Michel Talagrand awarded the 2024 Abel Prize

The Norwegian Academy of Science and Letters has decided to award the Abel Prize for 2024 to Michel Talagrand of the French National Center for Scientific Research (CNRS), Paris, France

"for his groundbreaking contributions to probability theory and functional analysis, with outstanding applications in mathematical physics and statistics."

Michel Talagrand receives the prize for his work in probability theory and stochastic processes. From the outset, the development of probability theory was motivated by problems that arose in the context of gambling or assessing risks. The common theme in Michel Talagrand's groundbreaking discoveries is working with and understanding the random processes we see all around us. It has now become apparent that a thorough understanding of random phenomena is essential in today's world. For example, random algorithms underpin our weather forecasting and large language models.

The modern world is a constant flow of random events, and understanding that randomness has impacts on everything from business logistics to condensed-matter physics. Much of Talagrand's work involves understanding and utilising the "Gaussian distribution", often better known as the "normal distribution" or – thanks to its shape – the "bell curve". Our whole life is guided by the Gaussian distribution: the weight of babies at birth, the test results students get at school and the ages athletes retire at are all seemingly random events that neatly follow the Gaussian distribution.

Three specific areas

The Abel Prize is given for three specific areas of Talagrand's work:

Suprema of stochastic processes – A stochastic process produces a sequence of random values, and the "supremum" is the largest value to be expected from a collection of those values. If the height of waves crashing on a beach is a stochastic process, it is useful to know what the largest wave to hit the beach next year is likely to be.

Concentration of measures – Counterintuitively, when a process depends on a range of different sources of randomness, instead of getting more complicated, it is possible for the different random factors to compensate for each other and produce more predictable results. Talagrand has given sharp quantitative estimates for this.

Spin glass – Leaving abstract probability theory behind, a "spin glass" is a special form of matter that atoms can arrange themselves in, much to the initial surprise of physicists. Talagrand used his knowledge of statistics and probability to prove

limits on how spin glass matter can behave, and thereby completed the proof of Giorgio Parisi's Nobel Prize winning work (2021).

"Talagrand is an exceptional mathematician, and a formidable problem solver. He has made profound contributions to our understanding of random, and in particular, Gaussian, processes. His work has reshaped several areas of probability theory. Furthermore, his proof of the celebrated Parisi formula for free energy of spin glasses is an amazing accomplishment," says Professor Helge Holden, chair of the Abel Prize Committee.

"Become rich with my prizes"

Michel Talagrand was born in 1952 in France, and he obtained his PhD in mathematics in 1977 from the University of Paris VI. He spent some years at Ohio State University in the US. He is married and has two sons. He is a member of the French Academy of Sciences. He has received numerous awards, and on his website he invites the mathematical community to solve puzzles under the heading "Become rich with my prizes".

Transforming results

"Talagrand is an outstanding and highly productive mathematician whose work has transformed probability theory, functional analysis and statistics. He has had an enormous impact on mathematics and its applications," says Lise Øvreås, president of the Norwegian Academy of Science and Letters.

About the Abel Prize:

- The award ceremony will take place in Oslo on 21 May 2024

- The Abel Prize is funded by the Norwegian Government and amounts to NOK 7.5 million

- The prize is awarded by the Norwegian Academy of Science and Letters and presented by King Harald V

- The choice of the Abel laureate is based on the recommendation of the Abel Committee, which is composed of five internationally recognised mathematicians

- For more information, please visit www.abelprize.no

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