1993 Ruth Lyttle Satter Prize

The 1993 Ruth Lyttle Satter Prize in Mathematics has been awarded to LAI-SANG YOUNG of the University of California at Los Angeles and the University of Arizona.

The Satter Prize was established in 1990 through funds donated to the AMS by Joan S. Birman of Columbia University, in memory of her sister, Ruth Lyttle Satter. Professor Satter earned a bachelor's degree in mathematics and then joined the research staff at AT&T Bell Laboratories during World War II. After raising a family, she received a Ph.D. in botany at the age of forty-three from the University of Connecticut at Storrs, where she later became a faculty member. Her research on the biological clocks of plants earned her recognition in the U.S. and abroad. Professor Birman requested that the prize be established to honor her sister's commitment to research and to encourage women in science. The prize is awarded every two years to recognize an oustanding contribution to mathematics research by a woman in the previous five years.

The 1993 Satter Prize was awarded by the AMS Council, acting through a selection Committee consisting of Professor Birman, Dusa McDuff (chair), and Alan Weinstein. The prize of $4000 was presented to Professor Young during the AMS-MAA Prize Session on January 15, 1993, at the Joint Mathematics Meetings in San Antonio.

The text that follows contains the Committee's citation for the prize, the recipient's response, and a brief biographical sketch of the recipient.

Lai-Sang Young

Citation

Young has played a leading role in the investigation of the statistical (or ergodic) properties of dynamical systems and has developed important and difficult techniques which have done much to clarify the subject. In one major paper she established the exponential decay of correlations for a certain class of quadratic maps, which are one of the simplest kinds of nonuniformly hyperbolic systems. This implies that the limit theorems of probability hold in this case. Although similar results were known for Axiom A systems (which have uniform hyperbolicity), nothing was known in the nonuniform case, and the numerical evidence was contradictory. Thus, her result was both unexpected and deep.

A second outstanding piece of work is her joint paper with Benedicks, in which they study the statistical properties of the Hénon attractor. They show that orbits from a subset of the basin of attraction of positive measure have a common distribution in the limit, giving rise to a Sinai-Bowen-Ruelle measure on the attractor. This explains why we "see" the attractor on the computer.

Lai-Sang Young

Response

I would like to thank Professor Birman for creating this prize, and the AMS committee for selecting me. I also want to take this opportunity to express my gratitude to my teachers and friends for their support and guidance over the years.

I would like to tell you a little about my work. For the last ten years one of my projects has been to study the dynamics of strange attractors. Numerically it has been observed time

and again that if we randomly pick a point near an attractor and plot the first n points of its orbit, then the same picture emerges independent of initial condition. This suggests the existence of a *natural invariant measure*, one that governs the asymptotic distribution of almost all points in the basin of attraction.

For uniformly hyperbolic or Axiom A attractors, the existence of this measure was proved by Sinai, Bowen, and Ruelle in the early 1970s (hence the name SBR measures). In the 1970s and early 1980s, an ergodic theory for systems with nonuniform hyperbolicity was developed by Oseledec, Pesin, Ledrappier, etc. This theory provided the language for defining SBR measures in a more general context. But while we (mostly Ledrappier, I was part of it also) were able to prove some abstract theorems about SBR measures, for several years no one was able to either prove or disprove the existence of SBR measures for a single non-Axiom A attractor. This lack of examples was starting to get a little embarrassing.

The Hénon maps were generally believed to be a real test case. They are polynomial maps of the plane with just about the simplest non-Axiom A attractors. A few years ago Benedicks and Carleson developed an elaborate machinery for analyzing the dynamics of a positive measure set of these maps. When they asked me to help finish the project, I was more than happy to join the team. Benedicks and I constructed SBR measures for maps in the same parameter set, resulting in one of the papers cited here. These are of course only first examples. We have a long way to go before we understand the ergodic theory of strange attractors.

Perhaps I should say a few words about women in mathematics. There is no doubt that our situation has improved; life in academia for women is easier for my generation than the generation before. I feel that more institutional support is still needed for women who try to juggle career and family, and a conscious effort on our part is necessary if we are to rid ourselves of the cultural prejudices that have existed for so long. I want to thank Professor Birman again for giving more visibility to women in mathematics, and I am very honored to be the recipient of this year's award.

Biographical Sketch

Lai-Sang Young was born in 1952 in Hong Kong. She received her B.S. from the University of Wisconsin at Madison (1973) and her M.A. (1976) and Ph.D. (1978) from the University of California at Berkeley. Professor Young taught at Northwestern University (1978–1980), then became assistant professor at Michigan State University (1980). She is currently professor of mathematics at the University of Arizona and the University of California at Los Angeles. She has held visiting positions at the University of Warwick, England (1980–1981), the Mathematical Sciences Research Institute at Berkeley (1983–1984), Universität Bielefeld, Germany (1985–1986), and the Institute for Advanced Study at Princeton (1989).

Young gave an invited address at the August 1985 AMS Meeting in Laramie, Wyoming. She has been the recipient of a Sloan Fellowship (1985–1986) and a National Science Foundation Faculty Award for Women Scientists and Engineers (1991 to the present). Her research interests are in dynamical systems in the direction of smooth ergodic theory.