Special Lectures by Professor Avi Wigderson at TU Berlin and BMS

Avi Wigderson is a leading scientist in computational complexity and related fields and holds the position of a professor at the Institute for Advanced Study, Princeton. He has received many prizes for his work (among others, the Nevanlinna Prize in 1994 and the Goedel Prize in 2009).

We are pleased to announce that Avi Wigderson will deliver a series of three talks:

Operator Scaling - Theory and Applications

TU Berlin, June 28, 16^{15}-18^{00}, MA 004

In this talk I will explain the "singularity problem" for symbolic matrices over non commuting variables, and describe its myriad origins and incarnations in commutative and non-commutative algebra, computational complexity, optimization, quantum information theory, Brascamp-Lieb inequalities and other areas.

I will describe the "Operator Scaling" algorithm, which efficiently solves all these related problems, and how its analysis combines ideas from these areas. This algorithm also efficiently solves a large family of non-convex optimization problems, and will hopefully find other applications.

No special background knowledge will be assumed. Based on joint works with Ankit Garg, Leonid Gurvits and Rafael Olivera.

Structural and Computational Aspects of Brascamp-Lieb Inequalities

TU Berlin, June 29, 16^{15}-18^{00}, MA 004

The celebrated Brascamp-Lieb (BL) inequalities are an important mathematical tool, unifying and generalizing numerous inequalities in analysis, convex geometry and information theory, with many used in computer science.

I will survey the well-understood structural theory of BL inequalities, and then discuss their computational aspects. Far less was known about computing their main parameters, and I will discuss new efficient algorithms (via operator scaling) for those, which also inform structural questions. In particular, these efficiently solve a large family of linear programs with exponentially many facets, potentially useful for combinatorial optimization. The analysis of this (very analytic) algorithm crucially uses recent results in invariant theory.

No prior knowledge from previous talk will be assumed. Joint work with Ankit Garg, Leonid Gurvits and Rafael Olivera

Randomness

BMS Friday Colloquium, June 30, 14^{15}-15^{45}, BMS Loft Urania

Is the universe inherently deterministic or probabilistic? Perhaps more importantly - can we tell the difference between the two?

Humanity has pondered the meaning and utility of randomness for millennia. There is a remarkable variety of ways in which we utilize perfect coin tosses to our advantage: in statistics, cryptography, game theory, algorithms, gambling... Indeed, randomness seems indispensable! Which of these applications survive if the universe had no randomness in it at all? Which of them survive if only poor quality randomness is available, e.g., that arises from "unpredictable" phenomena like the weather or the stock market?

A computational theory of randomness, developed in the past three decades, reveals (perhaps counter-intuitively) that very little is lost in such deterministic or weakly random worlds. In the talk I'll explain the main ideas and results of this theory.

The talk is aimed at a general scientific audience.