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Maryna Viazovska* (viazovska.maryna@epfl.ch), École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland. *The sphere packings and modular forms.*

The sphere packing problem asks for the densest configuration of non-intersecting open unit balls at the Euclidean space. This classical geometric problem is solved only in dimensions 1, 2, 3, 8, and 24. In this talk, we will present a solution of the sphere packing problem in dimensions 8 and 24. It seems that each dimension has its own features and requires a different approach. One method of estimating the density of a sphere packing from above was suggested by H. Cohn and N. Elkies in 2003. Their approach is based on Fourier optimization. Namely, they showed that the existence of a function satisfying certain inequalities for the function itself and for its Fourier transform leads to an upper bound of the density of a sphere packing. Using this method Cohn and Elkies were able to prove almost sharp bounds in dimensions 8 and 24. We will show that functions providing exact bounds can be constructed explicitly. The key ingredient of our construction is the theory of modular forms. (Received April 12, 2017)