

ICM regional satellite event

Japan forum associated with ICM 2022

RIMS Kyoto

June 13–14, 2022

<https://www.mathsoc.jp/activity/meeting/JapanForum2022/>

Summary

June 13 (Mon), 2022

Tadahisa Funaki (Univ. Tokyo/Waseda Univ./YMSC)

Hydrodynamic limit and stochastic PDEs related to interface motion

We consider several types of interacting particle systems at microscopic level, in which particles move performing random walks with or without creation and annihilation depending on the situation. From these systems, via the hydrodynamic space-time scaling limit or its nonlinear fluctuation limit, we derive three different objects at macroscopic level: the motion by mean curvature arising in phase separation phenomena, Stefan free boundary problem describing segregation of species, and coupled KPZ equation which is a system of singular stochastic PDEs. These are all related to the problem of interface motion. The Boltzmann-Gibbs principle plays a fundamental role. We also touch the discrete Schauder estimate.

Yoshiko Ogata (Univ. Tokyo)

Classification of gapped ground state phases in quantum spin systems

Recently, classification problems of gapped ground state phases have attracted a lot of attention in quantum statistical mechanics. We explain about operator algebraic approach to these problems.

Keita Yokoyama (Tohoku Univ.)

Reverse mathematics from multiple points of view

Reverse mathematics is a program in mathematical logic that was initiated by H. Friedman in the 1970s and developed by S. Simpson and others. The aim of the program is to classify mathematical theorems by comparing them with various types of axioms, typically set-existence and induction axioms in the formal system for the natural numbers and their subsets. The strength of axioms can be measured by several different viewpoints, such as consistency strength or computability strength, which are heavily connected to various fields of mathematical logic. For example, consider the Peano existence theorem for ordinary differential equations and the Hilbert basis theorem for polynomial rings. Then the former is stronger in the sense of consistency strength while the latter is stronger in the sense of computability. Recently, the field of reverse mathematics has been widely expanding with newer perspectives and techniques. In this talk, we overview the recent developments of reverse mathematics and their connections to related fields.

June 14 (Tue), 2022

Benoît Collins (Kyoto Univ.)

Weingarten calculus and its applications

A fundamental property of compact groups and compact quantum groups is the existence and uniqueness of a left and right invariant probability the Haar measure. This is a very natural playground for classical and quantum probability, provided that it is possible to compute its moments. Weingarten calculus addresses this question in a systematic way. The purpose of this talk is to survey recent developments, describe some salient theoretical properties of Weingarten functions, as well as applications of this calculus to random matrix theory, quantum probability and algebra, mathematical physics, and operator algebras.

Hiroshi Iritani (Kyoto Univ.)

On decompositions of quantum cohomology D-modules

We discuss decompositions of quantum cohomology D-modules arising from various geometric settings. These decompositions can be related to semi-orthogonal decompositions of topological K-groups via the Gamma integral structure.

Shu Kato (Kyoto Univ.)

The formal model of semi-infinite flag manifolds

We explain our description of the formal model of semi-infinite flag manifolds as explicit algebro-geometric objects, based on some recent developments in the representation theory of affine Lie algebras. We also discuss its consequences and perspectives.

Atsushi Ichino (Kyoto Univ.)

Theta lifting and Langlands functoriality

We review various aspects of theta lifting and its role in studying Langlands functoriality. In particular, we discuss realizations of the Jacquet-Langlands correspondence and the Shimura-Waldspurger correspondence in terms of theta lifting and their arithmetic applications.

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