

Fall 2017, Course 18.747: Infinite dimensional Lie algebras

TR 2:30-4, Rm. 2-147

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**Office hours** Thursday after class or by appointment

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, such as Heisenberg algebras, Kac-Moody algebras and Virasoro algebra.

There are no required textbooks for the course, but the exposition will follow the books: Kac and Raina "Highest weight representations of infinite dimensional Lie algebras" and Kac "Infinite dimensional Lie algebras". I will also use an expository paper by Feigin and Zelevinsky "Representations of contragredient Lie algebras and Kac-Macdonald identities" (the file is provided upon request). We will start with introducing the classes of infinite dimensional Lie algebras listed above, we will then discuss representations of Heisenberg and Virasoro algebras covering the first four chapters of the book by Kac and Raina.

We will then discuss Kac-Moody algebras (starting with a reminder on the finite dimensional case) and some of their representation theory following Kac's book and Feigin-Zelevinsky's survey.

Time permitting we will then go deeper into the book of Kac and Raina looking into applications to integrable systems, as well as additional topics such as classification of Lie algebras of Cartan type, the KZ equation and the fusion (Kazhdan-Lusztig) tensor product. Assuming still more time remains, we will touch upon the relation to quantum groups.

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