The 25th Takagi Lectures

October 18 (Sat)–19 (Sun), 2025

NISSAY Lecture Hall
Graduate School of Mathematical Sciences
The University of Tokyo, Tokyo, Japan

ABSTRACT

Noga Alon:

Graph-Codes: Questions, Results and Methods

The study of Graph-Codes is motivated by questions in Extremal Combinatorics, Additive Number Theory and Coding Theory. The initial guiding fact is that viewing binary vectors as characteristic vectors of edge-sets of graphs transforms the basic combinatorial questions of Coding Theory into intriguing extremal problems about families of graphs. I will discuss some of these questions and describe several results and open problems. The relevant methods combine Combinatorial and Probabilistic tools with techniques from Information Theory, Number Theory and the theory of Combinatorial Designs.

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Fanny Kassel:

Discrete Subgroups of Lie Groups and Proper Actions

Discrete subgroups of Lie groups play a fundamental role in several areas of mathematics. In the case of $\mathrm{SL}(2,\mathbb{R})$, they are well understood and classified by the geometry of the corresponding hyperbolic surfaces. In the case of $\mathrm{SL}(n,\mathbb{R})$ with $n>2$, they remain more mysterious, beyond the important class of lattices (i.e. discrete subgroups of finite covolume for the Haar measure). These past twenty years, several interesting classes of discrete subgroups have emerged, which are "thinner" than lattices, more flexible, and with remarkable geometric and dynamical properties. We will give an overview of such developments and present some of these new classes. We will also discuss when discrete subgroups can act properly discontinuously on homogeneous spaces, with an emphasis on the so-called Problem of Compact Quotients, which asks for which homogeneous spaces G/H there exists a discrete subgroup Γ of G such that $\Gamma\backslash G/H$ is a compact manifold.

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W. Hugh Woodin:

Lecture 1: *The* $\mathbf{AD}^+$ *Duality Program*
Lecture 2: *The* HOD *Conjecture and the Ultimate-*L *Conjecture*

The study of descriptive set theory in the context of determinacy axioms began nearly 60 years ago. The context for this study is now understood to be the Axiom AD^+, which is a refinement of the Axiom of Determinacy (AD). The objects of this study are the sets of reals in a natural hierarchy which extends the borel sets.

This has led to what is arguably the main duality program of Set Theory, which is the connection between the sets of reals A for which AD^+ holds, and generalizations of L, the inner model of the universe of sets constructed by Gödel.