2019 2ND q-DAY MEETING: TITLES AND ABSTRACTS

Reidmeister torsion from asymptotic expansion of q-series

Byungmin Kang (KIAS)

Volume conjecture relates the asymptotic behavior of a combinatorial object, the so-called colored Jones polynomial, of a hyperbolic knot with geometric invariants, such as Chern-Simons invariant and the Reidmeister torsion, of the knot complement. Although the rigorous proof of the volume conjecture has not been established so far, the volume conjecture gives valuable insights as it provides a way to express geometric invariants of hyperbolic knot complements in terms of the combinatorics of the asymptotic series of q-series. Along this line of thought, the optimistic limit was introduced which established a combinatorial method to evaluate the volume and Chern-Simons invariant of a hyperbolic knot complement. In this talk, I will push this program further by presenting a combinatorial way to evaluate the Reidmeister torsion of a hyperbolic knot complement. The method is based on a rudimentary yet meticulous treatment of the asymptotic expansion of q-series appearing in the colored Jones polynomial. Based on numerical experiments on a few hyperbolic knots, I will present evidences that the method indeed computes the Reidmeister torsion of the hyperbolic knot complements.

Monster Anatomy

Sungjay Lee (KIAS)

We investigate the two-dimensional conformal field theories (CFTs) of $c = 47/2$, $c = 116/5$ *and* $c = 23$ *dual to the critical Ising model, the three-state Potts model and the tensor product of two Ising models, respectively. We argue that these CFTs exhibit moonshines for the double covering of the baby Monster group,* $2 \cdot B$*, the triple covering of the largest Fischer group,* $3 \cdot Fi_{24}$ *and multiple-covering of the second largest Conway group,* $2 \cdot 2^{1+22} \cdot Co_2$*. Various twined characters are shown to satisfy generalized bilinear relations involving Mckay-Thompson series. We also rediscover that the self-dual two dimensional bosonic conformal field theory of* $c = 12$ *has the Conway group* $Co_0 \simeq 2 \cdot Co_1$ *as an automorphism group.*

Quantum modular forms and mock modular forms

Subong Lim (Sungkyunkwan Univeristy)

Quantum modular forms and mock modular forms are new modular objects introduced by Zagier. In this talk, we give a linear injective map from mock modular forms to quantum modular forms.

With this, we prove a claim of Ramanujan that for each mock theta function $f(q)$ there is a collection of g_j of modular forms such that for each root of unity ζ there is j such that $\lim_{q\to\zeta}(f(q)-g_j(q)) = O(1)$.

Generalized Kontsevich-Zagier series via knots

Robert Osburn (University College Dublin)

Over the past two decades, there has been substantial interest in the overlap between quantum knot invariants, q-series and modular forms. In this talk, we discuss one such instance, namely an explicit q-hypergeometric expression for the Nth colored Jones polynomial for double twist knots. As an application, we generalize a duality at roots of unity between the Kontsevich-Zagier series and the generating function for strongly unimodal sequences. This is joint work with Jeremy Lovejoy (Paris 7 and Berkeley).

On the potential function of a knot diagram

Seokbeom Yoon (KIAS)

Volume conjecture, first proposed by Kashaev, says that the asymptotic limit of the colored Jones polynomial gives the complex volume of a knot complement. Motivated by the conjecture, Yokota suggests a combinatorial formula for computing the complex volume with the use of a knot diagram. In this talk, I would like to briefly explain his idea together with the work of Cho-Murakami, which gives a direct connection with the notion of Ptolemy variety. If time permits, I would like to introduce a deformation of their work.