Topics course: Quantum Kac-Moody algebras and applications

Classical Kac-Moody algebras are infinite-dimensional Lie algebras which have many properties of finite-dimensional simple Lie algebras. They have applications in combinatorics (identities), number theory (modular forms), physics (conformal field theory).

Quantum Kac-Moody algebras are deformations of classical ones. Although the definition is similar, the properties are different. As an example I can mention unexpected appearance of elliptic curves in relation to representation theory of quantum affine algebras.

I plan to start with recollections in simple Lie algebras and Kac-Moody algebras, so the course will be self-contained.

Then I plan to move on to quantum Kac-Moody algebras and their representation theory. Most of the theory will be illustrated in the simplest case of quantum affine algebra $sl(2)$.

If time permits I am going to discuss relations to vertex algebras, Knizhnik-Zamolodchikov equations, elliptic functions, automorphic forms and Langlands duality.

The course will be designed in such a way, that no serious knowledge of algebra will be assumed. But at the very end I plan to discuss the latest achievements in the field.

Recommended books:

2. V. Kac, Vertex algebras for beginners, American Math. Soc., 1996

Yan Soibelman