CHAOS VERSUS ORDER IN NUCLEI

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The order-to-chaos transition in the dynamics of independent classical particles gas was studied by means of the computer simulations within the nuclear model based on the time-dependent mean-field approach [1-6]. The excitation of the gas for containers whose surfaces are rippled according to Legendre polynomials P_2, P_3, P_4, P_5, P_6 is now followed for ten periods of oscillations. A quantum-classical correspondence of chaos is investigated in such potentials with the help of Poincare sections and more precised characteristics of stability of the classical dynamics in terms of the Lyapunov exponents as well as within the periodic orbit theory (POT). Looking at classical Poincare sections and Lyapunov exponents we have constructed the wall formula for energy dissipation corrected for the degree of chaoticity which is different in each of the cases. The respective role of chaoticity, deformation and symmetry-breaking of the non-linear dynamics (bifurcations of the periodic orbits) is extensively studied through such a comparison of the numerical and analytical results with the help of the POT. The excitation of a gas due to the corrected wall formula agrees very well with the excitation obtained in the numerical simulations, especially for even Legendre polynomials with accounting for the probability distributions over initial angular momentum of the nucleon that lead to the so called chaoticity correction. An anomaly nonlinear and nonadiabatic pecularities of the quantum calculations of the excitation energy as function of time and adibaticity parameter for ten oscillation periods are explained in contrast to the results of the classical dynamics.

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