

## JACOB TSIMERMAN TO RECEIVE 2015 SASTRA RAMANUJAN PRIZE

The 2015 SASTRA Ramanujan Prize will be awarded to Dr. Jacob Tsimerman of the University of Toronto, Canada. The SASTRA Ramanujan Prize was established in 2005 and is awarded annually for outstanding contributions by young mathematicians to areas influenced by the genius Srinivasa Ramanujan. The age limit for the prize has been set at 32 because Ramanujan achieved so much in his brief life of 32 years. The prize will be awarded during December 21-22, 2015 at the International Conference on Number Theory at SASTRA University in Kumbakonam (Ramanujan's hometown) where the prize has been given annually.

Jacob Tsimerman is an extraordinary young mathematician who has made deep and highly original contributions to diverse parts of number theory, and most notably to the famous Andre-Oort Conjecture. He is one of the few mathematicians to have complete mastery over two very different areas of mathematics - *analytic number theory* and *algebraic geometry*. This has enabled him to achieve significant progress on a number of fundamental problems lying at the interface of the two subjects.

Much of Tsimerman's research stems from the spectacular PhD thesis entitled "Towards an unconditional proof of the Andre-Oort conjecture and surrounding problems" that he wrote at Princeton University in 2010 under the direction of Professor Peter Sarnak. The thesis concerns arithmetical questions around the Andre-Oort conjecture and makes substantial progress towards it.

The Andre-Oort Conjecture states that special subsets of Shimura varieties that are obtained as Zariski closures of special points, are finite unions of Shimura varieties. Shimura varieties are special algebraic varieties (such as moduli spaces of abelian varieties) which arise as quotients of suitable complex domains by arithmetic groups. Thus Shimura varieties lie at the heart of arithmetic geometry and automorphic forms. Yves Andre initially stated this conjecture for one dimensional subvarieties, and subsequently Frans Oort proposed that it should hold more generally. The conjecture lies at the confluence of Diophantine problems and the arithmetic of modular forms. By assuming the Generalized Riemann Hypothesis (GRH), the conjecture was proved in 2006 by Klingler, Ullmo, and Yafaev, but as of 2008 only the very simplest cases had been proved unconditionally. One of the techniques to attack the Andre-Oort conjecture is to obtain suitable bounds for certain Galois orbits of special points. A major achievement of Tsimerman in his thesis was to establish certain unconditional bounds up to dimension 6, and this was published in the Journal of the American Mathematical Society in 2012. This went beyond the work of Ullmo and Yafaev who had unconditionally established such bounds up to dimension 3.

Another very important result in his thesis was to answer in the affirmative a question due to Nick Katz and Oort whether there exists an Abelian variety over the set of all algebraic numbers which is not isogenous to the Jacobian of a stable algebraic curve over the algebraic numbers. This fundamental result appeared in the Annals of Mathematics in 2012. Previously Ching-Li Chai and Frans Oort had answered the question assuming the Andre-Oort conjecture, but Tsimerman was able to do so unconditionally.

About a decade ago, Jonathan Pila had introduced a new method to attack the Andre-Oort Conjecture. In 2009 Tsimerman and Pila joined forces and over the next few years established several deep results, one of which was a functional transcendence statement

known as “Ax-Lindemann” for Abelian varieties of all dimensions (Ax-Lindemann is one of the tools to attack the Andre-Oort conjecture). This paper has just been accepted in the *Annals of Mathematics*. In another major joint paper of Pila-Tsimerman that appeared in *Compositio Mathematica* in 2013, they establish the Andre-Oort Conjecture for certain moduli spaces of Abelian surfaces.

The most recent advance by Tsimerman is his proof this year of the Andre-Oort Conjecture for the moduli spaces of principally polarized Abelian varieties of any dimension  $g$ , which has been sought for a long time. What was missing was a certain lower bound for Galois orbits of special points in dimensions greater than 6. Tsimerman’s brilliant insight was to use a recently proven weighted average version of a conjecture of Colmez to establish the crucial lower bound, building on deep results of Andreatta, Goren, Howard and Madapusi-Pera.

Tsimerman has made major contributions not just to the Andre-Oort conjecture, but to many other fundamental problems. Even as a graduate student at Princeton, Tsimerman collaborated with Manjul Bhargava (recipient of the First SASTRA Ramanujan Prize in 2005) and Arul Shankar to determine the second term in the asymptotic formula for the number of cubic fields with a bounded discriminant. This work appeared in *Inventiones Mathematica* in 2013. Especially relating to Ramanujan’s mathematics, we note his 2014 paper joint with Ali Altug entitled “Metaplectic Ramanujan conjecture over function fields with applications to quadratic forms” that appeared in the *International Mathematical Research Notices (IMRN)*. Most recently, Tsimerman and Pila have turned their attention to multiplicative relations among singular moduli - a topic dear to Ramanujan.

Tsimerman has several more first rate contributions spanning algebraic geometry, number theory, mathematical logic and analysis. He is an exceptionally broad and creative mathematician. The breadth of his expertise seems unrivaled among number theorists of his age. All indications are that he will continue to contribute at the very highest level and will be a major force in the world of mathematics for the next several decades.

Jacob Tsimerman was born in Kazan, Russia on April 26, 1988. In 1990 his family first moved to Israel and then in 1996 to Canada, where he participated in various mathematical competitions from the age of 9. In 2003 and 2004 he represented Canada in the International Mathematical Olympiad (IMO) and won gold medals both years, with a perfect score in 2004. During 2004-06, in just two years, he finished his Bachelors degree courses in Toronto. During 2006-11, he was a doctoral student at Princeton under the supervision of Professor Peter Sarnak; there he was supported by an American Mathematical Society (AMS) Centennial Fellowship. Following his PhD, he had a post-doctoral position at Harvard University as a Junior Fellow of the Harvard Society of Fellows. In July 2014 he was awarded a Sloan Fellowship and he started his term as Assistant Professor at the University of Toronto. The SASTRA Ramanujan Prize is the first major international prize awarded to him. He emerged as the top choice out of a pool of exceptionally strong candidates.

The 2015 SASTRA Ramanujan Prize Committee consisted of Professors Krishnaswami Alladi - Chair (University of Florida), Henri Darmon (McGill University), Winnie Li (The Pennsylvania State University), Hugh Montgomery (University of Michigan), Peter Paule (Johannes Kepler University Linz), Michael Rapoport (University of Bonn), and Cameron

Stewart (University of Waterloo). Previous winners of the Prize are Manjul Bhargava and Kannan Soundararajan in 2005 (two full prizes), Terence Tao in 2006, Ben Green in 2007, Akshay Venkatesh in 2008, Kathrin Bringmann in 2009, Wei Zhang in 2010, Roman Holowinsky in 2011, Zhiwei Yun in 2012, Peter Scholze in 2013 and James Maynard in 2014. The award of the 2015 SASTRA Ramanujan Prize to Jacob Tsimerman is in keeping with the tradition of recognizing the spectacular contributions by the most brilliant young mathematicians.

*Krishnaswami Alladi*

Chair: 2015 SASTRA Ramanujan Prize