

WILL SAWIN TO RECEIVE 2021 SASTRA RAMANUJAN PRIZE

The 2021 SASTRA Ramanujan Prize will be awarded to Dr. WILL SAWIN of Columbia University, USA. This annual 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 is awarded annually at an International Conference in Number Theory during December 21-22, at SASTRA University in Kumbakonam (Ramanujan's hometown) in South India. Since the live conference will not take place in December 2021, Dr. Sawin will receive the prize in 2022 in Kumbakonam at a suitable date.

WILL SAWIN is a tremendously talented mathematician who has made path-breaking contributions at the interface of number theory and algebraic geometry due to his great technical ability and deep understanding of a variety of powerful methods in different branches of mathematics. In particular, he has been the central force in various collaborative projects that have led to the resolution in the affirmative of various long-standing problems in number theory such as the Goldbach and Prime Twins Conjectures in a finite field/function field setting, and in extending the powerful Hardy-Littlewood-Ramanujan circle method to an algebro-geometric framework. These and other fundamental contributions of his are having far reaching consequences in mathematics.

A major line of investigation is to take deep unsolved problems in classical number theory, and study their counterparts in rings of polynomial functions over finite fields and their quotient fields. It is important to establish such results in the framework of such function fields, and the hope is that this would eventually lead to the resolution on the original classical problems. In collaboration with Mark Shusterman, Sawin has established the analogues of the celebrated prime twins and Goldbach conjectures in the function field context. Moreover, Sawin and Shusterman have also proved in the function field setting, the analogue of Chowla's conjecture on the correlations of the Moebius function, and Landau's conjecture that there are infinitely many primes of the form $N^2 + 1$. It is amazing that so many classical number theoretic conjectures, have now been proven by Sawin and Shusterman in the setting of function fields.

In developing these function field analogues, the techniques invented by Sawin are having other major implications. For example, Sawin's quantitative sheaf theory is having significant impact in ℓ -adic cohomology and answers certain questions posed by Fouvry, Kowalski and Michel for higher dimensional varieties.

With regard to ℓ -adic cohomology, it must be stressed that Sawin's ideas were absolutely essential (both in the technical aspects and in designing the proof) in his joint paper with Emmanuel Kowalski and Philippe Michel (*Annals of Mathematics* (2017)) on bilinear forms with Kloosterman sums, where a long standing problem on moments of L -functions is solved by combining techniques from automorphic forms, analytic number theory, and ℓ -adic cohomology.

Yet another advance by Sawin is his joint work with Tim Browning on a geometric version of the circle method (*Annals of Mathematics* (2020)). This has vastly increased our understanding of spaces of rational curves of a given degree on a smooth hypersurface,

and also enabled us to perform enumerative geometry on such surfaces in situations that were beyond the reach of traditional geometric methods.

One more instance of the impact of Sawin's work is the resolution of the *mixing conjecture* of Philippe Michel and Akshay Venkatesh in the function field setting. This conjecture has its origins in homogeneous dynamics in ergodic theory, and was motivated by a study of the distribution of Heegner points on modular or Shimura curves. In 2017, Shende and Tsimerman investigated a function field analogue, and reduced the conjecture to one on the growth of the dimension of certain cohomology groups, and proved this in characteristic 0. In a paper in *Inventiones Mathematicae* (2020), Sawin settled the conjecture in positive characteristic by exploiting Saito's recent theory of characteristic cycles in the same setting.

Will Sawin was born in Malden, Massachusetts in October 1993. He was a child prodigy who finished learning the high school mathematics curriculum by the age of 8. The famous mathematician Serge Lang of Yale University came to Sawin's elementary school to meet him, following which Sawin started taking BSc classes at Yale University at the tender age of 10! He was concurrently working on his high school and Yale University curricula and in 2011 at the age of 17, he simultaneously received both his high school diploma and his undergraduate degree from Yale majoring both in mathematics and economics. He was awarded the George Beckwith undergraduate prize at Yale for proficiency in mathematics or astronomy. He then joined Princeton University and worked under the guidance of Professor Nick Katz for his PhD, which was when he gained mastery over techniques of both number theory and algebraic geometry. Shortly after his PhD, he started making these major advances by studying notoriously hard number theoretic problems in algebraic and geometric settings. After holding a post-doctoral position as Junior Fellow at the Institute for Theoretical Studies at ETH in Zurich (2016-18), he joined the faculty at Columbia University where he held the prestigious Clay Research Fellowship until July this year. What he has achieved already at the young age of 28 is phenomenal, and he is expected to continue to shape the development of mathematics in the decades ahead.

The 2021 SASTRA Ramanujan Prize Committee comprised: Krishnaswami Alladi - Chair (University of Florida), William Duke (University of California, Los Angeles), Dan Goldston (San Jose State University), Alex Lubotzky (Hebrew University, Jerusalem), Ken Ono (University of Virginia), Anne Schilling (University of California, Davis), and Cam Stewart (University of Waterloo). Sawin, who was the unanimous choice of the Committee for the 2021 award, joins the illustrious group of winners of the SASTRA Ramanujan Prize.

Krishnaswami Alladi

Chair - SASTRA Ramanujan Prize Committee