Rolf Schock Prize to Nikolai Makarov

Nikolai Makarov defended his thesis at the LOMI Institute for Mathematics in St Petersburg in 1986. He is now professor at California Institute of Technology (Caltech).

His most well-known result concerns the theory of harmonic measure in the complex plane. Harmonic measure appears when you solve the Dirichlet problem, i.e. the Laplace equation, in a domain with prescribed boundary values. The solution in a given point z_0 is given by a measure on the boundary. As Shizuo Kakutani, Yale University, noticed this measure can be interpreted as the hitting distribution on the boundary of Brownian motion starting at z_0. The Laplace equation describes e.g. electrostatics and as it is well-known, lightning tends to strike i protruding objects. This was made precise in Makarov's famous theorem: the support of harmonic measure for simply connected domains (domains without holes) is located in a set of Hausdorff dimension 1. Even for a domain like the von Koch snowflake with boundary of dimension $\log 4/\log 3 > 1$, harmonic measure is located on a set of dimension 1.

Makarov has also studied growth phenomena (Diffusion Limited Aggregation, DLA) which describes crystal growth in two dimensions with Lennart Carleson and completeness of exponentials on the interval (Beurling-Mallivin theory) with his former student Alexei Poltoratski. He has studied the thermodynamic formalism for iterations of rational function with another of his former students Stanislav Smirnov, Fields medal.

His most recent interest concerns the mathematical foundations of Conformal Field Theory (CFT) in theoretical physics which has important application to condensed matter physics, statistical mechanics and string theory. Makarov is particularly interested in its relations to complex analysis and probability. In this area he has collaborated with among others his former postdoc Nam-Gyu Kang and the Swedish matematicians Yacin Ameur and Håkan Hedenmalm.