2 Title & Abstract

Name	Ralf Schiffler
Title	Definition and basic properties of cluster algebras
Abstract	This talk is a short introduction to cluster algebras. I will give the definition and several examples, describe different types of cluster algebras and discuss some results.

Name	Tomoki Nakanishi
Title	On generalized cluster algebras
Abstract	Generalized cluster algebras (GCAs) was introduced by Chekhov and Shapiro in 2011. They are generalizations of the ordinary cluster algebras by replacing the ``binomial" in the right hand side of the exchange relation of cluster variables with ``polynomial" so that the Laurent property still holds. Recently GCAs appear in several different contexts such as Teichm¥"uller theory, quantum groups, exact WKB analysis. In this talk I explain that GCAs preserve (perhaps) all basic and important properties of the ordinary cluster algebras, including the structure theorems of seeds and quantization. References: 1. L. Chekhov and M. Shapiro, Teichm¥"uller spaces of Riemann surfaces with orbifold points of arbitrary order and cluster variables, Int. Math. Res. Notices 2014 (2014), 2746–2772;arXiv:1111.3963 [math–ph]. 2. Tomoki Nakanishi, Structure of seeds in generalized cluster algebras, arXiv:1409.5967. 3. Tomoki Nakanishi, Quantum generalized cluster algebras and quantum dilogarithms of higher degrees, arXiv:1410.0584.

Name	Michael Gekhtman
Title	Networks on surfaces and integrable systems
Abstract	This talk is an overview of Poisson geometric properties of directed weighted networks and discrete integrable systems arising from transformations of these networks.

Name	Rinat Kedem
Title	Quantum Q-systems, grading on tensor products and generalized Whittaker functions
Abstract	The quantum discrete evolution coming from the cluster algebra associated with the Q-system allows us to express the graded Feigin-Loktev characters of tensor products of Kirillov-Reshetikhin modules as a constant term identity, in terms of a product of non-commuting cluster variables. This compact expression lends itself to the derivation of a family of difference equations due to the existence of integrals of motion for the quantum Q-system, which is a quantum integrable discrete evolution.

Name	Man Wai Cheung
Title	Scattering diagrams and cluster algebras
Abstract	The concepts of scattering diagrams and theta functions were introduced by Gross and Siebert when they were working on the toric degeneration of surfaces. Later on, It was discovered that these two objects encode far more information than the original setup. For instance, one can associate each cluster algebra with a scattering diagram. In this talk, we are going to discuss this geometric point of view to cluster algebras.

Name	Murad Alim
Title	BPS Quivers and Mirror Symmetry
Abstract	I will describe how a BPS quiver is assigned to a family of N=2 theories. These theories can be obtained geometrically using string theory on two mirror families of Calabi-Yau threefolds. The nodes of the quivers are assigned to bases of objects on both sides of mirror symmetry corresponding to stable coherent sheaves and special Lagrangians. Quiver representation theory together with a physically motivated stability condition encodes the BPS spectra of the theories and their wall-crossing behavior in the moduli space.

Name	Piljin Yi
Title	Quivers, Witten Index, and Wall-Crossing Invariants
Abstract	Quiver quantum mechanics is a useful tool for exploring wall-crossing phenomena of BPS objects in certain d=4 supersymmetric theories. After a

	cursory motivation from the physics side, we explore simple examples and discuss how the resulting wall-crossing formulae from tree-like quivers have been proved to coincide with predictions from Kontsevich-Soibelman (KS) algebra. Quivers with orientied loops offer more challenges, where the notion of wall-crossing-safe invariants, or the quiver invariant, become necessary and enter KS algebra as an input data. We explore these invariants using Abelian cyclic quivers, and outline strategies for counting and classifying BPS states for completely general quivers.

Name	Harold Williams
Title	Toda Systems, Cluster Characters, and Spectral Networks
Abstract	We discuss recent work identifying the Hamiltonians of the open relativistic Toda system as cluster characters of nonrigid representations of a quiver with potential. Equivalently, we use the spectral networks of the periodic Toda system to identify these cluster characters of traces of holonomies on a wild character variety of $₩BC^*$.

Name	Arkady Berenstein
Title	Noncommutative Laurent Phenomenon
Abstract	TBA

Name	Matthew B. Young
Title	Orientifold Donaldson-Thomas theory of quivers
Abstract	Motivated by the counting of BPS states in string theory with orientifolds, we study moduli spaces of self-dual representations of a quiver with contravariant involution. Wall-crossing formulas, describing the behaviour of generating functions counting semistable self-dual representations under changes in stability, recover formulas predicted in the string theory literature on orientifolds. In certain cases, wall-crossing can be understood in terms of quantum dilogarithm identities that are in some sense square roots of the identities appearing in ordinary Donaldson-Thomas theory. The main tool we

	use is a representation of the Hall algebra that is of independent interest- it is a model for the space of BPS states in an orientifolded theory.

Name	Thorsten Weist
Title	**Quiver Grassmannians of Type $\tilde{D}_n$**
Abstract	Quiver Grassmannians of real root representations of quivers of type $\tilde{D}_n$ have a decomposition into affine spaces. For representations of small defect the non-empty cells are in one-to-one correspondence with certain subgraphs of a particular tree-shaped coefficient quiver of the representation. In particular, the Euler characteristic is given by counting these subgraphs. A slight generalization of results of Caldero and Chapoton yields that also quiver Grassmannians of real root representations of higher defect have a decomposition into affine spaces. Moreover, the Euler characteristic is already given by Euler characteristics of quiver Grassmannians of representations of smaller defect. In both cases it is possible to give a recursive and also an explicit formula for the generating function of the Euler characteristics.

Name	Masashi Hamanaka
Title	Noncommutative Solitons and Instantons
Abstract	I would like to discuss extension of theory of solitons and instantons to noncommutative (NC) space, focusing on noncommutative anti-self-dual (ASD) Yang-Mills equations in four dimensional flat space. Firstly, we discuss Atiyah-Drinfeld-Hitchin-Manin (ADHM) construction of noncommutative instantons. Instantons are finite-action (global) solutions of the ASD Yang-Mills equations. ADHM construction is based on a beautiful duality between moduli space of the instantons and moduli space of the ADHM data. We prove the duality in NC space together with some introductory reviews of explicit examples and D-brane interpretations. This is based on collaboration with Toshio Nakatsu (Setsunan Univ.). Secondly, we give wide class of exact (local) solutions by using Backlund transformations for the G=U(2) noncommutative ASD Yang-Mills eqs. We find that one kind of noncommutative determinants, quasideterminants, play crucial roles in the construction of noncommutative solutions. We also discuss reduction of the noncommutative ASD Yang-Mills equations to lower dimensions to give various noncommutative integrable equations (such as KdV, NLS, Toda eqs. and so on). This is partially based on collaboration with C. Gilson and J. Nimmo (Glasgow Univ.).

Name	Masahito Yamazaki
Title	TBA
Abstract	TBA

Name	Amihay Hanany
Title	TBA
Abstract	TBA

Name	Alastair King
Title	Grasmannian cluster categories and dimers on a disc
Abstract	will describe a full categorification of the cluster structure on the homogeneous coordinate ring of a Grassmannian and explain how it provides an example of a dimer model (with boundary) on a disc.

Name	Gregg Musiker
Title	Pyramid Partition Functions for the Del-Pezzo 3 Quiver as Subgraphs of Brane Tilings
Abstract	This talk considers Pyramid Partition Functions as stuided by B. Szendroi and B. Young (for the conifold), W. Chuang and D. Jafferis (in relation to Seiberg duality), and later by R. Eager and S. Franco (in more generality). I will discuss the del Pezzo 3 quiver as a very interesting case, where work with REU students I. Jeong, S. Zhang on the one hand, and M. Leoni, S. Neel, and P. Turner, on the other, gave a combinatorial model for pyramid partition functions for a two-dimensional subspace of toric cascades of Seiberg dualities. I will also describe recent work in progress with T. Lai which generalizes these results to a three-dimensional subspace in the duality web. I will close with applications on the integrability of the related dynamical systems.

Name	Yang-Hui He

Title	Gauge Theories: Quivers, Mutations & Dessins d'Enfants
Abstract	We discuss how bipartite graphs on Riemann surfaces encapture a wealth of information about the physics and the mathematics of gauge theories. The correspondence between the gauge theory, the underlying algebraic geometry of its space of vacua, the combinatorics of dimers and toric varieties, the relation between Seiberg duality and cluster mutations, as well as the number theory of dessin d'enfants becomes particular intricate under this light.

Name	Philippe R. Di Francesco
Title	Whittaker functions, cluster algebras and McDonald difference operators
Abstract	Whittaker functions have recently reappeared in the context of random polymers and special McDonald processes. We revisit their earlier life in representation theory: they were originally built out of Whittaker vectors, for which we give a new statistical weighted path formulation, valid for simple and affine Lie algebras as well as the quantum algebra $U_q(sl_n)$. We show how this formulation bypasses the classical derivation of Toda-type differential/difference equations satisfied by these functions. We then consider graded tensor products of current algebra $g[t]$-modules, and show that their characters obey difference equations, generalizing the difference Toda equation, allowing for viewing graded characters as generalized Whittaker functions. This is done using a constant term expression for the characters using a solution of the quantum Q-system, a set of non-commuting integrable recursion relations that are particular mutations of a quantum cluster algebra attached to the Lie algebra g. Finally, we obtain a new compact expression for graded sl_n characters by constructing a presentation of the quantum Q-system via generalized McDonald-Ruijsenaars difference operators. (based on joint works with R. Kedem, and R. Kedem and B. Turmunkh).

Name	Michael Shapiro
Title	Higher pentagram maps and cluster dynamics
Abstract	The pentagram map associates to a projective polygon a new one formed by intersections of short diagonals. We reprove the famous result by V. Ovsienko,

	R. Schwartz and S. Tabachnikov that pentagram map is a discrete completely integrable system using the theory of cluster algebras and the Poisson geometry of weighted directed networks on surfaces. We prove also complete integrability for a discrete family of corrugated pentagram maps.The ingredients necessary for complete integrability -- invariant Poisson brackets, integrals of motion in involution, Lax representation -- are recovered from combinatorics of the networks. Our integrable systems depend on one discrete parameter k>1. The case k=3 corresponds to the pentagram map. For k>3, we give our integrable systems a geometric interpretation as pentagram-like maps involving deeper diagonals. If k=2 and the ground field is $₩C$, we give a geometric interpretation in terms of circle patterns. This a joint work with M.Gekhtman, S.Tabachnikov, and A.Vainshtein.