Curriculum Vitae Professor Dr Alain-Sol Sznitman

Image: Beyeler Zurich

Name: **Alain-Sol Sznitman**
Born: **13 December 1955**

Research Priorities: Probability theory, random media, propagation of chaos

Alain-Sol Sznitman is a French-Swiss mathematician, whose scientific focus is on the theory of probability, especially on random media and questions of physics. His early contributions to stochastic theory pertain to the field of the "propagation of chaos". Later, he dedicated himself to Brownian motion and random walks.

Academic and Professional Career

since 2021	Professor Emeritus, Eidgenössische Technische Hochschule (ETH) Zurich, Zurich, Switzerland
1991 - 2021	Professor, ETH Zurich, Zurich, Switzerland
1990	Professor, Courant Institute, New York University, New York City, USA
1987 - 1990	Associate Professor, Courant Institute, New York University, New York City, USA
1985 - 1987	Chargé de Recherche, Centre national de la recherche scientifique (CNRS), Université Pierre et Marie Curie (Paris 6), Paris, France
1983 - 1985	Guest Scientist, Courant Institute, New York University, New York City, USA
1979 - 1983	Research Associate, CNRS, Université Pierre et Marie Curie, Paris, France

Functions in Scientific Societies and Committees

since 2019	Member, Scientific Advisory Board, Berlin Mathematics Research Center MATH+, Berlin, Germany
2012 - 2014	Member, Chern Medal Award Committee, International Mathematical Union (IMU)

2010 - 2012 Member, Prizes Award Committee, European Mathematical Society (EMS)

2000 - 2002 Member, Programme Committee, International Congress of Mathematicians, Beijing, China

1995 - 1999 Director, Institute for Mathematics Research (FIM), ETH Zurich, Zurich, Switzerland

Project Coordination, Membership in Collaborative Research Projects

2009 Investigator, Advanced Grant "Random Walks, Percolation, and Random Interlacements" (RWPERCRI), European Research Council (ERC)

Honours and Awarded Memberships

since 2023 Member, German National Academy of Sciences Leopoldina, Germany

since 2022 Member, European Academy of Sciences (EURASC)

2022 Blaise Pascal Medal in Mathematics, EURASC

since 2014 Member, IMU Circle, IMU

2012 Member, Inaugural Class of AMS Fellows, American Mathematical Society (AMS), USA

since 2008 Member, Academia Europaea

1999 The Line and Michel Loève International Prize in Probability, University of California Berkeley, Berkeley, USA

1998 Invited Speaker, International Congress of Mathematicians (ICM), Berlin, Germany

1997 Member, Institute of Mathematical Statistics

1992 Plenary Address, 1st European Congress of Mathematicians (EMS), Paris, France

1991 Rollo Davidson Prize, Rollo Davidson Trust, University of Cambridge, Cambridge, UK

Research Priorities

Alain-Sol Sznitman is a French-Swiss mathematician, whose scientific focus is on the theory of probability, especially on random media and questions of physics. His early contributions to stochastic theory pertain to the field of the "propagation of chaos". Later, he dedicated himself to Brownian motion and random walks.

Alain-Sol Sznitman's early work concerned certain special models of interacting particles – so-called "mean-field models" – and their "Propagation of Chaos" property. This theory deals with statistical physics model, for which each particle (or individual) plays a similar role and interacts with the rest

of the (large) group through a similar rule, and yet individual particles behave almost independently. These concepts apply in several fields like statistical physics, fluid mechanics, but also social sciences. Alain-Sol Sznitman was able to determine the limit behavior for various systems for which the number of particles becomes large.

Alain-Sol Sznitman later investigated questions regarding the long-term survival of Brownian motion evolving among a random environment of Poissonian soft or hard traps. In this context he developed the “method of enlargement of obstacles” to investigate and quantify the key role of nearly obstacle-free regions of adequate size (so-called “clearings” in the “forest of obstacles”) that underpin the surviving trajectories. In the context of the Schrödinger equation in a random potential, these clearings are also related to the “Lifshits tail behavior” of the density of states for the Laplacian among soft or hard Poissonian obstacles. In a large box this Lifshits tail behavior describes the severe rarefaction of low eigenvalues near the bottom of the spectrum, due to the presence of the Poissonian obstacles.

Alain-Sol Sznitman also intensively investigated questions about the ballistic behavior of multi-dimensional Random Walks in Random Environment. At the various sites of a multi-dimensional grid the jump probabilities of a walker to the neighboring sites are chosen, once and for all, in an independent and identically distributed fashion. Of central interest is the large time behavior of the walker evolving in this static random environment. The model is well-known for its difficulty due to its genuinely non-self-adjoint character, when the dimension of the space is two or more. This feature renders its analysis challenging. Alain-Sol Sznitman made progress in the investigation of the “ballistic phase of the model”, when the particle exhibits a non-vanishing asymptotic velocity. He also studied the long-time diffusive behavior of certain multi-dimensional diffusions with drift in an homogeneous and isotropic medium (once again a genuinely non-self-adjoint situation).

Later Sznitman's research turned to properties of strongly correlated percolation models. In this context, he contributed to the development of the model of “Random Interlacements”. It corresponds to a certain random cloud of doubly infinite trajectories falling on the usual grid of dimension 3 or more, with a parameter, the so-called “level”, measuring how many trajectories are present. The model leads to an interesting percolation theory. Whereas the set of sites visited by the interlacement trajectories always constitutes a well-connected network, its complement set, the so-called “vacant-set of random interlacements”, undergoes a transition as the level varies. When the level is below a certain critical value, the vacant set contains a unique infinite connected component, and all the other connected components are finite. But when the level exceeds this critical value, all the connected components of the vacant set are finite. The model of random interlacements turns out to be closely related through so-called “isomorphism theorems”, to the “Gaussian free field”, a well-studied model of random field. In the percolation regime of the vacant set of random interlacements (and of the level-set percolation of the Gaussian free field) Sznitman investigated the cost of certain disconnection events of a large deviation character. For instance, the critical level of random interlacements naturally enters the asymptotic cost for a random walk on a fine mesh lattice to disconnect a regular body contained in a box from the exterior of the box.