

# Schedule

Events for:  
**Monday, April 18th - Friday, April 22nd**

**Monday, April 18th**

10:00am **Sara Pasquetti - SCGP 102**

**Speaker:** Sara Pasquetti

**Title:** Kernel functions, duality walls and mirror symmetries

**Abstract:**

11:00am **Break - Simons Center Cafe**

11:30am **Martin Hallnas - SCGP 102**

**Speaker:** Martin Hallnas

**Title:** A Lassalle-Nekrasov correspondence between rational and trigonometric deformed Calogero-Moser-Sutherland systems

**Abstract:**

12:30pm **Lunch - Simons Center Cafe**

2:30pm **Abhijit Gadde - SCGP 102**

**Speaker:** Abhijit Gadde

**Title:** Modularity of supersymmetric partition functions

**Abstract:** In this talk, I will present a novel modular property of 4d  $\mathcal{N}=1$  supersymmetric partition functions of supersymmetric theories with  $R$ -symmetry. It is a generalization of the modular invariance of the supersymmetric partition function of two-dimensional supersymmetric theories on a torus i.e. of the elliptic genus. It comes from requiring consistency of partition functions under gluing and, among other things, can be used to rederive the supersymmetric Cardy formula for four-dimensional gauge theories that has played a key role in computing the entropy of supersymmetric black holes.

3:30pm **Break - Simons Center Cafe**

4:00pm **Tadashi Okazaki - SCGP 102**

**Speaker:** Tadashi Okazaki

**Title:** M2-branes and plane partitions

**Abstract:** There is a correspondence between the protected local operators in the 3d SCFTs describing the geometry  $\mathbb{C}^2$  probed by a stack of  $N$  M2-branes and plane partitions of trace  $N$ . We discuss combinatorial expressions of the indices which count the local operators parametrizing  $\mathbb{C}^2/\mathbb{Z}_k$  probed by  $N$  M2-branes in the canonical and grand canonical ensembles in terms of generating functions for plane partitions. If time permits, we also discuss the asymptotic behaviors of the grand potential in the high-temperature limit and the scaling dimension in the large  $N$  limit.

**Tuesday, April 19th**

10:00am **Hjalmar Rosengren - SCGP 102**

**Speaker:** Hjalmar Rosengren

**Title:** Deformed Ruijsenaars operators and elliptic hypergeometric functions

**Abstract:** The Ruijsenaars operators are a commuting family of difference operators with elliptic coefficients, which define an integrable system of relativistic quantum particles. Through the work of Chalykh, Feigin, Silantyev, Veselov and others, it has become apparent that even more general "deformed" or "super" operators exist. We will describe how to obtain the main properties of such operators in a direct way, which works also in the elliptic setting. In particular, we can prove that the deformed elliptic Ruijsenaars model is integrable, which has until now been an unsolved problem. Our results are intimately related to identities for elliptic hypergeometric series. The talk is based on joint work (Comm. Math. Phys., 2022) with Martin Hallnäs, Edwin Langmann and Masatoshi Noumi.

11:00am **Zoom: Sameer Murthy - Zoom**

**Speaker:** Sameer Murthy

**Title:** TBD

**Abstract:**

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

1:00pm **SCGP Weekly Talk: Masahito Yamazaki - SCGP 102**

**Speaker:** Masahito Yamazaki

**Title:** Elliptic Hypergeometric Integrals in Mathematics and Physics

**Abstract:** One of the recurring themes in math/physics interactions is that mathematicians and physicists arrive at the same ingredients in completely different paths/motivations. In this colloquium we will see an example of this phenomenon for elliptic-hypergeometric integral identities. In addition to their intrinsic mathematical interest, they also appear in physics as precision checks of dualities in supersymmetric gauge theories. I will explain how this interplay has led me to use the techniques of supersymmetric gauge theories to find new elliptic-hypergeometric-type solutions to the Yang-Baxter equations.

3:30pm **Break - Simons Center Cafe**

4:00pm **Zoom: Jan Felipe van Diejen - Zoom/SCGP 102**

**Speaker:** Jan Felipe van Diejen

**Title:** Elliptic Ruijsenaars operators and WZW fusion rings

**Abstract:** The fusion ring for  $su(n)_m$  Wess-Zumino-Witten conformal field theories is known to be isomorphic to a factor ring of the ring of symmetric polynomials presented by Schur polynomials. We introduce a deformation of this factor ring associated with eigenpolynomials for the elliptic Ruijsenaars difference operators. The corresponding Littlewood-Richardson coefficients are governed by a Pieri rule stemming from the eigenvalue equation. The orthogonality of the eigenbasis gives rise to an analog of the Verlinde formula. In the trigonometric limit, our construction recovers the refined  $su(n)_m$  Wess-Zumino-Witten fusion ring associated with the Macdonald polynomials. This talk is based on joint work with Tamás Görbe, University of Groningen

**Wednesday, April 20th**

10:00am **Nikita Nekrasov - SCGP 102**

**Speaker:** Nikita Nekrasov

**Title:** Special functions from instanton counting

**Abstract:**

11:00am **Break - Simons Center cafe**

11:30am **Oleg Chalykh - SCGP 102**

**Speaker:** Oleg Chalykh

**Title:** TBD

**Abstract:**

12:30pm **Lunch - Simons Center Cafe**

1:30pm **Physics Seminar: Saebyeok Jeong - SCGP 102**

**Speaker:** Saebyeok Jeong

**Title:** Exact QFT duals of AdS black holes

**Abstract:** Recent studies showed that the  $N=4$  superconformal index leads to the microstate counting of the BPS black holes in  $AdS_5 \times S^5$ . I will explain how we can enhance such an account of the AdS black hole entropy from the saddle point analysis of the matrix model for the  $N=4$  index. Firstly, I will focus on the small black holes whose sizes are much smaller than the AdS radius. The saddle point equation can be solved exactly in this limit. The exact free energy obtained in this way gives a first principle account for the counting of the asymptotically flat black holes. Secondly, motivated by the previous exact solution for the small black holes, I will explain the saddle point equation can in fact be solved without taking any limit. I will show the saddles corresponding to the known BPS black holes arise as 'areal' distributions. The talk is based on <https://arxiv.org/abs/2111.10720> with Sunjin Choi, Seok Kim, and Eunwoo Lee; <https://arxiv.org/abs/2103.01401> with Sunjin Choi and Seok Kim.

3:30pm **Break - Simons Center Cafe**

4:00pm **Fei Yan - SCGP 102**

**Speaker:** Fei Yan

**Title:** Line defects in  $T[M]$  and Chern-Simons thimbles

**Abstract:** This talk concerns half-BPS line defects in a class of 3d  $N=2$  theories  $T[M]$  associated with three-manifolds  $M$ . I will describe a geometric way to compute the line defect index counting interface operators between line defects. I will also mention some connections to 2d (2,2) Chern-Simons Landau-Ginzburg models.

**Thursday, April 21st**

10:00am **Zoom: Vyacheslav Spiridonov - Zoom/SCGP 102**

**Speaker:** Vyacheslav Spiridonov

**Title:** Integrable Systems and Special Functions

**Abstract:**  $l$  functions can be defined as functions emerging from similarity reductions of integrable equations. I will demonstrate the power of this approach through the history of deriving continuous  $q$ -Painleve functions out of the ordinary Schrödinger equation and the elliptic hypergeometric function (the simplest superconformal index) out of the recurrence relation for biorthogonal rational functions.

11:00am **Break - Simons Center cafe**

11:30am **Sergei Gukov - SCGP 102**

**Speaker:** Sergei Gukov

**Title:** Fermionic forms and BPS quivers

**Abstract:**

12:30pm **Lunch - Simons Center Cafe**

2:30pm **Zoom: Andrew Kels - Zoom/SCGP 102**

**Speaker:** Andrew Kels

**Title:** Integrable models on lattices and dualities of supersymmetric indices

**Abstract:** In this talk I will consider two different types of integrable models that live on lattices. The first are the integrable lattice models of statistical mechanics which satisfy a special form of Yang-Baxter equation known as the star-triangle relation, the most famous example of which is the Ising model. The second are the integrable systems of discrete soliton equations which satisfy integrability in terms of a property known as multidimensional consistency. These provide discrete counterparts of integrable differential soliton equations such as the famous Korteweg-de Vries (KdV) equation. Both of these types of integrable models can be derived from dualities of indices of certain supersymmetric gauge theories in some particular limits. The connections to such supersymmetric indices has initially been developed in independent works of Spiridonov and Yamazaki, motivated by integrable models obtained by Bazhanov, Mangazeev, and Sergeev. On the mathematical side these dualities are identities for hypergeometric integrals. In this talk I will provide an overview to these topics mainly from the point of view of integrable models, and present some open problems that might be of interest to mathematicians/physicists working in the area.

3:30pm **Break - Simons Center Cafe**

4:00pm **Sergio Benvenuti - SCGP 102**

**Speaker:** Sergio Benvenuti

**Title:** Dualities from deconfinement

**Abstract:** We prove dualities involving four dimensional  $N=1$  gauge theories with rank-2 matter. We assume only elementary dualities, that is Seiberg and Intriligator-Pouliot dualities. The strategy is to use multiple times elementary S-confining dualities and elementary electric-magnetic dualities, until the desired dual theory is reached. As a first example, we derive the Wess-Zumino description of all S-confining single node quivers with rank-2 matter. As a second example, we derive a 'fully deconfined' dual of  $Usp(2N)$  with an antisymmetric and  $2F$  fundamental fields, then use it to prove a self-duality valid at  $F=4$ . These results are based on ongoing work with Stephane Baejot, and uplift 3d results obtained with Ivan Garozzo and Gabriele Lo Monaco.

**Friday, April 22nd**

10:00am **Maxim Zabzine - SCGP 102**

**Speaker:** Maxim Zabzine

**Title:** The index of M-theory and equivariant volumes

**Abstract:** Motivated by M-theory, I will review rank  $n$  K-theoretic Donaldson-Thomas theory on a toric threefold and its factorisation properties in the context of 5d/7d correspondence. In the context of this discussion I will revise the use of the Duistermaat-Heckman formula for non-compact toric Kahler manifolds, pointing out some mathematical and physical puzzles.

11:00am **Break - Simons Center cafe**

11:30am **Gabi Zafrir - SCGP 102**

**Speaker:** Gabi Zafrir

**Title:** Compactifying 5d superconformal field theories to 3d

**Abstract:**

12:30pm **Lunch - Simons Center Cafe**