Bauer and Bertsch Reply: In their work,[1] Legrand and Sornette find a similar exponential decay law for the stadium billiard to the one obtained by us[2] for the Sinai billiard. The difference between the two approaches is that they treat the problem of the return of a trajectory to a certain region in coordinate space (autocorrelations), and we treat the problem of the decay of a system whose initial phase-space population is uniform (correlations).

Exponential decay laws have been found for other chaotic systems besides the room acoustics mentioned above. After the publication of our Letter, other authors have communicated related exponential decay laws to us. After our article appeared, we learned of work by Mackey and Milton,[3] who found exponential survival functions for cancer patients using a model similar to our Sinai billiard, but also taking into account the case when the "small hole" expands or constricts. They cite work dating back to Pianigiani and Yorke.[4,5] We also became aware of work by Doron, Smilansky, and Frenkel,[6] who report the experimental demonstration of an exponential decay law in chaotic scattering of microwaves in an "elbow" cavity. Their setup uses a symmetry-reduced Sinai billiard, but the boundary conditions are such that they study the autocorrelation problem.

Chaoticity is a sufficient criterion for exponential decay, but it is not a necessary one, as the example of the exponential decay for the integrable circular window cited above shows. However, the case studied by us was used to show how this decay law can be modified in the presence of additional constants of motion which prevent ergodicity.

And finally, our derivations of the decay laws of course only hold in the limit of a small window area d, $d/A_c \to 0$, where A_c is the container volume. In addition, the chaotic case has to satisfy the condition $d/R \to 0$, where R is the radius of the circular scattering center. One obtains a smooth transition from chaos to regular motion by changing d/R from 0 to ∞. For any finite value of d/R, the exponential decay turns into a power law at extremely long times.

Wolfgang Bauer[(a)] and George F. Bertsch
National Superconducting Cyclotron Laboratory
and Department of Physics and Astronomy
Michigan State University
East Lansing, Michigan 48824-1321

Received 27 December 1990
PACS numbers: 05.45.+b, 05.20.−y

[(a)]Electronic address: bauer@msunscl (bitnet).

[1]O. Legrand and D. Sornette, Europhys. Lett. **11**, 583 (1990); Physica (Amsterdam) **44D**, 229 (1990); preceding Comment, Phys. Rev. Lett. **66**, 2172 (1991).

[2]W. Bauer and G. F. Bertsch, Phys. Rev. Lett. **65**, 2213 (1990).

[3]M. C. Mackey and J. G. Milton, J. Math. Biol. **28**, 22 (1990).

[4]G. Pianigiani and J. A. Yorke, Trans. Am. Math. Soc. **252**, 351 (1979).

[5]For more references, see L. Lasota and M. C. Mackey, *Probabilistic Properties of Deterministic Systems* (Cambridge Univ. Press, New York, 1985).

[6]E. Doron, U. Smilansky, and A. Frenkel, Phys. Rev. Lett. **65**, 3072 (1990).