THE ABEL PRIZE

The Abel Lectures

Wednesday May 21, 2014

Georg Sverdrups Hus, University of Oslo

Coffee and tea is served from 9:30 outside Auditorium 1

Program for The Abel Lectures 2014

10.00- 10:10	**Welcome** by Rector of the University of Oslo Ole Petter Ottersen, President of The Norwegian Academy of Science and Letters Nils Chr. Stenseth, and Chair of the Abel Committee Professor Ragni Piene
10.10-11:00	Abel Laureate **Yakov Sinai**, Princeton University and Landau Institute for Theoretical Physics, Russian Academy of Sciences *Now everything has been started? The origin of deterministic chaos* Chair: Professor Maria J. Esteban, Abel Committee
11.05- 11:50	**Gregory Margulis**, Yale University *Kolmogorov–Sinai entropy and homogeneous dynamics* Chair: Professor Gang Tian, Abel Committee
12.00-12:45	*Lunch (requires registration)*
12.45- 13:30	**Konstantin Khanin,** University of Toronto *Between mathematics and physics* Chair: Professor Ragni Piene
13.35- 14:15	*Coffee/tea*
14.15- 15:00	**Science Lecture: Domokos Szász,** Budapest University of Technology *Mathematical billiards and chaos* Chair: Professor Cédric Villani, Abel Committee
15.00	**Closing remarks** by Chair of the Abel Committee, Professor Ragni Piene

Abstracts

Yakov Sinai: *Now everything has been started? The origin of deterministic chaos*

The theory of deterministic chaos studies statistical properties of solutions of non-linear equations and has many applications. The appearance of these properties is connected with intrinsic instability of dynamics.

Gergory Margulis: *Kolmogorov-Sinai entropy and homogeneous dynamics*

Homogeneous dynamics is another name for flows on homogeneous spaces. It was realized during last the 30–40 years that such dynamics have many applications to certain problems in number theory and Diophantine approximation. In my talk I will describe some of these applications and briefly explain the role of Kolmogorov–Sinai entropy in the proof of corresponding results from homogeneous dynamics.

Konstantin Khanin: *Between mathematics and physics*

Over the past few decades we have witnessed an unparalleled process of unification between mathematics and physics. In this talk we shall discuss some of Sinai's seminal results which hugely contributed to this process. Sinai's contributions were based on outstanding new ideas in such core areas of mathematical physics as statistical mechanics, spectral theory of Schrödinger operators, renormalization theory, and turbulence.

Domokos Szász: *Mathematical billiards and chaos*

Can random behavior arise in purely deterministic systems? By way of responding to that question the theory of hyperbolic dynamical systems made a spectacular progress in the 1960's. Phenomenologically, being chaotic can be seen as being sensitive to initial conditions, something borne out in nature by the difficulty of forecasting weather or earthquakes, . . . (Sci-fi has dubbed this as the 'butterfly effect'.) To produce a mathematical model of chaotic motion Sinai, in the 60's, introduced scattering billiards, i. e. those with convex obstacles (like flippers in bingo halls). He also showed that the simplest' Sinai billiard was ergodic. This opened the way to answering a 1872 hypothesis of the great Austrian physicist Boltzmann, a hypothesis that, in the 1930's, also led to the birth of ergodic theory. Beyond their mathematical beauty and fruitful interconnections with many branches of mathematics, chaotic billiards are most appropriate models where laws of statistical physics can be verified. A celebrated example is Einstein's 1905 diffusion equation.

I intend to explain – for a general audience – some of Sinai's groundbreaking ideas and their implications for chaotic billiards. No particular background knowledge will be assumed.

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