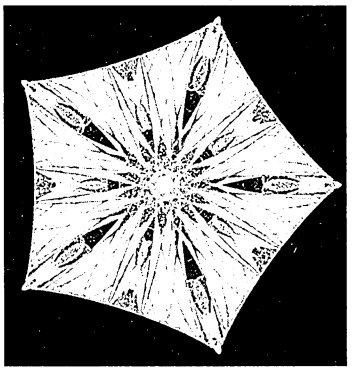
in effect average or sum instantaneous observations over a subset of the attractor that is large enough to reveal the global symmetry. In mathematical models, the relevant symmetry arises through such things as the choice of domain for the model and its boundary conditions. In experiments, symmetry derives from the design of the apparatus and the underlying symmetry of physical laws.



An example of symmetric chaos in a mathematical model.

Within the nonlinear dynamics community, the concept of symmetric chaos was formulated in 1988 by Chossat and Golubitsky (*3, 4*) and has been extensively studied since (*5–7*). To date, the main experimental verification is that of Gluckman *et al.* (*8*) for the Faraday experiment, in which a thin layer of fluid in a dish is vibrated vertically. At suitable frequencies, the instantaneous state appears chaotic. However, the symmetry of the dish affects the symmetry of the underlying chaotic attractor, and this effect can be revealed by averaging the observed patterns over time. Chaos notwithstanding, the averaged observation is not featureless. In a square dish, the averaged pattern is a square-symmetric checkerboard of waves parallel to the sides of the dish. In a circular dish, the average is a "target pattern" of concentric circular rolls.

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References

1. F. Encinas-Sanz, I. Leyva, J. M. Guerra, *Phys. Rev. Lett.* **84**, 883 (2000).
2. M. Field and M. Golubitsky, *Symmetry in Chaos* (Oxford Univ. Press, Oxford, 1992).
3. P. Chossat and M. Golubitsky, *Physica D* **32**, 423 (1988).
4. ———, *SIAM J. Math. Anal.* **19**, 1259 (1988).
5. E. Barany, M. Dellnitz, M. Golubitsky, *Physica D* **67**, 66 (1993).
6. L. Melboume, M. Dellnitz, M. Golubitsky, *Arch. Rat. Mech. Anal.* **123**, 75 (1993).
7. M. Field, I. Melbourne, M. Nicol, *Proc. London Math. Soc.* **72**, 657 (1996).
8. B. J. Gluckman, P. Marcq, J. Bridger, J. P. Gollub, *Phys. Rev. Lett.* **71**, 2034 (1993).

Scientists at Brookhaven

For the News Focus article "Meltdown on Long Island" by Andrew Lawler (25 Feb., p. 1382), I did not say to Lawler that "The whole lab is corrupt," in reference to Brookhaven National Laboratory. Although the STAR (Standing for Truth About Radiation) Foundation has had the greatest reservations about the truthfulness and good faith of those charged with overseeing Brookhaven's nuclear capabilities, we nonetheless recognize the good scientific work being done by many research scientists there. It would be unfair to contaminate them all, if you will, with the same brush.

Alec Baldwin*
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Editors' note

Baldwin's comment was shortened during editing. The full quote was, "The whole lab as an institution is corrupt."

CREDIT: MIKE FIELD AND MARTY GOLUBITSKY, *SYMMETRY IN CHAOS* (1992)

CORRECTIONS AND CLARIFICATIONS

News Focus: "A reluctant warrior" by Jocelyn Kaiser (18 Feb., p. 1190). Gene Likens' age should have been 65, not 67.