Fall 2019, Course 18.747: Infinite dimensional Lie algebras

TR 2:30-4, Rm. 2-135

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The course will be devoted to a detailed introduction, with proofs, into the structure and representation theory of some of the most important infinite dimensional Lie algebras – Heisenberg algebras, Kac-Moody algebras, Virasoro algebra.

The books for the course are V. Kac and A. Raina "Highest weight representations of infinite dimensional Lie algebras" (required; new edition came out in 2015) and V. Kac "Infinite dimensional Lie algebras". We will also use an expository paper by B. Feigin and A. Zelevinsky that will be distributed in class. The course notes are also available on my webpage under "Teaching".

We will start with the book of Kac and Raina and discuss representations of the Heisenberg algebra, Virasoro algebra, affine $sl(n)$, and relations to integrable systems.

We will then discuss the structure and representation theory of Kac-Moody algebras, including character formulas and Kac-Macdonald identities. Finally, we will discuss intertwining operators for affine Lie algebras, Knizhnik-Zamolodchikov equations, and quantum groups.

To officially pass the course, it will be required to solve homework assignments which will be assigned each Thursday and due the following Thursday.