2003 Cole Prize in Algebra

Hiraku Nakajima

The 2003 Frank Nelson Cole Prize in Algebra was awarded at the 109th Annual Meeting of the AMS in Baltimore in January 2003.

The Cole Prize in Algebra is awarded every three years for a notable research memoir in algebra that has appeared during the previous five years (until 2001 the prize was usually awarded every five years). The awarding of this prize alternates with the awarding of the Cole Prize in Number Theory, also given every three years. These prizes were established in 1928 to honor Frank Nelson Cole on the occasion of his retirement as secretary of the AMS after twenty-five years of service. He also served as editor-in-chief of the *Bulletin* for twenty-one years. The Cole Prize carries a cash award of $5,000.

The Cole Prize in Algebra is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2003 prize the members of the selection committee were: Michael Aschbacher (chair), Armand Borel, and J. T. Stafford.

Previous recipients of the Cole Prize in Algebra are: L. E. Dickson (1928), A. Adrian Albert (1939), Oscar Zariski (1944), Richard Brauer (1949), Harish-Chandra (1954), Serge Lang (1960), Maxwell A. Rosenlicht (1960), Walter Feit and John G. Thompson (1965), John R. Stallings (1970), Richard G. Swan (1970), Hyman Bass (1975), Daniel G. Quillen (1975), Michael Aschbacher (1980), Melvin Hochster (1980), George Lusztig (1985), Shigefumi Mori (1990), Michel Raynaud and David Harbater (1995), Andrei Suslin (2000), and Aise Johan de Jong (2000).

The 2003 Cole Prize in Algebra was awarded to Hiraku Nakajima. The text that follows presents the selection committee's citation, a brief biographical sketch, and the awardee's response upon receiving the prize.

Citation

The Cole Prize in Algebra is awarded to Hiraku Nakajima for his work in representation theory and geometry. In particular the prize is awarded for his papers "Quiver varieties and Kac-Moody algebras" (*Duke Math. J.* **91** (1998), 515–560) and "Quiver varieties and finite dimensional representations of quantum affine algebras" (*J. AMS* **14** (2001), 145–238), where he uses his notion of "quiver varieties" to construct hyper-Kähler varieties, irreducible integrable highest weight modules for Kac-Moody algebras with a symmetric Cartan matrix, and finite dimensional representations of affine quantized enveloping algebras; and for his paper "Heisenberg algebra and Hilbert schemes of points on projective surfaces" (*Ann. of Math.* **145** (1997), 379–388), where he constructs representations of the Heisenberg algebra on the direct sum of homology groups of Hilbert schemes of points on a quasi-projective surface, thus supplying a formula giving the corresponding Poincaré polynomials, found earlier by L. Goetsche.

Biographical Sketch

Hiraku Nakajima was born on November 30, 1962, in Tokyo, Japan. He received his M.A. (under the direction of Takushiro Ochiai) in 1987 and his Ph.D. in 1991 from the University of Tokyo.

Nakajima began his academic career as a research assistant at the University of Tokyo (1987–92). From 1992 to 1995 he was an assistant

professor at Tohoku University's Mathematical Institute. In 1995 he returned to the University of Tokyo, where he served as an assistant professor until 1997. At Kyoto University he has advanced from assistant professor (1997–2000) to professor of mathematics (December 2000–).

Nakajima received both the Geometry Prize (1997) and the Spring Prize (2000) from the Mathematical Society of Japan. He was a plenary speaker at the International Congress of Mathematicians (Beijing, 2002). His research interests include geometry and representation theory.

Response

It is a great honor and a great pleasure for me to receive the 2003 Frank Nelson Cole Prize in Algebra. I sincerely thank the AMS and the selection committee for awarding the prize to me.

My field of research is somewhere between geometry and representation theory. I started my mathematical career as a differential geometer. I chose to pursue the study of instanton moduli spaces on ALE spaces and found that it is related to representation theory of affine Lie algebras and quantum groups. This was totally unexpected. But I became a representation theorist in this way. I did not learn representation theory as a student; rather, I gained knowledge from discussions with my colleagues and friends, including G. Lusztig, V. Ginzburg, and others. I would like to express my thanks to all of them.