

**Vortrag von Herrn Prof. Dr. Alex Lubotzky am 19. Mai 2016  
an der HHU Düsseldorf im Rahmen der AG Algebra und Geometrie**

Detailed Abstract:

Expander graphs in general, and Ramanujan graphs, in particular, have played a major role in combinatorics and computer science in the last 4 decades and more recently also in pure math. Approximately 10 years ago a theory of Ramanujan complexes was developed by Li, Lubotzky-Samuels-Vishne and others.

In recent years a high dimensional theory of expanders is emerging. The notions of geometric and topological expanders were defined by Gromov in 2010 who proved that the complete  $d$ -dimensional simplicial complexes are such. He raised the basic question of existence of such bounded degree complexes of dimension  $d > 1$ .

Ramanujan complexes were shown to be geometric expanders by Fox-Gromov-Lafforgue-Naor-Pach in 2013, but it was left open if they are also topological expanders.

By developing new isoperimetric methods for "locally minimal small"  $F_2$ -co-chains, it was shown recently by Kaufman-Kazhdan-Lubotzky for small dimensions and Evra-Kaufman for all dimensions, that the  $d$ -skeletons of  $(d+1)$ -dimensional Ramanujan complexes provide bounded degree topological expanders. This answers Gromov's original problem, but still leaves open whether the Ramanujan complexes themselves are topological expanders.

We will describe these developments and the general area of high dimensional expanders and some of its open problems.

**Der Vortrag findet statt am 19.05.2016, 16:15 – 17:30 Uhr, in Hörsaal 5F**