复旦大学哲学学院逻辑论坛
复旦大学数学科学学院第 34 期院士讲坛
上海数学中心谷超豪讲座

Model-theory and Approximate Lattices

Ehud Hrushovski

牛津大学默顿数理逻辑教授 | 英国皇家学会会员 | 美国艺术与科学院院士 | 以色列科学与人文学院院士

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复旦大学江湾校区上海数学中心
谷超豪报告厅

An approximate subgroup is a subset X of a group G, such that $1 \in X$, $X = X^{-1}$, and such that the set of products $X \cdot X = \{x \cdot y : x, y \in X\}$ is 'almost' equal to X, more precisely it is contained in $X \cdot F$ for some finite $F \subset G$. Approximate subgroups arise in many areas of analysis, combinatorics and geometry, as well as in model theory. The finite ones were classified by Breuillard, Green and Tao; they essentially arise in nilpotent groups. An approximate lattice in $G = \mathbb{R}^n$, or in the matrix group $\mathrm{GL}_n(\mathbb{R})$, is a discrete approximate subgroup X that has finite covolume; i.e. there exists a subset $D \subset G$ of finite measure, with $XD = G$. Approximate lattices in $\mathbb{R}^n$ were classified by Meyer in the 1970's, and eventually became the mathematical model for quasicrystals. I will present a generalization to semisimple groups; in effect all irreducible approximate lattices have arithmetic origin. They arise from number fields via a classical construction of Borel-Harish-Chandra; the approximate setting allows greater flexibility in putting archimedean and non-archimedean places on the same footing. The proof uses a construction arising naturally from basic questions in model theory (amalgamation, the Lascar group).

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