Heavy-tail phenomena in the large deviations of random matrices

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In this talk, we will revisit the proof of the large deviations principle of Wiener chaoses partially given by Borell, and then by Ledoux in its full form. We show that some heavy-tail phenomena observed in large deviations can be explained by the same mechanism as for the Wiener chaoses, meaning that the deviations are created, in a sense, by translations. More precisely, we prove a general large deviations principle for a certain class of functionals $f_n : \mathbb{R}^n \to \mathcal{X}$, where $\mathcal{X}$ is some metric space, under the probability measure ν_α^n, where $\nu_\alpha = Z_\alpha^{-1} e^{-|x|^\alpha} dx$, $\alpha \in (0, 2]$, for which the large deviations are due to translations. We retrieve, as an application, the large deviations principles known for the so-called Wigner matrices without Gaussian tails of the empirical spectral measure, the largest eigenvalue, and traces of polynomials. We also apply our large deviations result to the last-passage time which yields a large deviations principle when the weight matrix has law $\mu_\alpha^{n^2}$, where μ_α is the probability measure on $\mathbb{R}^+$ with density $2Z_\alpha^{-1} e^{-x^\alpha}$ when $\alpha \in (0, 1)$.

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