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News

Geometer wins maths 'Nobel'

Abel prize awarded to Mikhail Leonidovich Gromov.

Lucas Laursen

Mikhail Leonidovich Gromov.

Jean-François Dars

A French-Russian mathematician has won the Abel Prize today for his work on advanced forms of geometry.

The winner of the 6 million Norwegian kroner (US$920,000) prize, Mikhail Leonidovich Gromov, has held a permanent appointment at the Institute of Advanced Scientific Studies (IHES) outside Paris since 1982.

The Abel committee cited Gromov specifically for his contributions to three sub-disciplines of modern geometry: the study of Riemannian space, symplectic geometry, and groups of polynomial growth. Gromov is "renowned among mathematicians for his original approach", says Ian Stewart, a mathematician at the University of Warwick in Coventry.

Among other things, modern geometers study the elements of a shape that remain unchanged no matter how they look at it — the object's 'invariants'. A circle would look like an ellipse if seen from outside its plane, but characteristics such as the circle's radius in each axis would remain unchanged. Mathematicians seek descriptions, such as the length of an ellipse in each axis, that hold true from all points of view.

Certain descriptions, also known as Riemann spaces, translate geometrical information into algebraic equations and back again, and can help physicists to understand real-life systems such as the way gravity distorts space and motion near massive objects. "Einstein was able to do [general] relativity because [Bernhard] Riemann developed higher-dimension geometries," says Marcus du Sautoy, a mathematician at the University of Oxford, UK. Unlike in traditional Euclidean geometry, for example, straight lines can sometimes meet in such geometries.

The more things change

Gromov introduced a more complex level of such geometric descriptions. "Rather than look at particular Riemann spaces," says du Sautoy, "he looked at the relationships between them." The creative methods he introduced have been just as influential on the field as the actual solutions, because other mathematicians have followed in Gromov's footsteps, adds Stewart.

Another area of geometry for which Gromov is well known is symplectic geometry, which Stewart calls "an abstract way of describing objects in motion, nearly indecipherable unless you are a theoretical physicist". As in the case of Riemann geometry, Gromov was able to step back and get the big picture view, says du Sautoy.

For example, a physical system such as a pendulum, has conserved properties — including its energy. In his work on symplectic geometry, Gromov found that different types of space also have unique, identifying 'invariant' characteristics.

Similarly, Gromov was able to contribute creative ideas to the branch of mathematics known as group theory, which seeks to define the possible outcomes if an object with certain symmetric properties is transformed, rotated, or otherwise moved in space.

The prize should prompt other researchers to study Gromov's work in more depth, which du Sautoy says is better known than understood in the wider scientific community.

"The thing that marks out the people who deserve these prizes," says du Sautoy, "is a new way of looking at things." Stewart agrees: "it's a well-deserved prize."

Comments

"Unlike in traditional Euclidean geometry, for example, straight lines can sometimes meet in such geometries". What the author meant to say is that _parallel_ lines can meet in non-Euclidian geometries. All lines are, by definition, straight lines. And "straight" lines meet in Euclidean geometry all the time: it's called an intersection.

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Posted by: **Bill Lumbergh** | 27 Mar, 2009

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