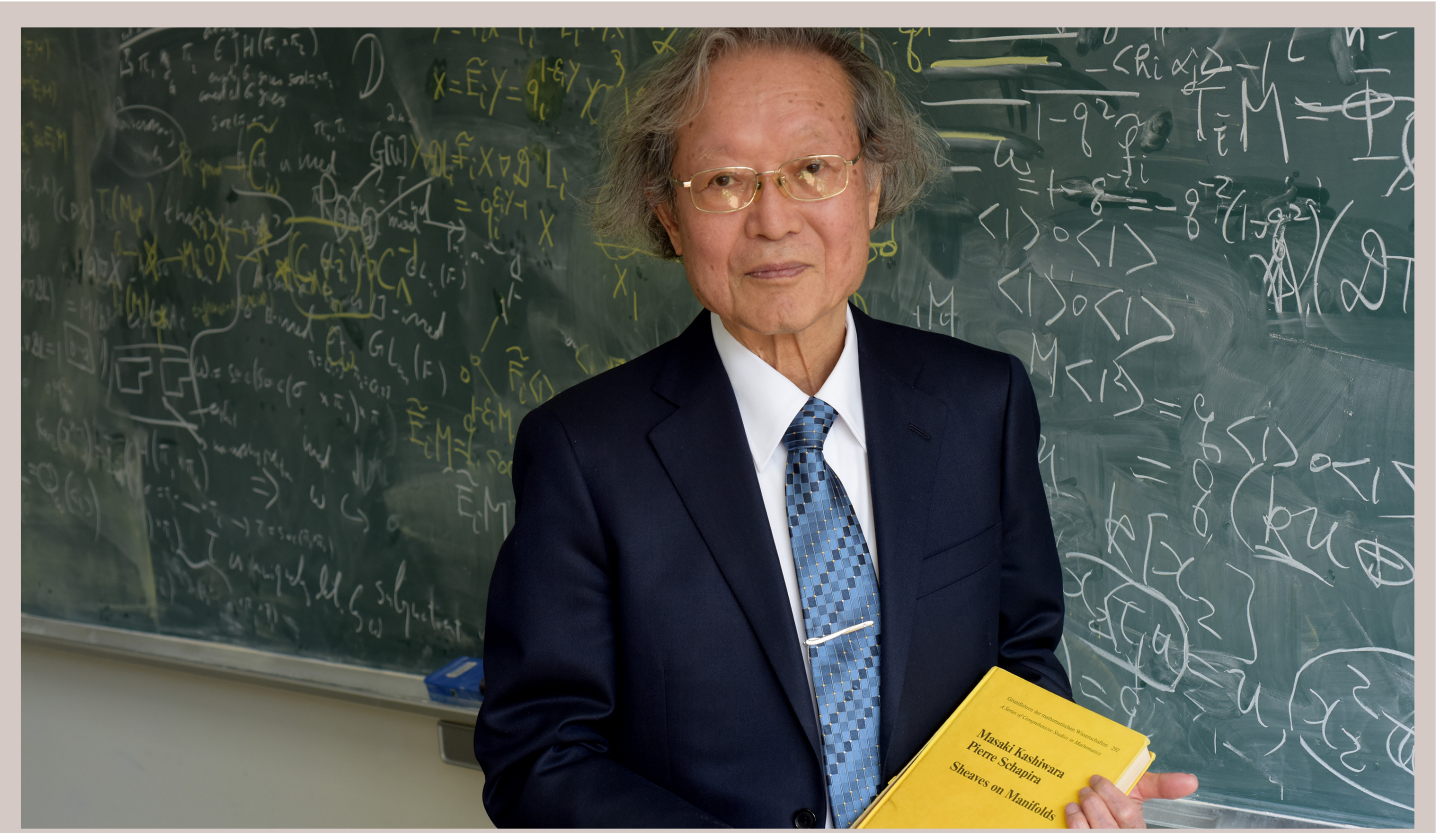

Biography of Masaki Kashiwara

Masaki Kashiwara was born on January 30th 1947 in Yūki, Ibaraki, near Tokyo, Japan. His father, Masaharu Kashiwara, worked for the Ministry of Agriculture, which meant that he, his wife Kazuko, and their family, had to move a lot when Masaki was young.

He remembers his love of algebra being kindled at school by a problem called *Tsurukamezan*, about calculating the numbers of cranes and turtles, respectively, from knowing the total numbers of heads and legs. He loved being able to generalise a method to solve any problem.

At the University of Tokyo he first encountered his mentor Mikio Sato (1928–2023), by enrolling for his senior year seminar. Sato created a new approach, algebraic analysis, applying the tools of algebra to understanding the characteristics of functions, and in particular linear partial differential equations (LPDEs).

In his 1970 master's thesis, under Sato's supervision, Kashiwara built on that work to establish the foundations of analytic D-Module Theory, a new basis for studying systems of LPDEs with algebraic analysis. This thesis had global influence, despite being available only in Japanese for the next 25 years.

In 1971, Kashiwara moved to Research Institute for Mathematical Sciences (RIMS), Kyoto University, where he continued to work with Sato on algebraic analysis. This year Kashiwara met the French mathematician Pierre Schapira (b. 1943), who was invited to the Taniguchi Symposium at Katata in Japan. This collaboration was to be continued in France. Pierre Schapira's mentor, André Martineau (1930–1972) invited the Japanese triad of Sato, Takahiro Kawai (b. 1945) and Kashiwara to the former Nice University (Université Côte d'Azur from 2019) for the academic year of 1972–73. Sadly, Martineau died

of cancer shortly before their arrival. Despite the loss, Sato, Kawai and Kashiwara went to Nice University. This academic stay cultured a thriving colleagueship between the mathematicians. Many years later, this resulted in a bilateral masterpiece on “Sheaves on Manifolds” by Schapira and Kashiwara.

In 1973 Sato, Kawai and Kashiwara published a groundbreaking scientific paper, later referred to as the famous ‘SKK Paper’, where the trio proved two important results in algebraic analysis. After completing his Ph.D. at Kyoto University in 1974, Kashiwara was appointed Associate Professor at Nagoya University.

In 1977 he went as a researcher to Massachusetts Institute of Technology (MIT) before returning to Japan in 1978, where he has remained ever since at the Research Institute for Mathematical Sciences (RIMS), Kyoto University. He was Director of RIMS from 2002–2003 and again from 2007–2009.

Kashiwara became Professor Emeritus and has continued his research as Project Professor at RIMS following his retirement in 2010. When Kashiwara received the Chern Medal in 2018, he directed parts of the prize money to RIMS. Today he serves as a Program-Specific Professor (since 2019) at the Kyoto University Institute for Advanced Study (KUIAS), specially established as a hub for the world’s most advanced research.

In 1980, Kashiwara used D-module theory to prove the Riemann-Hilbert Correspondence, a conjecture about the behaviour of differential equations that had defied mathematicians for decades. In 1981 he was awarded the Mathematical Society of Japan Iyanaga Prize, for mathematicians under 40 who have obtained outstanding mathematical results.

Building further on the Riemann-Hilbert result, Kashiwara’s work on the Kazhdan-Lusztig Conjecture with Jean-Luc Brylinski (b. 1951), and later with Toshiyuki Tanisaki (b. 1955), brought together algebra, analysis and geometry to transform representation theory.

Continuing working with Pierre Schapira since the 1970s, Kashiwara developed microlocal sheaf theory, a major contribution to representation theory with applications in geometry, topology and knot theory. In 2018, Kashiwara described their 1990 book, ‘Sheaves on Manifolds’ (Springer-Verlag), as one of his most important works.

Another major contribution to representation theory was Kashiwara’s development in 1990 of the theory of crystal bases of quantum groups. Quantum groups are algebraic objects with their origins in lattice models in statistical mechanics. By using crystal bases to represent quantum groups as directed graphs, Kashiwara created a combinatorial tool that enabled the solution of many problems in representation theory.

A prolific collaborator, Kashiwara has worked with over 70 mathematicians across algebraic analysis and representation theory. As well as his many publications, he has contributed unpublished ideas to be developed by others. For example, the Kashiwara Watermelon Cut Theorem, bringing together hyperfunctions, vector fields and analytic wave fronts.

Since the 1981 Iyanaga Prize, Kashiwara has won many awards for his work. In 1988 he was awarded the Asahi Prize for science together with Takahiro Kawai. In 1988 he received the Japan Academy Prize for his study of algebraic analysis and was accepted as a member of the Japan Academy in 2007. He received the Fujihara Award in 2008, for “scientists who have contributed greatly to the development of science and technology in Japan.”

At the 2018 International Congress of Mathematicians, Kashiwara was awarded the International Mathematical Union’s Chern Medal for outstanding achievements in the field of mathematics. In the same year he received the Inamori Foundation’s international Kyoto Prize for “outstanding contributions to a broad spectrum of modern mathematics.”

He received the Frontiers of Science Award of the International Congress of Basic Science with three collaborators from South Korea (Myungho Kim (b. 1957), Se-Jin Oh and Euiyong Park) in 2023, and with Andrea D’Agnolo in 2024.

In 2020, Kashiwara was honoured with Japan's Order of the Sacred Treasure, Gold and Silver Star, and in 2024 the Kyoto Prefecture Culture Prize for Outstanding Contribution.

Masaki Kashiwara is married to Hiroko Kashiwara, they married in 1981. In his spare time, he enjoys playing table tennis.

Prizes awarded to Kashiwara:

2025: The Abel Prize by The Norwegian Academy of Science and Letters

2024: Frontiers of Science Awards of the International Congress of Basic Science with Andrea D'Agnolo from Italia

2024: The Kyoto Prefecture Culture Prize for Outstanding Contribution

2023: Frontiers of Science Award of the International Congress of Basic Science with Myungho Kim, Se-Jin Oh, and Euiyong Park

2020: Japan's Order of the Sacred Treasure, Gold and Silver Star

2018: Kyoto Prize by Inamori Foundation

2018: Chern Medal by International Mathematical Union

2008: Fujihara Award

1988: Japan Academy Prize (Kashiwara became a member of the Japan Academy in 2007)

1981: Iyanaga Prize (Mathematical Society of Japan)

1988: Asahi Prize with Takahiro Kawai

Reference to the groundbreaking SKK-paper 1973:

Mikio Sato, Takahiro Kawai, and Masaki Kashiwara (1973). "Microfunctions and pseudo-differential equations". In: Hyperfunctions and pseudo-differential equations (Proc. Conf., Katata, 1971; dedicated to the memory of André Martineau). Vol. 287. Lecture Notes in Math. Springer, Berlin, pp. 265–529. MR: 0420735 (cit. on p. 98).

Explanation for the term Tsuru-kame-zan:

Sometimes mathematics is verbally pronounced:

The wordplay Tsurukamezan is an equation on cranes (tsuru) and turtles (kame), and san (mathematics). It consists of:

鶴(つる)(*tsuru*, "crane") + 亀(かめ)(*kame*, "turtle") + 算(さん)(*san*, "mathematics").

(The *san* changes to *zan* as an instance of *rendaku* (連濁).

This is a mathematical "riddle" much used in Japan. It says that: "The cranes and turtles. The count of heads is X and count of legs is Y. How many cranes and turtles are there respectively?"