinite system of stochastic differential equations defined on the Galton-Watson tree. We prove this using local weak convergence of graphs. We also need new results to show how the dynamics depends on the local properties of the graphs. We extend these results for other models of graphs. This is a joint work with Roberto I. Oliveira.

**Keywords** Interacting Particle Systems · Random Graphs · McKean-Vlasov Equation · Large Deviation · Weak Law of Large Numbers · Weak Local Limit of Graphs

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