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Low-Dimensional Chaotic Dynamics in Dripping Faucets

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Dynamical characteristics of low-dimensional chaos have been observed in dripping faucet experiments. The fluid is an infinite dimensional system, so how can low-dimensional dynamics be extracted from the fluid system? To try to answer this question, we studied potential structure of the dripping faucet system. Through numerical computations, it was shown that the dripping faucet dynamics can be basically described using an approximate potential function with only two variables, the mass of the pendant drop and the position of the center of mass. The potential function corresponds to a set of solutions of Young-Laplace equation which describes the static equilibrium shape of drops. The potential landscape based on a quasi-static approximation illustrates how the drop formation dynamics can exhibit low-dimensional chaos. The numerical results have been supported by experimental observations using a high-speed camera.

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