Titles and Abstracts

Workshop on Modular structures in Gromov-Witten theory and related topics
January 25-27, 2019
University of Michigan, Ann Arbor

- **Philip Engel** (Georgia)

  Title: The elliptic orbifold of order 5

  Abstract: A group acting on an elliptic curve must have order 1, 2, 3, 4, or 6. We call the quotient an *elliptic orbifold*. Certain branched covers of the order N elliptic orbifold are in bijection with tiled surfaces, and form a lattice in the moduli space of N-ic differentials on Riemann surfaces. Following Eskin-Okounkov, generating functions of these Hurwitz numbers can be computed as the q-trace of operators on Fock space. These operators naturally generalize to all orders $N > 1$, suggesting a phantom "elliptic orbifold of order 5." I will discuss work-in-progress with Peter Smillie, proposing a definition for the Hurwitz theory of this non-existent object, and relating it to quasi-crystals in the moduli space of quintic differentials and the enumeration of Penrose-tiled Riemann surfaces.

- **Bohan Fang** (BICMR, Peking)

  Title: Modularity of GW invariants from the remodeling conjecture

  I will describe how to use the remodeling conjecture to study the modularity of GW theory for toric CY 3-folds. In particular when the mirror curve is of genus one and in some hyperelliptic form one can obtain the modularity of open-closed GW invariants and have a Yamaguchi-Yau type holomorphic anomaly equation. This talk is based on the joint works with Chiu-Chu Melissa Liu, Zhengyu Zong, and with Yongbin Ruan, Jie Zhou, Yingchun Zhang.

- **Francois Greer** (SCGP, Stony Brook)

  Title: Quasi-modularity from toroidal compactifications

  Abstract: We present a program for showing quasi-modularity of the Gromov-Witten generating series of an elliptically fibered projective manifold, using the homogeneous structure of period domains. The modularity comes from the theta correspondence of Kudla-Millson, and the holomorphic anomaly comes from the boundary of a toroidal compactification. As an application, we compute a genus 0 potential for a broken K3 fibration.

- **Shuai Guo** (Peking) & **Felix Janda** (Michigan)

  Title: LG/CY correspondence for quintic threefolds

  Abstract: This is a report on joint work in progress with Y. Ruan relating the Gromov-Witten theory of a quintic threefold to the Fan-Jarvis-Ruan-Witten theory of the corresponding quintic singularity in $[\mathbb{C}^5/\mathbb{Z}_5]$. Our approach uses the localization formula on log GLSM spaces to express each theory in terms of a twisted theory and effective invariants. The main computational input is a direct identification of the two twisted theories, while the main geometrical input is a matching of the effective invariants.

- **Si Li** (YMSC, Tsinghua)

  Title: Landau-Ginzburg models and Hodge-to-de Rham degeneration

  Abstract: Let X be a non-compact Calabi-Yau manifold and f be a holomorphic function on X with compact critical locus, satisfying a general asymptotic condition. We establish a version of twisted L^2 Hodge theory for the pair (X,f) and prove the corresponding Hodge-to-de Rham degeneration property. It can be viewed as a generalization of Kyoji Saito's higher residue theory and primitive forms for isolated singularities, putting Landau-Ginzburg B-model of the pair (X,f) into the same setting as compact Calabi-yau manifolds. This is joint work with Hao Wen.

- **Hossein Movasati** (IPMA/CMSA Harvard)

  Title: Calabi-Yau modular forms

  Abstract: In the B-model of mirror symmetry, period manipulations play an important role for computing the Gromov-Witten invariants of the A-model. This requires computing power series of periods, finding a maximal unipotent monodromy, mirror map etc. In this talk I will present a purely algebraic version of such computations for Calabi-Yau varieties of arbitrary dimension. It involves a construction of the moduli space of enhanced Calabi-Yau varieties and modular vector fields on it. This will give us an algebraic BCOV anomaly equation and will eventually lead us to the the theory of Calabi-Yau modular forms.

- **Linhui Shen** (Michigan State)

  Title: Cyclic sieving and mirror symmetry for Grassmannians

  Abstract: The Grassmannian $\mathrm{Gr}(k,n)$ parametrizes k-dimensional subspaces in $\mathbb{C}^n$. Due to work of J. Scott, its homogenous coordinate ring $\mathbb{C}[\mathrm{Gr}(k,n)]$ is a cluster algebra of geometric type. We introduce a periodic configuration space $X(k,n)$ equipped with a natural potential function W. We prove that the topicalization of $(X(k,n),W)$ canonically parametrizes a linear basis of $\mathbb{C}[\mathrm{Gr}(k,n)]$, as expected by the Duality Conjecture of Fock-Goncharov. We identify the tropical set of $(X(k,n),W)$ with the set of plane partitions. As an application, we show a cyclic sieving phenomenon involving the latter. We further show its connections with mirror symmetry for Grassmannians. This is joint work with Daping Weng.

- **Yingchun Zhang** (Michigan/Peking)

  Title: Modularity of open-closed Gromov-Witten theory of $K_{\mathbb{P}^2/\mu_3}$

  Abstract: I will focus on modularity property of open-closed Gromov-Witten potential of $K_{\mathbb{P}^2/\mu_3}$ and this is a sequel work to Modularity of Gromov-Witten theory of K_S for $S = \mathbb{P}^2$, $\mathbb{P}[1,1,2]$, $\mathbb{P}^1 \times \mathbb{P}^1$, $\mathbb{F}_1$ whose mirror curves are all hyperelliptic curves. For $K_{\mathbb{P}^2/\mu_3}$, the mirror curve has no hyperelliptic structure, which makes it a different case, but we still have method to mend this gap. Using Remodeling conjecture, we can get the modularity property of open-closed Gromov-Witten potential of $K_{\mathbb{P}^2/\mu_3}$. These series works are joint with Bohan Fang, Yongbin Ruan and Jie Zhou.

- **Jie Zhou** (YMSC, Tsinghua)

  Title: LG/CY correspondence for Calabi-Yau onefolds and modularity

  Abstract: I will present works with Yefeng Shen, and with Yefeng Shen and Jun Li, which match the Gromov-Witten theories of Calabi-Yau onefolds (elliptic curve and elliptic orbifolds) with the corresponding Fan-Jarvis-Ruan-Witten theories. The idea is to extract from these enumerative theories sets of managable differential and functional equations satisfied by the correlation functions, then solve for the solutions in terms of objects living on the moduli spaces of these Calabi-Yau onefolds which (naturally) turn out be modular forms, and finally use modular transformations to relate correlation functions of the Gromov-Witten and Fan-Jarvis-Ruan-Witten theories. The same strategy in studying the global properties and dualities is expected to work for those cases in which modularity of an enumerative theory exists.