

2019 Ruth Lyttle Satter Prize in Mathematics

MARYNA VIAZOVSKA was awarded the 2019 Ruth Lyttle Satter Prize in Mathematics at the 125th Annual Meeting of the AMS in Baltimore, Maryland, in January 2019.



Maryna Viazovska

Citation

The 2019 Ruth Lyttle Satter Prize in Mathematics is awarded to Maryna Viazovska of École Polytechnique Fédérale de Lausanne for her groundbreaking work in discrete geometry and her spectacular solution to the sphere-packing problem in dimension eight.

In his 1900 list of outstanding mathematical problems, David Hilbert asked, “How can one arrange most densely in space an infinite number of equal solids of a given form, e.g., spheres with given radii...?” Viazovska’s work is a major advance in addressing this question. Her 2017 paper in *Annals of Mathematics* shows that the E_8 root lattice is the densest sphere packing in eight dimensions. Shortly after this much heralded breakthrough, Dr. Viazovska, in collaboration with Henry Cohn, Abhinav Kumar, Stephen D. Miller, and Danylo Radchenko, adapted her methods to prove that the optimal sphere-packing density in dimension twenty-four is achieved by the Leech lattice. Prior to these results, the sphere-packing problem had not been solved beyond dimension three.

Maryna Viazovska’s work has been described as “simply magical,” “very beautiful,” and “extremely unexpected.” Her solution to the sphere-packing problem in dimension eight, while conceptually simple, has a deep structure based on certain functions that she explicitly constructs in terms of modular forms. It establishes a new, unanticipated connection between modular forms and discrete geometry.

Dr. Viazovska’s earlier results on spherical designs are fundamental contributions to the topic. Her 2013 *Annals of Mathematics* paper with Andriy Bondarenko and Danylo Radchenko solved a conjecture of J. Korevaar and J. L. H. Meyers by showing for $N > C_d t^d$, where C_d is a positive constant depending only on d , that spherical t -designs with N points exist in the unit sphere S^d . Spherical designs have been essential tools of practical importance in the statistical design of experiments and in both combinatorics and geometry. Most recently, spherical t -designs have appeared in the guise of quantum t -designs with applications to quantum information theory and quantum computing.

For more about the proof and background on the sphere-packing problem, see “A conceptual breakthrough in sphere packing,” by Henry Cohn, *Notices of the AMS*, 64 (2017), no. 2; 102–115.

Biographical Sketch

Maryna Viazovska was born in Ukraine and received her doctorate from the University of Bonn in 2013. She was a postdoctoral researcher at Berlin Mathematical School and Humboldt University of Berlin, as well as a Minerva Distinguished Visitor at Princeton University, before joining the faculty at Lausanne as a full professor in 2018. She has been awarded the Salem Prize (2016), a Clay Research Award (2017), the SASTRA Ramanujan Prize (2017), a European Prize in Combinatorics (2017), and a New Horizons Prize in Mathematics (2018). She was an invited speaker at the 2018 International Congress of Mathematicians in Rio de Janeiro.

About the Prize

The Ruth Lyttle Satter Prize is awarded every two years to recognize an outstanding contribution to mathematics research by a woman in the previous six years. Established in 1990 with funds donated by Joan S. Birman, the prize honors the memory of Birman's sister, Ruth Lyttle Satter. 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 PhD 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 in plants earned her recognition in the United States and abroad. Birman requested that the prize be established to honor her sister's commitment to research and to encourage women in science. The prize carries a cash award of US\$5,000.

The Satter Prize is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2019 prize, the following individuals served as members of the selection committee:

- Georgia Benkart,
- Estelle Basor (Chair),
- Richard Taylor.

A list of previous recipients of the Ruth Lyttle Satter Prize in Mathematics may be found on the AMS website at <https://www.ams.org/profession/prizes-awards/pabrowse?purl=satter-prize>.

Credits

Photo of Maryna Viazovska is courtesy of Maryna Viazovska.