Bourgain Receives 2010 Shaw Prize

On May 27, 2010, the Shaw Foundation announced that it would award its annual Shaw Prize in Mathematical Sciences to Jean Bourgain "for his profound work in mathematical analysis and its application to partial differential equations, mathematical physics, combinatorics, number theory, ergodic theory, and theoretical computer science." The prize carries a cash award of US$1 million.

The Shaw Prize in Mathematical Sciences committee made the following statement:

"Mathematical analysis deals with limiting processes such as the approximation of a circle by inscribed regular polygons with increasing numbers of sides (a method used by Archimedes) or the notion of instantaneous velocity used in dynamics. The calculus of Newton and Leibniz provided the machinery for its successful application, from the orbits of planets to flight of aeroplanes and the devastation of a tsunami. Underpinning this limiting process is a variety of inequalities, often of a combinatorial nature, whose precise formulation and proof require great insight and ingenuity. The tools and language of analysis form the foundation for vast areas of mathematics, ranging from probability theory and statistical physics to partial differential equations, dynamical systems, combinatorics, and number theory.

"Jean Bourgain is one of the most brilliant analysts of our times. He has resolved central and long-standing problems in each of the above fields. In doing so he has introduced fundamental techniques, many of which have become standard tools in these areas. His work and ideas have greatly enhanced the very fruitful cross-fertilizations between all these disciplines.

"A prime example of his work is his development of the sum-product phenomenon. This is a fundamental combinatorial property which quantifies the relation between the two most basic operations of addition and multiplication. He has used this sum-product theory to resolve problems connected with distribution and counting of symmetries, combinatorics, number theory, and solutions of algebraic equations.

"More surprisingly, these techniques of Bourgain are intimately related to the very subtle geometry of the Kakeya problem, where a car (idealized as a line segment) is to be reversed in an arbitrarily small area, using an N-point turn with very large N.

"In many areas of mathematics and science, random numbers play a key role, but they are in fact hard to produce: tossing a coin is not a practical solution, and the coin may be biased. Bourgain has applied his techniques to provide explicit structures that exhibit randomness, and these have important applications in theoretical computer science."

Jean Bourgain

Jean Bourgain, born in 1954 in Brussels, Belgium, has been a professor at the Institute for Advanced Study in Princeton since 1994. He obtained his Ph.D. from the Free University of Brussels in 1977. He served as professor of mathematics at the Free University of Brussels from 1981 to 1985, at the University of Illinois at Urbana-Champaign from 1985 to 2006, and at the Institut des Hautes Études Scientifiques, Paris, from 1985 to 1995. He is a foreign member of the Academies of Science of France, Poland, and Sweden.

The Shaw Prize is an international award established to honor individuals who are currently active in their respective fields and who have achieved distinguished and significant advances, who have made outstanding contributions in culture and the arts, or who have achieved excellence in other domains. The award is dedicated to furthering societal progress, enhancing quality of life, and enriching humanity's spiritual civilization. Preference is given to individuals whose significant work was recently achieved.

The Shaw Prize consists of three annual awards: the Prize in Astronomy, the Prize in Life Science and Medicine, and the Prize in Mathematical Sciences. Established under the auspices of Run Run Shaw in November 2002, the prize is managed and administered by the Shaw Prize Foundation based in Hong Kong.

Previous recipients of the Shaw Prize in Mathematical Sciences are Simon K. Donaldson and Clifford H. Taubes (2009), Vladimir Arnold and Ludwig Faddeev (2008), Robert Langlands and Richard Taylor (2007), David Mumford and Wen-Tsun Wu (2006), Andrew Wiles (2005), and Shiing-Shen Chern (2004).

—From Shaw Foundation announcements