The 15th Takagi Lectures

June 27 (Sat)–28 (Sun), 2015
Lecture Theater (3rd floor), House of Creativity
Tohoku University, Sendai, Miyagi, Japan

ABSTRACT

V.F.R. Jones:
Knots and Groups
Subfactors Knots and Physics

Groups have played a big role in knot theory. We show how subfactors (subalgebras of certain von Neumann algebras) lead to unitary representations of the braid groups and Thompson's groups F and T. All knots and links may be obtained from geometric constructions from these groups. And invariants of knots may be obtained as coefficients of these representations. We include an extended introduction to von Neumann algebras and subfactors.

A. Vershik:
Invariant Measures, Exit Boundaries, Branching Graphs and Standardness of Filtrations

One of the old and important problems in dynamics is the description of the invariant measures with respect to action of groups or groupoids. Another equivalent version of this problems occurred in theory of representations of locally finite groups, and locally semi-simple algebras — is to describe the characters or traces The same problem appeared in the theory of Markov chains, approximation of measure preserving actions martingale theory and so on.

The formulation of all such questions is reduced to the rough classification of the filtrations and its intersections. Here filtration is the decreasing sequences of the sigma-fields of the subsets in standard Borel, or measure spaces. The principle example is a filtration of the past of stochastic processes, or tail sigma-fields in the space of paths of the branching graph (Bratteli diagram).

The fundamental notion of this theory is the notion of standard filtration, for which the general problem of the classification of invariant measures became smooth (or tame) — the standardness guarantees the existence of good parametrization of the ergodic measures.

The first lecture will be devoted to the series of the problems of above type.

In the second lecture I will explain the role of standardness in the different areas of mathematics.

C. Villani:
Optimal Transport, Entropy and Curvature: The State of the Art

Around the turn of the 21st century, it was discovered that the combination of entropy and optimal transport in a metric-measured geometry was related to curvature bounds. A few years later, this was exploited to found the synthetic theory of Ricci curvature. Now the field is more popular than ever; it is time for a recap and synthesis.