



istanbul matematiksel bilimler merkezi  
istanbul center for mathematical sciences

# QUANTUM TOROIDAL ALGEBRAS AND THEIR APPLICATIONS

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## Abstract

In this mini-course we will introduce quantum toroidal algebras, discuss their structure and representation theory. We will also mention the general philosophy of how these algebras are related to string theory backgrounds and branes.

1. Affine and quantum affine algebras. R-matrix formulation.
2. Quantum toroidal algebras and quantum affinization.
3. Nakajima theory and action of quantum toroidal algebras on the K-theories of the moduli spaces of instantons.
4. Representations of quantum toroidal algebras and branes.
5. The recursive tensor product construction of representations.
6. Quantum toroidal algebras and refined topological strings. Intertwiners of representations. Awata- Feigin-Shiraishi theorem.
7. Coproduct structures and preferred directions for quantum affine and quantum toroidal algebras. Drinfeld twists and R-matrices.
8. Brane networks and networks of intertwiners. Higgsing. Brane creation effects. The algebra of BPS states in string theory.
9. Higher Chern-Simons theory. qq-characters from branes.
10. The pentagon identity.

**Date :** Wednesday, March 16 & Tuesday, March 17, 2022

**Time:** 09:00-11:00

**Place:** IMBM at Boğaziçi University, South Campus