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Random-matrix theories in quantum physics: common concepts

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Abstract

We review the development of random-matrix theory (RMT) during the last fifteen years. We emphasize both the theoretical aspects, and the application of the theory to a number of fields. These comprise chaotic and disordered systems, the localization problem, many-body quantum systems, the Calogero-Sutherland model, chiral symmetry breaking in QCD, and quantum gravity in two dimensions. The review is preceded by a brief historical survey of the developments of RMT and of localization theory since their inception. We emphasize the concepts common to the above-mentioned fields as well as the great diversity of RMT. In view of the universality of RMT, we suggest that the current development signals the emergence of a new “statistical mechanics”: Stochasticity and general symmetry requirements lead to universal laws not based on dynamical principles.



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Keywords

Random matrix theory; Chaos; Statistical many-body theory; Disordered solids

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