Ergod. Th. & Dynam. Sys. (1996), **16**, 863–869
Printed in Great Britain

Obituary

ROLAND L. DOBRUSHIN (1929–1995)

Roland Dobrushin passed away in Moscow, on the 12th of November 1995, after a serious illness. His loss is incalculable for his family, his friends and the world scientific community.

His outstanding scientific contributions had their source in his very deep intuition as a probabilist, which he developed during his university years, being a student of A. N. Kolmogorov. His first important papers [**9, 10**] (1956) concern the central limit theorem for non-homogeneous Markov chains. There he introduced the notion of 'ergodicity coefficient', which plays a major role in treatments of any system with some sort of weak dependence. This topic was one of his favourites, and in his last (thus far unpublished) paper he revisited it, using methods of cluster expansion and analytic random fields.

His best known results belong to the field of rigorous statistical mechanics, which he considered to be a branch of probability theory. His first, and by now classical, result in the foundations of statistical mechanics concerns the representation of the Gibbs states as probability measures [**47**, **48**] (1968). This result was obtained independently by Lanford and Ruelle at about the same time, and is known now as the Dobrushin–Lanford–Ruelle (DLR) equation.

His other well-known results are, perhaps, even deeper than those which made him famous. In his papers written in 1972–73 [**59**, **60**], he constructed the first example of a three-dimensional random field, which has a translation-invariant system of conditional distributions, but which itself is not translation-invariant. These papers already contained ideas which were later developed into what is now known as the cluster expansion method.

Dobrushin liked very much the so-called method of coupling, which is also known, partially due to him, as the Kantorovich distance method. He brought it into the theory of random fields and developed the theory, which is now known as 'Dobrushin uniqueness'. The topic of uniqueness and the related theme of mixing properties of random fields was among the topics which were revisited by Roland several times. The most general technique developed by him and his coworkers is known under the name 'constructive uniqueness', and the related property of complete analyticity of the random field turned out to be very natural, became widely used and triggered a flow of papers on the subject.

The physical problem of equivalence of ensembles is translated into a mathematical question about the conditions when a central limit theorem implies a local limit theorem. Dobrushin found such conditions. A somewhat related question concerns the study of large deviations behavior of models in statistical mechanics. Here his numerous contributions culminated in the book, co-authored by R. Kotecky and S. Shlosman, 'Wulff Construction: A Global Shape From Local Interaction' [**129**]. The main result of the book is contained in the theorem about the typical behavior of the configurations which contribute to the large deviation regime of the system. It turns out that their structure is described by a well-known (in crystallography) Wulff construction, which predicts the shape of the crystal when the corresponding surface tension is given. Again, once the importance of the concept of the surface tension was realized, it was used in different contexts by many authors.

Roland Dobrushin also contributed to the theory of dynamical systems. Some of his contributions are described in the review paper 'Dynamical systems of statistical mechanics', co-authored by Ya. Sinai and Yu. Suhov [**112**]. His best known and by now classical results about non-equilibrium dynamics of one- and two-dimensional infinite particle systems with a singular interaction were obtained in collaboration with J. Fritz [**79**, **80**]. His other field of constant interest was the so-called hydrodynamic limit for interacting particle systems.

Dobrushin made important contributions to all directions of the theory of random fields. Probably the only direction left is the area of correlation inequalities; in his words, he always preferred equalities (asymptotic, though). The only inequality he found was the known FKG inequality (private communication).

Roland Dobrushin made crucial contributions to the theory of interacting particle systems. His papers 'Markov processes with a large number of locally interacting components' [**56**, **57**] (1971) laid the foundations of this modern theory.

He successfully applied ideas and methods of statistical physics in the theory of information networks. The results in that direction are contained in the review paper 'Qualitative methods of queuing network theory' [**127**] (1990), written together with M. Kelbert, A. Rybko and Yu. Suhov. The important discovery made by this application is the possibility of interpretation of instabilities in such networks as phase transition phenomenon.

The main part of Roland Dobrushin's scientific life came in times very different from today; with no e-mail or fax connection between East and West, and with western visitors infrequent to Moscow and almost no Russian visitors in the West, scientific groups were some times working in parallel, unaware of each other. Because of his active moral and political standing, Roland Dobrushin was never given permission to visit his Western colleagues until the time of 'perestroika'. That changed his life in many respects, but not the basic one: his wonderful scientific creativity stayed at the very highest level, being independent of his age, political climate in Russia, or anything else.

A characteristic feature of his scientific style was the astonishing simplicity and clarity of his main ideas. However, they required his full technical might to be translated into final results. His creativity and the depth of his insights were amazing, and he kept them throughout his life. He was constantly generating new ideas, and he generously shared them with his coworkers and other scientists. This concerned not only mathematics, but also politics, literature and history—fields of constant interest to him, where he enjoyed an undisputed authority among his friends and colleagues. For example, in the mid-sixties he was already predicting the collapse of the USSR into national states. He was a welcome guest in most scientific capitals of the world; but he felt at his best in Moscow.

Roland Dobrushin was an outstanding representative of the Moscow mathematical school. His departure is felt as an end of a chapter in its history.

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