

## **Interpolation between random matrices and free operators.**

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We shall start by introducing the problems that this method was first designed to solve, notably the question of strong convergence of a family of random matrices. Indeed if one considers a polynomial in those random matrices, one can wonder how the spectrum of the resulting matrix behaves when the dimension goes to infinity. In particular, a recurring question is whether the operator norm converges. After having defined some usual notions of Free Probability, we will talk about free stochastic calculus, which is an analogue of classical stochastic calculus where we replaced the notion of independence by the one of “freeness”. We will then explain how to use this tool to compute some highly non trivial quantities in Random Matrix Theory. In particular, this let us compute so-called topological expansions, i.e. considering the trace of a functional in our random matrices, one can get a Taylor series of its expectation in terms of the dimension of the matrices. We will study the case of GUE as well as Haar unitary random matrices.

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