Freie Universität Berlin

Fachbereich Mathematik und Informatik

A U S H A N G
E I N L A D U N G
zum Habilitationsvortrag

Im Rahmen seines Habilitationsverfahrens wird

Herr Dr. Dr. Franz Király

am Mittwoch, d. 27. April 2016 um 14.00 Uhr
Ort: Hörsaal B (0.1.01), Physikgebäude, Arnimallee 14, 14195 Berlin

einen Vortrag über das Thema:

The Kepler conjecture's proof

halten.

Der Vortrag wird ca. 45 Minuten dauern (Zusammenfassung s.u.).
Die Universitätsöffentlichkeit ist dazu herzlich eingeladen.
gez. Prof. Dr.-Ing. Jochen Schiller
Dekan des FB Mathematik und Informatik

Abstract:
The Kepler conjecture, due to Johannes Kepler in 1611, conjectures that the densest possible packing of spheres in three-space is the well-known hexagonal sphere packing (in the average and limiting sense), in which the spheres are packed, layer by layer, of the form:
http://www.spiegel.de/fotostrecke/keplersche-vermutung-beweis-vorgelegt-fotostrecke-118106.html
(and so on ad infinitum). The Kepler conjecture has an eminent relevance in the physics of solids where the spheres model atoms, and a dense packing is an energy efficient form that the material may assume, the densest packing thus being the most energetically favourable.

C.F. Gauss proved in 1831 that the hexagonal packing is indeed the most dense/energy efficient amongst regular packings, i.e., those with a (translational) lattice symmetry. Unfortunately, this did not rule out potentially denser irregular packings with disconcerting physical meaning, nor were mathematicians able to construct such an example, eventually making a proof or disproof of Kepler's conjecture part of Hilbert's famous list of 23 unsolved mathematical problems for the 20th century (number 18, 3rd part).

Work of László Fejes Tóth in the 1950s from the then-nascent Hungarian school of combinatorics reduced the problem of determining whether the densest packing was irregular to checking a finite number of cases – unfortunately, a very large finite number not amenable to computing resources at the time. Later, after a reduction to around 100.000 linear programming problems, and their computer-aided solution which lasted from 1992 and 1998, Hales and Ferguson were able present a solution which consisted of a series of eight papers totalling around 250 pages, and several gigabytes of data.
Reviewing the clamed proof then became a prolonged effort of the mathematical community, involving a referee panel of 12 referees for the Annals of Mathematics that convened until 2003, and subsequent work of Hales and 22 collaborators on providing an automated proof checker to check the validity of the original proof, a report on which was published in early 2015.

As of 2016, it is now widely believed that Hales' proof of the Kepler conjecture is correct, that the proof of the proof via the automated proof checker is correct, and that the proof that the proof checker's proof is correct is correct as well.
The talk attempts to give an overview.