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Spontaneous Breaking of U(N) symmetry in Invariant Matrix Models

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Abstract:

Matrix Models are the most effective way to describe strongly interacting systems with many degrees of freedom. They have proven successful in describing very different settings, from nuclei spectra to conduction in mesoscopic systems, from holographic models to various aspects of mathematical physics and integrability. This success reflects the existence of a large universality class for all these systems, signaled by the so-called Wigner–Dyson statistics for the matrix eigenvalues. These models are defined in a base invariant way and this U(N) symmetry has traditionally been read to imply that they describe extended system. We show that certain matrix models, which deviates from the Wigner–Dyson universality, can spontaneously break their U(N)invariance and localize their eigenvectors on a portion of their Hilbert space. This conclusion establishes once more a direct connection between the eigenvalue and eigenvector distributions. Recognizing this loss of ergodicity discloses the power of non-perturbative techniques available for matrix models to the study of localization problems and introduces a novel spontaneous symmetry breaking mechanism. Moreover, it brings forth the overlooked role of eigenvectors in the study of matrix models and allows for the consideration of new types of observable.

- F. Franchini, arXiv:1412.6523
- F. Franchini, arXiv:1503.03341