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Bay Area Mathematical Adventures

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Kannan Soundararajan

From Tic-Tac-Toe to Additive Combinatorics

San José State UNIVERSITY

San Jose State University*
Engineering Auditorium, Rm. 189

7:30 pm
Wednesday, April 2

Young kids play tic-tac-toe on a 3x3 square using crosses and noughts to mark squares. As they get older they realize that the game is not much fun, and no one ever wins. However, if they were to play tic-tac-toe on a high dimensional board, the surprising fact is that the first person has a winning strategy. Even more strangely, there can never be a draw! Not even if both players cooperate to find one. This beautiful fact is called the Hales-Jewett theorem, and is an example of how some order must necessarily exist even in apparently random situations. The emerging field of additive combinatorics explores this dichotomy between order and chaos more fully, using ideas from combinatorics, probability, number theory, ergodic theory ..., and has led to spectacular breakthroughs such as Green and Tao's theorem that the prime numbers contain long arithmetic progressions. We will start with tic-tac-toe and see where this leads!

Kannan Soundararajan (Sound, for short)
grew up in Chennai, India. He received his undergraduate degree from the University of Michigan, and a Ph.D. from Princeton University. After his Ph.D. he received the first five year fellowship from the American Institute of Mathematics, and held positions at Princeton University, the Institute for Advanced Study, and the University of Michigan. From 2006 he is a Professor of Mathematics at Stanford University. Sound's main research interests are in number theory, but that forces him to work with ideas from harmonic analysis, combinatorics and probability. He is a recipient of the Morgan Prize, the Salem Prize, and the SASTRA Ramanujan Prize.

* See back for map and directions.