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Exploring Extensive Chaos in Rayleigh-Benard Convection[1]
ALIREZA KARIMI, MARK PAUL, Virginia Tech — For large spatially extended systems it is expected that the fractal dimension will scale linearly with system size yielding extensive chaos. The variation of the dimension for small changes in system size can yield fundamental insights into the nature of the underlying spatiotemporal chaos. Results from well known model equations of spatiotemporal chaos have yielded both deviations from extensivity as well as microextensivity. We explore this for experimentally accessible Rayleigh-Benard convection using large-scale numerical simulations for system parameters where convection has been shown to be extensive. We solve the full Boussinesq equations and compute the spectrum of Lyapunov exponents by simultaneously evolving many copies of the governing equations linearized about the full nonlinear driving solution. Using long-time numerical simulations we study the variation of the fractal dimension over a small range of system sizes chosen to introduce approximately two new chaotic degrees of freedom.

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