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Physics Reports

Volume 299, Issues 4–6, 1 June 1998, Pages 189-425

Random-matrix theories in quantum physics: common concepts

Thomas Guhr ... Hans A. Weidenmüller

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[https://doi.org/10.1016/S0370-1573\(97\)00088-4](https://doi.org/10.1016/S0370-1573(97)00088-4)

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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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02.50.Ey; 05.45.+b; 21.10.â''k; 24.60.Lz; 72.80.Ng

Keywords

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

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