University of Florida • Mathematics Department
13th Ramanujan* Colloquium
by
Professor Alex Lubotzky **
Hebrew University of Jerusalem, Israel
on
From Ramanujan Graphs to Ramanujan Complexes

Date and Time: 4:05 - 4:55pm, Monday, March 11, 2019
Room: 101 Little Hall
Refreshments: Before Colloquium in Little Hall Atrium

OPENING REMARKS
by
Kevin Knudson (Math Dept Chair)

Abstract: Ramanujan graphs are k-regular graphs with all non trivial eigenvalues are bounded (in absolute value) by $2\sqrt{(k-1)}$. They are optimal expanders (from 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 the action of suitable congruence subgroups of arithmetic groups. The spectral bound was 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 associated with $GL(n)$ over F. This way one gets finite simplicial complexes which on one hand are *random like* and at the same time have strong symmetries. These seemingly contradicting properties make them very useful for constructions of various external objects.

Recently various applications have been found in combinatorics, coding theory and in relation to Gromov's overlapping properties. We will survey some of these applications.

Professor Lubotzky will also give two additional seminar talks:

(i) Tuesday, March 12, 1:55 – 2:45pm in The Little Hall Atrium (3rd floor):

 From expander graphs to high dimensional expanders

(ii) Tuesday, March 12, 3:00 - 3:50pm in Little Hall Atrium (3rd floor):

 Ramanujan graphs and error correcting codes

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 * ABOUT RAMANUJAN: Srinivasa Ramanujan (1887-1920), a self-taught genius from South India, dazzled mathematicians at Cambridge University by communicating bewildering formulae in a series of letters. G. H. Hardy invited Ramanujan to work with him at Cambridge, convinced that Ramanujan was a "Newton of the East"! Ramanujan's work has had a profound and wide impact within and outside mathematics. He is considered one of the greatest mathematicians in history.

 ** ABOUT THE SPEAKER: Alex Lubotzky is the Maurice and Clara Weil Professor of Mathematics at the Hebrew University of Jerusalem, Israel, and an adjunct professor at Yale University. He is an honorary member of the American Academy of Arts and Sciences. With Phillips and Sarnak he coined *Ramanujan graphs*. He was awarded the 2018 Israel Prize, which is considered to be Israel's highest cultural honor. He is a leading researcher in finite and infinite group theory, including topological, algebraic, and arithmetical groups. His work on expander graphs has been deeply influential in both mathematics and computer science. He is the winner of the Erdős Prize and the Rothschild Prize. He is the current President of the Israel Mathematical Union.

 ABOUT THE SPONSOR: Evan Pugh Professor George Andrews of The Pennsylvania State University is the world's premier authority in the theory of partitions and work of the Indian mathematical genius Srinivasa Ramanujan combined. He is a Member of the National Academy of Sciences. He has close ties with the UF Mathematics Department which has one of the strongest programs on mathematics related to Ramanujan's work. He was a recipient of an Honorary Doctorate from UF in December 2002. Since 2005, he is a Distinguished Visiting Professor each year in the Spring term in the Mathematics Department. During 2008-2009 he was President of the American Mathematical Society.