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IN MEMORIAM

Oscar E. Lanford III (Jan 6, 1940–Nov 16, 2013)

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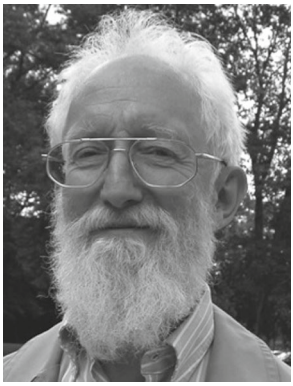

Oscar Lanford passed away on November 16, 2013, after a battle with cancer, at the age of 74 years. With him, the community of mathematical physics, and of mathematics, loses a scientist of very high standards who gratified us with interesting and important results.

Oscar was born in New York, got an undergraduate degree from Wesleyan University (which gave him later an honorary PhD degree) and graduated with a PhD in quantum field theory under the direction of Arthur Wightman. He became soon professor at UC Berkeley, then at the IHES in France, and was since 1987 professor at the ETH in Zürich, where he retired in 2005. He continued teaching at the Courant Institute until 2012.

His papers, not numerous by today's standards, contain several gems which have influenced directions which mathematical physics would take. The Boltzmann equation, a computer assisted proof of the Feigenbaum conjectures, the Dobrushin–Lanford–Ruelle equations, just to name the (probably) most prominent among them. They will certainly continue to be of importance for the study of many questions in mathematical physics.

Highlights of Lanford's research

- Consider statistical mechanics on a lattice Z^d. It is natural to define *equilibrium states* as probability measures invariant under translations, and satisfying a variational principle. One can also consider states such that in any finite region they are in equilibrium with the outside of the region: these are the *Gibbs states*, defined by the so-called DLR equations.

It turns out that equilibrium states are just the same thing as translationally invariant Gibbs states. We have thus equivalence of a global and a local definition.

- The Feigenbaum equation is a functional equation which plays an important role in chaos theory. The existence of a solution is a highly nontrivial problem, first solved rigorously by Oscar Lanford. He used a computer-aided proof, where difficult inequalities are proved using *interval arithmetic* and a computer. This work launched a whole new field of research.
- The Boltzmann equation is an approximate description of a gas of colliding particles. In a suitable limit (Grad limit) two particles that collide will never touch again, and the Boltzmann equation is then rigorous. In this situation, Oscar Lanford proved the existence of a solution for a finite time. During this finite time, there is actually a nonzero increase of entropy! This may be Lanford's most spectacular result. It is and will remain of fundamental importance for our understanding of non-equilibrium physics.

Oscar was a modest, somewhat shy person, and perhaps only those who were closer to him could fathom the inner workings of his personality. Then, a warm person would shine through, always curious about new things, and wanting to understand them from scratch, and on his own terms. Those who knew him in the beginnings of serious electronic computing will remember his enthusiasm when the first (trans-)portable computers appeared. He would immediately learn the standards of numerical computations, dig into computers to understand their inner workings—and in the end, this would allow him to define the field of computer-assisted proofs, of which he gave a brilliant example by proving Feigenbaum's conjecture, as explained in the box. This example just shows the typical working method of Oscar, which he applied with success to his other famous papers: Go to the bottom of a problem, find its elementary pieces, and then construct a solution from the bottom up.

This same method also made him an excellent teacher, especially at longer summer schools, such as Les Houches (1981) or at Battelle (1971), which are still a very good reading. The care and detail of the exposition are simply impressive and set standards which may be somewhat forgotten these days. These standards are also the reason that much of his work never made it into print, just into "drafts", which the more lucky among us got to read for inspiration

Apart from the science, there is of course the person, which both of us, the elder and the younger, learned to appreciate over the years. Picnics, discussions on literature, family, are some of the memories we shall keep of him. We will miss him, and keep a fond memory of his exemplary standards, as well as his continuous friendship and help. We hope that our appreciation of having known him will serve as a consolation for his wife Regina and their daughter.

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