

# Vertex Algebras and Gauge Theory Schedule

**Events for:  
Monday, December 17th - Friday, December 21st**

## Monday, December 17th

9:30am **Tomoyuki Arakawa - SCGP 102**

**Speaker:** Tomoyuki Arakawa

**Title:** Chiral algebras of class S and Moore-Tachikawa symplectic varieties

10:30am **Coffee Break - Simons Center Cafe**

11:00am **Mykola Dedushenko - SCGP 102**

**Speaker:** Mykola Dedushenko

**Title:** Vertex operator algebras and four-manifolds

12:00pm **Lunch - Simons Center Cafe**

2:15pm **Pavel Putrov - SCGP 102**

**Speaker:** Pavel Putrov

**Title:** 4-manifolds and topological modular forms

3:30pm **Tea Time - Simons Center Cafe**

4:00pm **Leonid Rybnikov - SCGP 102**

**Speaker:** Leonid Rybnikov

**Title:** Gaudin model and crystals (joint work with Iva Halacheva, Joel Kamnitzer and Alex Weekes).

## Tuesday, December 18th

9:00am **Ivan Cherednik - SCGP 102**

**Speaker:** Ivan Cherednik

**Title:** Superpolynomials, zeta-functions and Riemann hypothesis for plane curve singularities

**Abstract:** Generally, the zeta-equivalence of two schemes over  $\mathbb{C}$  (upon the passage to finitely generated  $\mathbb{Z}$ -subalgebras in  $\mathbb{C}$ ) implies the coincidence of their virtual Hodge numbers (N.Katz). A much stronger theory can be expected for (local rings of) singularities. For plane curve singularities (at least), proper zeta-functions capture their topological type. Namely, motivic superpolynomials of plane curve singularities conjecturally coincide with the Galkin-Stohr  $L$ -functions and with the corresponding DAHA-superpolynomials (known to be topological invariants). In their turn, the latter conjecturally coincide with the stable Khovanov-Rozansky polynomials (proven for uncolored torus knots) and with physics superpolynomials. In these two theories, the roles of  $q, t$  are quite involved. Motivically:  $q$  is the cardinality of a finite field,  $t$  is simply  $T$  from the zeta-function. The superduality becomes the functional equation, but the Riemann Hypothesis mostly holds only for  $q$  sufficiently close to  $0$ . In physics, properly extended  $L$ -functions of singularities  $W(x, y) = 0$  are expected some correlation functions for LGSM with superpotentials  $W(x, y)$ ; no Representation Theory (VOA,  $W$ -algebras, DAHA) is needed in the motivic approach.

10:00am **Coffee Break - Simons Center Cafe**

10:30am **Alexei Oblomkov - SCGP 102**

**Speaker:** Alexei Oblomkov

**Title:** 3D Kapustin-Rozansky theory and knot homology

**Abstract:** Based on the joint work with Lev Rozansky. In my talk I will outline 3D TQFT that provides an unified approach to Hall Algebras of instanton moduli spaces and HOMFLYPT homology. As application we find an interpretation of HOMFLYPT homology of torus knots as a space of sections of particular sheaves on the Hilbert scheme of points on the plane.

11:30am **Lunch - Simons Center Cafe**

1:00pm **SCGP Weekly Talk: Hiraku Nakajima - 102**

**Speaker:** Hiraku Nakajima

**Title:** Vertex algebras in 4 dimensional theories

**Abstract:** Vertex algebras originally arose in a mathematical approach to 2-dimensional conformal field theories. Nevertheless they appear also in dimension 4. For example, we have examples of vertex algebras associated with 4-manifolds via gauge theories (Feigin-Gukov), and also ones associated with 4d  $N=2$  superconformal field theories (Beem et al). I will survey various constructions and give open problems.

2:15pm **Raphael Rouquier - SGCP 102**

**Speaker:** Raphael Rouquier

**Title:** Higher vertex algebra

3:30pm **Tea Time - Simons Center Cafe**

4:00pm **Pavel Etingof - SCGP 102**

**Speaker:** Pavel Etingof

**Title:** Short star-products on filtered quantizations

**Abstract:** Let  $A$  be a filtered Poisson algebra with Poisson bracket  $\{\cdot, \cdot\}$  of degree  $-2$ . A  $\{\cdot, \cdot\}$  star product on  $A$  is an associative product  $*$ :  $A \otimes A \rightarrow A$  given by  $a*b = ab + \sum_{i \geq 1} C_i(a,b)$ , where  $C_i$  has degree  $-2i$  and  $C_1(a,b) - C_1(b,a) = \{a,b\}$ . We call the product  $*$  is  $\{\cdot, \cdot\}$  even if  $C_i(a,b) = (-1)^i C_i(b,a)$  for all  $i$ , and call it  $\{\cdot, \cdot\}$  short if  $C_i(a,b) = 0$  whenever  $i > \min(\deg(a), \deg(b))$ . Motivated by three dimensional  $N=4$  superconformal field theory, Beem, Peelaers and Rastelli considered short even star-products for homogeneous symplectic singularities (more precisely, hyperKähler cones) and conjectured that they exist depend on finitely many parameters. We prove the dependence on finitely many parameters in general and existence for a large class of examples, using the connection of this problem with zeroth Hochschild homology of quantizations suggested by Kontsevich. Beem, Peelaers and Rastelli also computed the first few terms of short quantizations for Kleinian singularities of type A, which were later computed to all orders by Dedushenko, Pufu and Yacoby. We will discuss some generalizations of these results. This is joint work with Eric Rains and Douglas Stryker.

**Wednesday, December 19th**

9:30am **Yongbin Ruan - SCGP 102**

**Speaker:** Yongbin Ruan

**Title:** Verlinde/Grassmanian Correspondence and quantum K-theory

**Abstract:** More than twenty years ago, Witten proposed an equivalence of two quantum fields governing Verlinde algebra (or the theory of stable bundles over a curve) and the quantum cohomology of Grassmanian. Motivated by Witten's physical work and recent revival of quantum K-theory, we proposed a K-theoretic version of so called Verlinde/Grassmanian correspondence. We will first review the new ingredient of level structure in quantum K-theory and surprising appearance of mock theta function. Then, we will present a proof of correspondence in rank two using wall-crossing technique. This is a joint work with Davesh Maulik and Ming Zhang

10:30am **Coffee Break - Simons Center Cafe**

11:00am **Fedor Malikov - SCGP 102**

**Speaker:** Fedor Malikov

**Title:** On one example of a chiral Lie group.

12:00pm **Lunch - Simons Center Cafe**

2:15pm **Iarion Melnikov**

**Speaker:** Iarion Melnikov

**Title:** The chiral algebra of (0,2) theories in two dimensions

3:30pm **Tea Time - Simons Center Cafe**

4:00pm **Du Pei - SCGP 102**

**Speaker:** Du Pei

**Title:** Modular tensor categories from the Coulomb branch

**Thursday, December 20th**

9:30am **Leonardo Rastelli - SCGP 102**

**Speaker:** Leonardo Rastelli

**Title:** VOAs and 4d SCFTs (part I)

10:30am **Coffee Break - Simons Center Cafe**

11:00am **Christopher Beem - SCGP 102**

**Speaker:** Christopher Beem

**Title:** VOAs and 4d SCFTs (part II)

12:00pm **Lunch - Simons Center Cafe**

2:15pm **Eric Vasserot - SCGP 102**

**Speaker:** Eric Vasserot

**Title:** on COHA's of quivers and surfaces

3:30pm **Tea Time - Simons Center Cafe**

4:00pm **Mikhail Kapranov - SCGP 102**

**Speaker:** Mikhail Kapranov

**Title:** Applications of factorization algebras: Gelfand-Fuchs cohomology and COHA.

**Abstract:** Factorization algebras provide a powerful technique for "integrating" local statements to global ones. In this talk I will discuss two works which apply this technique to "outside" problems. First, joint with B. Hennion, finds the cohomology of the Lie algebra of regular vector fields on a smooth affine algebraic variety. Second, in progress with E. Vasserot, describes the cohomological Hall algebra of punctual coherent sheaves on a smooth algebraic surface.

6:00pm **Workshop Banquet - Simons Center Cafe**

**Friday, December 21st**

9:30am **Oleksandr Tsymbaliuk - SCGP 102**

**Speaker:** Oleksandr Tsymbaliuk

**Title:** K-theoretic Coulomb branches and  $q$ -Toda systems via shifted quantum affine algebras

10:30am **Coffee Break - Simons Center Cafe**

11:00am **Daide Gaiotto - SCGP 102**

**Speaker:** Davide Gaiotto

**Title:**

12:00pm **Lunch - Simons Center Cafe**

2:15pm **Boris Feigin - SCGP 102**

**Speaker:** Boris Feigin

**Title:** Coset vertex algebras,  $W$  algebras corresponding super Lie algebras and Langlands type triality.

3:30pm **Tea Time - Simons Center Cafe**