Ruth Lyttle Satter Prize in Mathematics

The Satter Prize recognizes an outstanding contribution to mathematics research by a woman in the previous six years. This prize was established in 1990 using funds donated by Joan S. Birman in memory of her sister, Ruth Lyttle Satter. Professor Birman requested that the prize be established to honor her sister's commitment to research and to encourage women in science. An anonymous benefactor added to the endowment in 2008. The prize is awarded every two years.

Panagiota Daskalopoulos

Nataša Šešum

Citation

Panagiota Daskalopoulos and Nataša Šešum

The 2023 Ruth Lyttle Satter Prize is awarded to Panagiota Daskalopoulos and Nataša Šešum for groundbreaking work in the study of ancient solutions to geometric evolution equations.

Ancient solutions are crucial to the understanding of singularities of geometric flows and are of major interest in the theory of renormalization group flows in theoretical physics. Daskalopoulos and Šešum launched a systematic investigation of ancient solutions in 2010 in foundational work with Richard Hamilton. Their deep and influential work over the past decade culminated in the exciting breakthroughs for which this prize is being awarded.

In a 2020 paper in the *Annals of Mathematics,* preceded by a 2019 article in *Journal of Differential Geometry,* Daskalopoulos and Šešum, along with Sigurd Angenent, completely classified ancient compact solutions of the mean curvature flow that are uniformly two-convex, a condition that has played a pivotal role in allowing surgery constructions for general solutions of the flow. The proof developed highly original techniques to estimate the various asymptotic growth rates in different parts of the surfaces backward in time, enabling them to establish rotational symmetry of solutions. The ideas developed here helped pave the way for the remarkable results we describe next.

Two decades ago Perelman established the existence of a non-collapsed compact ancient solution of the three-dimensional Ricci flow that is not a soliton. Daskalopoulos and Šešum, in joint work with Angenent and Simon Brendle (*Comm. Pure and Appl. Math.* 2022, online version 2021), provided a complete asymptotic description of Perelman's ancient solution, in fact of all rotationally symmetric, non-collapsed compact ancient solutions that are not flat. Subsequently, Brendle, Daskalopoulos and Šešum (*Invent. Math* 2021) proved the longstanding conjecture that the only non-collapsed, non-flat, compact ancient solutions of the three-dimensional Ricci flow are Perelman's solution and shrinking spheres.

Biographical Note

Panagiota Daskalopoulos is a native of Greece and has been a Professor at Columbia University since 2001. Her primary research interest lies at the interface of Partial Differential Equations and Differential Geometry. She earned her PhD from the University of Chicago under the supervision of Carlos Kenig and received her BS from the University of Athens, Greece. Previously, she was a visiting member at the Institute of Advanced Study and taught at the University of Minnesota, and the University of California, Irvine. Her honors and awards include a Guggenheim Fellowship, Sloan Fellowship, Simon's Fellowship, and the Distinguished Award for Research from University of California, Irvine. In 2014 she was an invited speaker at the Special Section in PDE, at the ICM in Seoul, and in 2016 she gave an AMS Invited Address at the Joint Meetings in Seattle. In 2022 she was elected a member of the American Academy of Arts and Sciences.

Biographical Note

Nataša Šešum is a native of Serbia and has been a Professor at Rutgers University since 2010. Her primary research interest lies at the interface of Partial Differential Equations and Differential Geometry. She earned her PhD from the Massachusetts Institute of Technology under the supervision of Gang Tian and received her BS from the University of Belgrade, Serbia. Previous academic appointments include MSRI (visiting member), New York University, Columbia University and University of Pennsylvania (UPenn).

Her honors and awards include being selected as an AMS fellow and Simon's Fellowship. In 2011 she gave an AMS Invited Address at the Joint Meetings at the College of the Holy Cross in Worcester, MA, and in 2014 she was an invited speaker at the Special Section in Geometry, at the ICM in Seoul.

Response from Panagiota Daskalopoulos and Nataša Šešum

We are deeply honored and happy to receive the Ruth Lyttle Satter Prize. We are extremely grateful to those who nominated us, to those colleagues who wrote letters to support our nomination, and to the selection committee. We would like to thank Joan Birman who established the prize in memory of her sister Ruth Lyttle Satter to encourage women in science. Joan Birman's deep contributions to mathematics have been an inspiration for the younger generations of women mathematicians.

We are very happy that the mathematics community has recognized our work on ancient solutions in geometric flows, which would not be possible without the support of our collaborators. We would like to thank Richard Hamilton who shared with us the importance of classification of ancient solutions in geometric flows and collaborated with us on works that marked the beginning of our project on ancient solutions. We also want to thank Sigurd Angenent, our collaborator of several years now, with whom we developed methods for classifying ancient solutions that played an essential role in the development of the subject, and have been widely used since then, even in more general settings. It has been very inspiring and gratifying working with him all these years and we have learned a lot from him. We also want to thank Simon Brendle for sharing with us, since early on, his ideas on establishing the rotational symmetry of solutions and collaborating with us in proving the compact case of Perelman's conjecture in dimension three. Finally, we would like to thank all of our colleagues at Columbia University and Rutgers University for their support all these years, and without whose support all of our accomplishments in this citation would be impossible.

Credits

Photo of Panagiota Daskalopoulos is courtesy of Scott Mead.
Photo of Nataša Šešum is courtesy of Nenad Dedic.