Sphere Packings and CFT

Rapport sur les contributions

ID de Contribution: **1** Type: **Non spécifié**

Geometric applications of the conformal bootstrap

mercredi 18 octobre 2023 13:30 (1 heure)

I will explain how ideas familiar from the conformal bootstrap lead to new rigorous upper bounds on the spectral gap of the Laplacian on hyperbolic orbifolds. The bounds follow from a combination of representation theory and linear programming. In two dimensions, the bounds allow us to determine the set of spectral gaps attained by all hyperbolic orbifolds. I will also discuss the question of sharpness of linear programming bounds appearing in the conformal bootstrap. In some cases, sharpness can be proven rigorously. The method of proof is essentially identical to that used by Viazovska to solve the sphere packing problem in dimension 8. Remarkably, the method was developed by physicists independently of Viazovska almost simultaneously.

Orateur: MAZÁČ, Dalimil (Institut de Physique Théorique - CEA-Saclay)

ID de Contribution: **3** Type: **Non spécifié**

Towards classifying perturbative conformal field theory in 4-eps expansion

mercredi 18 octobre 2023 16:30 (1 heure)

Classifying perturbative fixed points near upper critical dimensions is crucial for understanding the space of conformal field theories and critical phases of matter. The one-loop beta functions for general scalar field theories are a set of polynomial equations. There are various mathematical approaches to solve these equations, including Buchberger's algorithm to calculate the Gröbner basis and a group theory approach that relies on known subgroups of the orthogonal group. I will introduce the history of this problem and then discuss our recent revisit of this problem.

Orateur: RONG, Junchen (IHES, Université Paris-Saclay)

ID de Contribution: **4** Type: **Non spécifié**

Density of disc and sphere packings

mercredi 18 octobre 2023 15:00 (1 heure)

How to stack an infinite number of oranges to maximize the proportion of the covered space? Kepler conjectured that the "cannonball" packing is an optimal way to do it. This conjecture took almost 400 years to prove, and the proof of Hales and Ferguson consists of 6 papers and tens of thousands of lines of computer code.

Given an infinite number of coins of 3 fixed radii, how to place them on an infinite table to maximize the proportion of the covered surface? Triangulated disc packings are those where each "hole" is bounded by three pairwise tangent discs. Connelly conjectured that for the sets of disc radii where triangulated packings exist, one of them maximizes the proportion of the covered surface; this holds for unary and binary disc packings.

In this talk, we will discuss various techniques used in the proof of the Kepler conjecture and other important results in the domain of disc and sphere packings. They allow us to prove the statement of the Connelly conjecture for 31 triangulated triplets of disc radii and disprove it for 45 other triplets. Besides that, we obtain tight bounds on the local density of simplicial cells in 2-sphere packings.

Orateur: PCHELINA, Daria (LIPN, Université Sorbonne Paris Nord)