Onset of nuclear fragmentation through nonlinear dynamics

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The cluster formation is thoroughly investigated by studying the time evolution of the nucleons in a potential well for specific cases and by taking into account the coupling between the single particle and the collective degrees of freedom in the presence of dissipation. A semiclassical version of the nuclear billiard is employed by adding spin, charge and internal structure to the nucleons. The treatment of this problem includes Pauli blocking effect. By comparing the order-to-chaos transition for several physical cases of interest from adiabatic to resonance regime, it is shown that every new interaction that allows suplimentary couplings between particles would significantly decrease the onset of the nuclear fragmentation towards realistic nuclear interaction time scale. In proving the above mentioned, the authors performed many types of analyses from single-particle phase-space and Poincare maps, fractal dimensions of such maps to autocorrelation functions, power spectra, Shannon and Kolmogorov entropies, Lyapunov exponents, frequency blocking processes and so on.