## 2017 Clay Research Awards

### Aleksandr Logunov and Eugenia Malinnikova

A Clay Research Award is made jointly to Aleksandr Logunov (Tel Aviv University and Chebyshev Laboratory, St Petersburg State University) and Eugenia Malinnikova (NTNU) in recognition of their introduction of a novel geometric combinatorial method to study doubling properties of solutions to elliptic eigenvalue problems.

This has led to the solution of long-standing problems in spectral geometry, for instance the optimal lower bound on the measure of the nodal set of an eigenfunction of the Laplace-Beltrami operator in a compact smooth manifold (Yau and Nadirashvili's conjectures).

### Maryna Viazovska

A Clay Research Award is made to Maryna Viazovska (Princeton University and École Polytechnique Fédérale de Lausanne) in recognition of her groundbreaking work on sphere-packing problems in eight and twenty-four dimensions. In particular, her innovative use of modular and quasimodular forms, which enabled her to prove that the E8 lattice is an optimal solution in eight dimensions.

The result had been suggested by earlier work of Henry Cohn and Noam Elkies, who had conjectured the existence of a certain special function that would force the optimality of the E8 lattice through an application of the Poisson summation formula. Viazovska's construction of the function involved the introduction of unexpected new techniques and establishes important connections with number theory and analysis. Her elegant proof is conceptually simpler than that of the corresponding result in three dimensions.

She subsequently adapted her method in collaboration with Henry Cohn, Abhinav Kumar, Stephen Miller, and Danylo Radchenko to prove that the Leech lattice is similarly optimal in twenty-four dimensions.

Clay Mathematics Institute

# Clay Research Conference

Andrew Wiles Building

University of Oxford

27 September 2017

10:00 **Larry Guth** (MIT)
*Introduction to decoupling*
Introduced by Nets Katz (Caltech)

11:00 Coffee

11:30 **Bertrand Toën** (CNRS)
*Algebraic geometry, categories and trace formulas*
Introduced by Balázs Szendrői (Oxford)

12:30 Lunch

14:00 **Ovidiu Savin** (Columbia)
*From second order equations to nonlocal PDEs*
Introduced by Alexis Vasseur (Austin)

15:00 Coffee

15:30 **Tamar Ziegler** (Hebrew University)
*Dynamics, arithmetic progressions and approximate cohomology*
Introduced by Tom Ward (Leeds)

16:30 **Carlos Kenig** (Chicago)
*The work of Aleksandr Logunov and Eugenia Malinnikova*

**Henry Cohn** (Microsoft and MIT)
*The work of Maryna Viazovska*

**Richard Clay**
Presentation of 2017 Clay Research Awards

17:30 Reception

**Larry Guth** is Professor of Mathematics at MIT. He obtained his PhD from MIT in 2005 under the supervision of Tomasz Mrowka. His research covers a wide range of problems in metric and combinatorial geometry as well as harmonic analysis. He was an invited speaker at the ICM at Hyderabad in 2010, where his talk focused on different ways of looking at Gromov's systolic inequality for tori. In 2015 Larry Guth and Nets Katz were jointly presented with a Clay Research Award for their solution of the Erdős distance problem and for other joint and separate contributions to combinatorial incidence geometry.

**Bertrand Toën** is *Directeur de Recherche* at CNRS, and a permanent member of IMT in Toulouse. He obtained his PhD in 1999 from the University of Toulouse under the supervision of Joseph Tapia and Carlos Simpson. His research lies in Algebraic Geometry, Algebraic Topology, and Category Theory. In 2014, he gave an invited lecture at the ICM at Seoul on *Derived algebraic geometry and deformation quantization.*

**Ovidiu Savin** is Professor of Mathematics at Columbia University. He obtained his PhD in 2003 at the University of Texas at Austin under the supervision of Luis Caffarelli. He is best known for his important work on De Giorgi's conjecture about global solutions to certain semilinear equations, which he proved up to dimension eight and on which he spoke in an invited lecture at at the International Congress of Mathematicians in 2006 at Madrid. He was awarded the Stampacchia Medal in 2012.

**Tamar Ziegler** is Professor of Mathematics at the Hebrew University of Jerusalem. She obtained her PhD in 2003 under the supervision of Hillel Furstenberg. Her research has focused on ergodic theory, and its application to combinatorical and additive number theory, and extensions of the Green-Tao Theorem. In 2014, she gave an invited lecture on *Linear equations in primes and dynamics of nilmanifolds* at the ICM in Seoul. She was awarded the Erdős Prize in Mathematics in 2011 and was the EMS lecturer of the year in 2013.