

QUANTUM ALGEBRAS

This course is a НИС for master course and 3rd and 4th years of undergraduate. The prerequisite knowledge is linear algebra and basic algebra. The knowledge of Lie groups and Lie algebras of finite type is not required but it will help you to understand. Note that this course is given in English.

In this seminar, we study representation theory of affine Kac-Moody algebras and other related algebras, including Virasoro algebra, vertex algebras and affine W-algebras.

The affine Kac-Moody algebras are infinite dimensional Lie algebras which are one-dimensional central extension of loop algebras (i.e. Lie algebras of functions $S^1 \rightarrow \mathfrak{g}$ for reductive Lie algebras \mathfrak{g}). They are the infinite dimensional Lie algebras which are the most popular and widely used in several areas of mathematics and mathematical physics. They are known as symmetries of certain important infinite dimensional integrable systems. On the other hand, representation theory of the affine Kac-Moody algebras itself is an important and interesting research area in pure mathematics. They were developed widely for the last several decades and connections with quantum enveloping algebras and cyclotomic rational Cherednik algebras were revealed.

In the seminar, mainly the teachers will give talks. We first start from review of basic concepts of Lie algebras and representation theory, representation theory of \mathfrak{sl}_2 . Then we introduce the affine Kac-Moody algebras and gradually introduce concepts for affine Kac-Moody algebras and vertex algebras.

The talks in the seminar will be mainly based on the following books:

[BF] Ben-Zvi and Frenkel, Vertex algebras and algebraic curves, 2004.

[C] Carter, Lie Algebras of Finite and Affine Type, 2005.

[K1] Kac, Infinite dimensional Lie algebras, Cambridge University Press, 1994.

[K2] Kac, Vertex algebras for beginners, AMS, 1996.

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