Date/Time: Monday December 5th, 4:00-5:00pm

Location: Room 507 Mathematics

Speaker: Mina Aganagic, UC Berkeley

Title: "Refined Chern-Simons Theory and Knot Homology".

Abstract:

I will describe a deformation of Chern-Simons theory which can be defined on 3-manifolds with knots admitting a semi-free U(1) action. The latter are Seifert 3-manifolds with Seifert knots. The theory can be solved explicitly, in terms of a one-parameter refinement of the S and T matrices of Chern-Simons theory, related to the theory of Macdonald polynomials. The ordinary and refined Chern-Simons theory are similar in many ways; for example, the Verlinde formula holds in both. For torus knots in S^3, colored by fundamental representation of SU(N), the theory can be used to compute the superpolynomial of the triply graded knot homology theory of Dunfield, Gukov and Rasmussen, as can be shown by explicit computation in a large number of cases.

More generally, the physical origin of the refined Chern-Simpons amplitudes, in terms of an index in M-theory, implies that knot homology of Seifert knots in Seifert manifolds should admit an additional grade.

This allows for a refinement of the usual index that Chern-Simons theory computes. Occasionally, such as in the superpolynomial case, the index happens to compute the Poincare polynomials themselves. The computations of this index get related, by dualities, to other problems in mathematical physics, such as partition functions of certain gauge theories in 4 and 6 dimensions.

This is joint work with S. Shakirov.