EMBEDDED RANDOM MATRIX ENSEMBLES FOR COMPLEXITY AND CHAOS IN FINITE INTERACTING PARTICLE SYSTEMS

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Embedded random matrix ensembles for complexity and chaos in finite interacting particle systems

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Abstract

Universal properties of simple quantum systems whose classical counterparts are chaotic, are modeled by the classical random matrix ensembles and their interpolations/deformations. However for finite interacting...
many-particle systems such as atoms, molecules, nuclei and mesoscopic systems (atomic clusters, helium droplets, quantum dots, etc.) for wider range of phenomena, it is essential to include information such as particle number, number of single-particle orbits, lower particle rank of the interaction, etc. These considerations led to resurgence of interest in investigating in detail the so-called embedded random matrix ensembles and their various deformed versions. Besides giving a overview of the basic results of embedded ensembles for the smoothed state densities and transition matrix elements, recent progress in investigating these ensembles with various deformations, for deriving a statistical mechanics (with relationships between quantum chaos, thermalization, phase transitions and Fock space localization, etc.) for isolated finite systems with few particles is briefly discussed. These results constitute new progress in deriving a basis for statistical spectroscopy (introduced and applied in nuclear structure physics and more recently in atomic physics) and its domains of applicability. © 2001 Elsevier Science B.V. All rights reserved.

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