Speakers

1 **Xuhua He**

2 **Hiraku Nakajima**

3 **Se-Jin Oh**

4 **Xinwen Zhu**

Abstracts

Mini courses

(19–21 and 27–29 December 2022)

1 Xuhua He

The Chinese University of Hong Kong, China
Total positivity: combinatoics, geometry, logic and representation theory

Abstract

An invertible matrix is called totally positive if all its minors are positive. In 1994, Lusztig developed the theory of total positivity for arbitrary split real reductive groups and their flag manifolds. He further generalized the theory to arbitrary Kac-Moody groups in 2019. The theory of total positivity has found important applications in different areas: cluster algebras, higher Teichmuller theory, the theory of amplituhedron in physics, etc.

In the lecture series, I plan to explain some interesting aspects in the theory of total positivity. In the first lecture, I will explain the total positivity on the groups and their flags for the group GL_n. In the second lecture, I will explain how to generalize the theory from the positive real numbers to the tropical numbers, via the Tarski's principle from logic. In the third lecture, I will explain the geometric/topological properties of total positivity.

2 Hiraku Nakajima

KAVLI IPMU, Japan

Coulomb branches of 3d N=4 SUSY gauge theories and bow varieties

Abstract

In the first part of the minicourse, I will review the definition of Coulomb branches of gauge theories given in my joint work with Braverman and Finkelberg. In the second part, I will focus on particular examples of gauge theories, called quiver gauge theories. Then I will review bow varieties, originally defined by Cherkis and further studied in my joint work with Takayama. They arise when the quiver is of affine type A.

3 Se-Jin Oh

Ewha Womans University, Korea

Monoidal categorifications, quantum affine algebras and quiver Hecke algebras

Abstract

In this mini-course, we first understand the concept of monoidal categorification of (quantum) cluster algebras. Then we investigate and compare the representation theories related to quantum affine algebras and quiver Hecke algebras, whose finite dimensional module categories provide monoidal categorifications. In the last part, we shall review one of the frameworks for proving monoidal categorifications, suggested by Kang-Kashiwara-Kim and the lecturer.

4 Xinwen Zhu

Caltech, USA

An introduction to the geometric Satake equivalence

Abstract

I will give an introduction to the geometric Satake equivalence, which is a cornerstone in the geometric Langlands program and has found numerous applications in representation theory. Along the way, we will discuss the related geometric object such as affine Grassmannians.