Recent aspects of sphere packings - Part I
(Org: **Karoly Bezdek** (University of Calgary, Canada) and/et **Oleg Musin** (The University of Texas Rio Grande Valley, USA))

MARIA DOSTERT, Royal Institute of Technology (KTH), Stockholm, Sweden
Kissing number of the hemisphere in dimension 8

The kissing number of spherical caps asks for the maximal number of pairwise non-overlapping unit spheres that can simultaneously touch a central spherical cap in n-dimensional Euclidean space. Bachoc and Vallentin proved using semidefinite optimization that the kissing number of the hemisphere in dimension 8 is 183. In this talk I will explain our rounding procedure to determine an exact rational solution of the semidefinite program from an approximate solution in floating point given by the solver. Furthermore, I will show that the lattice E8 is the unique solution for the kissing number problem on the hemisphere in dimension 8.

ALEXEY GLAZYRIN, The University of Texas Rio Grande Valley, USA
Linear programming bounds revisited

This talk will be devoted to linear programming methods for sphere packing bounds. I will describe a new approach to classic bounds and, at the end, present a new short solution of the kissing number problem in dimension three.

ALEXANDER KOLPAKOV, University of Neuchatel, Neuchatel, Switzerland
Kissing number in non-Euclidean spaces of constant sectional curvature

We obtain upper and lower bounds on the kissing number of congruent radius $r > 0$ spheres in hyperbolic $\mathbb{H}^n$ and spherical $\mathbb{S}^n$ spaces, for $n \geq 2$, and show that $\kappa_H(n,r) \sim (n-1) \cdot d_{n-1} \cdot B(\frac{n-1}{2}, \frac{1}{2}) \cdot e^{(n-1)r}$ for large n. Here d_n is the sphere packing density in $\mathbb{R}^n$, and B is the beta-function. We also produce numeric bounds by using semidefinite programs and spherical codes. A similar approach locates the values of $\kappa_S(n,r)$, for $n = 3,\, 4$, over subintervals in $[0,\pi]$ with relatively high accuracy. Joint work with Maria Dostert (KTH Stockholm, Sweden).

OLEG MUSIN, The University of Texas Rio Grande Valley, USA
The SDP bound for spherical codes using their distance distribution

In this talk we present a new extension of known semidefinite and linear programming upper bounds for spherical codes and consider a version of this bound for distance graphs. We apply the main result for the distance distribution of a spherical code and discuss reasonable approaches for solutions of two long standing open problems: the uniqueness of maximum kissing arrangements in 4 dimensions and the 24-cell conjecture.

SERGE VLADUT, Aix-Marseille University, France
Lattices with exponentially large kissing numbers

The quality of a lattice $L \subset R^n$, considered as a sphere packing can be measured by its density and/or its kissing number. For $n \to \infty$ the classical Minkowski theorem implies the existence of lattice families with density behaving as $O(2^{-n})$. However, that classical method does not permit to construct lattices with exponentially large (in n) kissing numbers, and their existence was not known until very recently. I will explain how to construct such lattice families using rather roundabout way through coding theory and algebraic geometry.