

2014 The Arne Magnus Lecture Series
Professor Alex Lubotzky

Maurice and Clara Weil Chair of Mathematics
Einstein Institute of Mathematics
Hebrew University of Jerusalem



Public Lecture

Wednesday, February 4, 2014 at 3:00-3:50pm
TILT Building Room 221

(Coffee and cookie reception prior to talk in 117 Weber from 3:30-4:00pm)

Title: Real applications of non real numbers

Abstract: Number theoretic considerations led mathematicians over a century ago to introduce the "field of p -adic numbers", which is just like the "field of real numbers" a completion of the familiar "field of rational numbers". This abstract system of numbers has found in the last 3 decades some unexpected applications in computer science and engineering. We will explain the basic ideas and some of these applications.

Colloquium – Open to Faculty and Graduate Students
Monday, February 3, 2014 at 4:00-4:50pm
237 Weber Building

(Reception to following in 117 Weber from 5:00-6:30pm)

Title: Ramanujan graphs and error correcting codes

Abstract: While many of the classical error correcting codes are cyclic, a long standing conjecture asserts that there are no 'good' cyclic codes. In recent years the interest in symmetric codes has been promoted by Kaufman, Sudan, Wigderson and others (where symmetric means that the acting group can be any group). Answering their main question (and in contrary to the common expectation), we show that there DO exist symmetric good codes. In fact, our codes satisfy all the "golden standards" of coding theory. Our construction is based on the Ramanujan graphs constructed by Lubotzky-Samuels-Vishne as a special case of Ramanujan complexes. The crucial point is that these graphs are edge transitive and not just vertex transitive as in previous constructions of Ramanujan graphs. All notions will be explained. This is joint work with Tali Kaufman.

Research Seminar – Open to Faculty and Advanced Graduate Students
Wednesday, February 5, 2014 at 4:00-4:50pm
237 Weber Building

(Coffee and cookie reception prior to talk in 117 Weber from 3:30-4:00pm)

Title: From Ramanujan graphs to Ramanujan complexes

Abstract: Ramanujan graphs are optimal expanders (from a spectral point of view). Explicit constructions of such graphs were given in the 80's as quotients of the Bruhat-Tits tree associated with $GL(2)$ over a local field F , by suitable congruence subgroups. The spectral bounds were proved using works of Hecke, Deligne and Drinfeld on the "Ramanujan conjecture" in the theory of automorphic forms. The work of Lafforgue, extending Drinfeld from $GL(2)$ to $GL(n)$, opened the door for the construction of Ramanujan complexes as quotients of the Bruhat-Tits buildings. This gives finite simplicial complexes, which on one hand are "random like", and at the same time have strong symmetries. Recently various applications have been found in combinatorics, coding theory and in relation to Gromov's overlapping properties. We will describe these developments and give some details on recent applications.

The work of a number of authors will be surveyed. Our works in these directions are in collaboration with various subsets of {S. Evra, K. Golubev, T. Kaufman, D. Kazhdan, R. Meshulam, S. Mozes, B. Samuels, U. Vishne}.