

RUIXIANG ZHANG TO RECEIVE 2023 SASTRA RAMANUJAN PRIZE

The 2023 SASTRA Ramanujan Prize will be awarded to **Dr. Ruixiang Zhang** of the University of California, Berkeley, USA. This annual \$10,000 prize is for outstanding contributions by individuals not exceeding the age of 32 in areas of mathematics influenced by Ramanujan in a broad sense. The age limit has been set at 32 because Ramanujan achieved so much in his brief life of 32 years. The prize will be awarded at an International Conference in Number Theory during December 20-22, 2023, at SASTRA University in Kumbakonam (Ramanujan's hometown) in South India.

Dr. Ruixiang Zhang is a brilliant young mathematician whose fundamental work spans analytic number theory, combinatorics, Euclidean harmonic analysis and geometry. Building on his Princeton PhD thesis, Zhang in collaboration with Shaoming Guo, with many novel insights, proved a multivariable generalization of the main conjecture in Vinogradov's Mean Value Theorem. The original conjecture, proved by Wooley in degree 3, and by Bourgain, Demeter, and Guth in general, was concerned with asymptotically sharp bounds for the number of solutions to a system of diophantine equations involving power sums being equal. Such bounds were used in the application of the Hardy-Littlewood variant of the Hardy-Ramanujan circle method to Waring's problem on expressing non-negative integers as sums of k -th powers. Likewise the Guo-Zhang multivariable generalization gives bounds on the number of solutions to Parsell-Vinogradov systems of diophantine equations, and this has many new applications: to counting linear subspaces lying on a hypersurface, to expressing homogeneous forms as sums of powers of linear forms, and to bounding short mixed character sums. This work, which has appeared in *Inventiones Mathematicae* in 2019, is a major achievement.

While working on his thesis, Zhang branched out to work in restriction theory in Fourier and classical harmonic analysis, where Bourgain and Demeter were making major advances by creating a whole new direction in research called decoupling theory. Zhang contributed to solving two long-standing problems in restriction theory: (i) Carleson's problem on pointwise convergence of solutions to the Schrödinger equation, and (ii) the two-dimensional case of Sogge's local smoothing conjecture for wave equations.

In 1979, Carleson raised the question of determining the exact range of the Sobolev exponent in n -dimensional space for which every solution to the Schrödinger equation converges to the initial data as time tends to 0. Carleson, Dahlberg and Kenig, answered this question in dimension 1, while Du, Guth, and Li in 2017 answered this for dimension 2 using decoupling along with a fundamental tool called polynomial partitioning. In a 2019 *Annals of Mathematics* paper, Zhang in collaboration with Xiumin Du, introduced novel techniques tailored to this problem, and settled the question in all dimensions, avoiding the use of the partitioning method which had appeared to be fundamental to progress on the problem.

The local smoothing problem was raised by Christopher Sogge in the early 90s: If we have bounds on some Sobolev norms of the initial data, what bounds can we conclude on the Sobolev norms of the solution? Local smoothing leads to a sharp conjecture in this problem. In a 2020 *Annals of Mathematics* paper, Zhang, Larry Guth and Hong Wang solved the problem in three dimensions, and Zhang played an important role in finding the right generalization so that induction could be applied.

In summary, Zhang is an original and highly skilled mathematician who has had a large impact in a wide range of areas. He is a rising world leader in the field of harmonic analysis and in its striking applications, and amply merits this award.

Ruixiang Zhang received his BS degree in mathematics from Peking University in 2012, and his PhD in mathematics under the supervision of Peter Sarnak at Princeton University in 2017. Subsequently he has held positions as a Visiting Member at the Institute for Advanced Study, Princeton (2017–18, and 2020–21), and as Van Vleck Visiting Assistant Professor at the University of Wisconsin (2018–21). Since 2021, he has been at the University of California, Berkeley, as an Assistant Professor. Awards for Zhang include the Gold Medal at the 2008 International Mathematics Olympiad, and a Silver Medal for his doctoral thesis for the New World Mathematics Awards. He currently holds a Sloan Fellowship (2022-24) and an NSF CAREER award (2022-27).

The 2023 SASTRA Ramanujan Prize Committee comprised: Krishnaswami Alladi - Chair (University of Florida), Don Blasius (University of California, Los Angeles), Sergei Konyagin (Lomonosov Moscow State University), Jonathan Pila (Oxford University), Bjorn Poonen (MIT), Zeev Rudnick (Tel Aviv University), and Wadim Zudilin (Radboud University, The Netherlands). The SASTRA Ramanujan Prize Committee and SASTRA are delighted to welcome Zhang to join the illustrious group of winners of the prize.