Stability study for quark systems using a semi-classical billiard model

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We consider a semi-classical version of the motion of the particles and of the collective coordinates. Several interacting quarks are moving in a 2D potential well and hitting the vibrating surface. We use a Cornell type potential consistent with the indications of lattice QCD calculations. The numerical simulation is based on the solutions of the Hamilton equations which was solved using an algorithm of Runge-Kutta type (order 4-5) having an optimized step size, taking into account that the absolute error for each variable is less than 10^(-6). Total energy is conserved with high accuracy, i.e. approx. 10^(-6) in absolute value. We analyze the chaotic behaviour of the nonlinear dynamics system using phase-space maps, autocorrelation functions, power spectra and Lyapunov exponents. There is a transition from a chaotic motion corresponding to hadronic plasma to a more ordered behaviour of the system for quark glun plasma, which could be revealed from the dependence of the largest Lyapunov exponent (LLE) versus temperature.