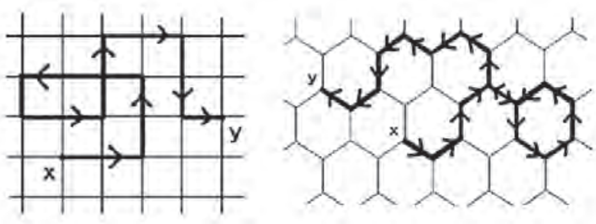
Motoko Kotani ／Professor ／Graduate School of Science

Profile

Motoko Kotani graduated in mathematics from University of Tokyo in 1983, and received the degree of Doctor of Science from Tokyo Metropolitan University in 1990. She became an associate professor in the Department of Mathematics at Tohoku University in 1999, and was then, promoted to professor in 2004. In her career, she has studied at the Max-Planck Institute in Germany (September 1993 – August 1994), the IHES in France (April 2001 – November 2001), the Isaac Newton Institute in Britain (February 2007 – March 2007 and May 2007), and at other foreign institutes, being recognized as a mathematician of worldwide reputation. In 2005, for her contribution to "Discrete geometric analysis on a crystal lattice", she was awarded the 25th Saruhashi Prize, which is given to a female scientist who has produced outstanding achievements in natural science. She greatly contributes to the promotion of mathematics in Japan by taking an active part in a variety of committees of the Mathematical Society of Japan.

Research Activities

Her main research field is Geometry, studying symmetries of figures. Symmetry is described by "Group" in Mathematics. Geometry in the 20th century has been developed mainly in connection with Group Theory. Understanding of a discrete group has been accelerated by introducing geometric structures into it, although it had remained almost untouched until recently, due to lack of appropriate tools. She employed the concept of random walks to investigate discrete groups, which raised her interest in the interplay of Geometry and Probability Theory. Probability Theory provides a useful tool to understand random and complex phenomena in the physical world. She now works to establish a mathematical theory by using Discrete Geometric Analysis to clarify how macroscopic dynamics, such as an electric current or a heat flow in materials, are controlled by their microscopic geometric structures.



random walk

$$p_n(x,y) \sim \frac{1}{(4\pi n)^{d/2}} e^{-\frac{d_0(x,y)^2}{4n}} \left(c_0 + \frac{c_1}{n} + \frac{c_2}{n^2} + \cdots \right), \quad (n \to \infty)$$

central limit theorem

Message

Albert Einstein said, "The most incomprehensible thing about the world is that it is comprehensible." It gives us great pleasure to understand the universe, which ranges from invisible microscopic regions to unreachable boundaries of space, by our own ingenuity and imagination. Why it is possible is, I think, a miracle, but I don't know any other thing which gives me such a keen sense of joy than to discover an appropriate "word" or "concept" that describes a simple principle hidden in a seemingly complex chaotic phenomenon. This is what mathematics does.

When I was a university student, the forefront of mathematical research looked far out of my reach. I was almost crushed by a sad and hopeless feeling, accepting the fact that I was not able to participate in the creation of a beautiful, attractive world of mathematics that only geniuses were allowed to do. However, I was wrong. I felt relieved when I found that mathematics is full of richness, and accepts all varieties of ideas, offering me complete freedom to pursue my own interests, driven by curiosity.

If you encounter a world you devote yourself to work for, I truly believe that you will be welcomed to join there.