Abstract Submitted
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The fluid trampoline: droplets bouncing on a soap film JOHN BUSH, MIT, TRISTAN GILET, University of Liege — We present the results of a combined experimental and theoretical investigation of droplets falling onto a horizontal soap film. Both static and vertically vibrated soap films are considered. A quasi-static description of the soap film shape yields a force-displacement relation that provides excellent agreement with experiment, and allows us to model the film as a nonlinear spring. This approach yields an accurate criterion for the transition between droplet bouncing and crossing on the static film; moreover, it allows us to rationalize the observed constancy of the contact time and scaling for the coefficient of restitution in the bouncing states. On the vibrating film, a variety of bouncing behaviours were observed, including simple and complex periodic states, multiperiodicity and chaos. A simple theoretical model is developed that captures the essential physics of the bouncing process, reproducing all observed bouncing states. Quantitative agreement between model and experiment is deduced for simple periodic modes, and qualitative agreement for more complex periodic and chaotic bouncing states.

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