Abstracts

Peigen Cao, HKU

Title: *F-invariant in cluster algebras*

In this talk we introduce F-invariant in cluster algebras. It gives a very convenient characterization of when the product of two cluster monomials remains a cluster monomial.

Will Donovan, Tsinghua University

Title: *Derived symmetries for crepant resolutions of hypersurfaces*

Given a singularity with a crepant resolution, a symmetry of the derived category of coherent sheaves on the resolution may often be constructed. I discuss work in progress on general constructions of such symmetries for hypersurface singularities, in particular when the resolution is the blowup in a smooth locus. This builds on previous results with Segal, and is inspired by work of Bodzenta-Bondal.

Ryo Fujita, Kyoto

Title: *Isomorphisms among quantum Grothendieck rings and their cluster theoretical interpretation*

Quantum Grothendieck ring in this talk is a deformation of the Grothendieck ring of the monoidal category of finite-dimensional modules over the quantum loop algebra, endowed with a canonical basis consisting of the so-called simple (q,t)-characters. We discuss a collection of isomorphisms among the quantum Grothendieck rings of different Dynkin types respecting the canonical bases, via which the (q,t)-characters of non-simply-laced type inherit several good properties from those of the unfolded simply-laced type. We also discuss their cluster theoretical interpretation, which particularly yields non-trivial birational relations among the (q,t)-characters of different Dynkin types. This is a joint work with David Hernandez, Se-jin Oh, and Hironori Oya.

Norihiro Hanihara, IPMU

Title: *Calabi-Yau completions from roots of Auslander-Reiten translations*

Roots of Auslander-Reiten translations, or shifted inverse dualizing complexes, appear naturally in tilting theory for singularity categories or for projective varieties. We formulate a version of the Calabi-Yau completion for such functors, and present its application to a construction of non-commutative resolutions for commutative Gorenstein rings.

Min Huang, Sun Yat-sen University at Zhuhai

Title: *Positivity for quantum cluster algebras from orbifolds*

In this talk, I will present an expansion formula for quantum cluster algebras from orbifolds. As a consequence, we obtain the positivity for this class of quantum cluster algebras.

Ivan Ip, HKUST

Title: *Regular Positive Representations*

In the study of positive representations of split real quantum groups, it is natural to consider an associated embedding of Uq(g) to certain quantum cluster algebra related to the moduli space of framed G-local systems. Over the past few years, various new variations of such representations are realized as certain reductions of the original one, and share some common features which we call "regular". We will explain the current status of the classification of these regular positive representations.

Tasuki Kinjo, Kyoto

Title: *Geometric Calabi-Yau completion*

In this talk, we discuss a geometric counterpart of Keller's deformed Calabi--Yau completion. It includes the Dolbeault and the de Rham stack of Riemann surfaces as examples. After that, we discuss its application to the study of the geometry of the moduli space of G-Higgs bundles. This talk is based on a joint work with Pavel Safronov.

Bernard Leclerc, CNRS Caen

Title: *A cluster structure on the category O for shifted quantum affine algebras*

I will report on a joint work with C. Geiss and D. Hernandez. We show that the Grothendieck ring of the category O for the shifted quantum affine algebras, introduced by Hernandez in arXiv:2010.06996, has the structure of a cluster algebra of infinite rank, with explicit initial seeds parametrized by reduced expressions of the associated (finite) Weyl group W. The initial cluster variables are constructed by means of the new Weyl group action of Frenkel and Hernandez (arXiv:2211.09779). In type A,D,E, we obtain a surprising connection with the Berenstein-Fomin-Zelevinsky cluster algebra structure on the open double Bruhat cell of the corresponding simple algebraic group G.

Fang Li, Zhejiang University

Title: *On Galois-like theory of cluster algebras and some examples from surfaces*

One of the key-points in Galois theory via field extensions is to build up a correspondence between subfields of a field and subgroups of its automorphism group, so as to study fields via methods of groups. As an analogue of the Galois theory, we study the relations between cluster subalgebras of a cluster algebra and subgroups of its automorphism group and then to set up the Galois-like method. As examples, we characterize the cluster automorphism group of cluster algebras from feasible surfaces. For the kind of cluster algebras, as the answers of two conjectures given in the first part, we prove the rank invariants of maximal cluster subalgebras under action of subgroups of the cluster automorphism group of such a cluster algebra and moreover construct the descending series of cluster subalgebras via an ascending series of subgroups. This work is joint with Jinlei Dong.

Tomoki Nakanishi, Nagoya

Title: *Reducibility of dilogarithm identities in cluster algebras*

The well-known relation between dilogarithm identities and cluster algebras was recently updated in view of cluster scattering diagrams. This, in particular, clarifies that any dilogarithm identity associated with a period in a cluster algebra or a cluster scattering diagram is reduced to a trivial one by applying the pentagon identity possibly infinitely many times.

Jie Pan, HKU

Title: *Polytope functions under mutations*

In previous joint work with Professor Fang Li, we constructed a polytope function ρ_h for each vector $h\in\Z^n$ for a totally sign-skew-symmetric cluster algebra, which equals a cluster monomial when h equals its g-vector. The behavior of polytope functions under mutations of the initial seed helps us to generalize several results to totally sign-skew-symmetric case.

Fan Qin, Shanghai Jiao Tong University

Title: *Triangular Bases for Varieties from Lie Theory*

Triangular bases are Kazhdan-Lusztig type bases for quantum cluster algebras. Examples include the dual canonical bases for the quantized coordinate rings of unipotent subgroups. In this talk, we show the existence of these bases for the quantized coordinate rings of more varieties from Lie theory, generalizing the results from unipotent subgroups. It is worth noting that when the Cartan matrix is symmetric, their structure constants are positive which have monoidal categorification after minor modification.

Yu Qiu, Tsinghua University

Title: *On cluster braid groups*

We review the definition of cluster braid groups. In the Coxeter-Dynkin case, they are naturally isomorphic to the corresponding braid groups. In the surface, we give finite presentations w.r.t. quivers with potential and show that they are natrually isomorphic to braid twist groups. This is based on many (past/ongoing) collaborations, including the ones with Yu Zhou, Alastair King, Jon Woolf, Zhe Han and Ping He.

Antoine de Saint Germain, HKU

Title: *Patterns from intersection pairings*

Motivated by higher Techmuller theory, Fock and Goncharov postulated a series of conjectures commonly referred to as the Fock Goncharov duality conjectures. In particular, they conjectured the existence of a canonical intersection pairing. In this talk, we discuss the canonical intersection pairing (suitably defined) in acyclic cluster algebras, and show how cluster additive functions and tropical friezes arise as patterns of said pairing. This is based on joint work with Peigen Cao and Jiang-Hua Lu.

Travis Schedler, Imperial College

Title: *Birational geometry of GIT quotients and symplectic resolutions*

Many varieties of interest in representation theory and algebraic geometry are given by GIT quotients; this includes many symplectic resolutions such as Nakajima quiver varieties and more generally Higgs and Coulomb branch varieties of vacua of 3d supersymmetric gauge theories. I will explain how under certain conditions one can classify all small modifications of these, via GIT chambers. In particular this classifies symplectic resolutions of Nakajima quiver varieties, as well as 3D quotient singularities. Via stratified resolutions one can extend this to arbitrary moduli spaces of 2CY algebras and categories. This includes joint work with Bellamy and Craw as well as with Dan Kaplan.

Yilin Wu, USTC

Title: *Relative cluster categories and Higgs categories with infinite-dimensional morphism spaces*

Cluster categories were introduced in 2006 by Buan–Marsh–Reineke–Reiten–Todorov in order to categorify acyclic cluster algebras without coefficients. Their construction was generalized by Amiot to Jacobi-finite quivers with potential (2009). Later, Plamondon generalized it to arbitrary cluster algebras associated with quivers (2009 and 2011). Cluster algebras with coefficients are important since they appear in nature as coordinate algebras of varieties like Grassmannians, double Bruhat cells, unipotent cells, ...The work of Geiss-Leclerc-Schröer often yields Frobenius exact categories which allow to categorify such cluster algebras. In previous work, we have constructed Higgs categories and relative cluster categories in the relative Jacobi-finite setting (arXiv:2109.03707). Higgs categories generalize the Frobenius categories used by Geiss-Leclerc-Schröer.

In this talk, we give the construction of the Higgs category and of the relative cluster category in the relative Jacobi-infinite setting under suitable hypotheses. As in the relative Jacobi-finite case, the Higgs category is no longer exact but still extriangulated in the sense of Nakaoka-Palu (2019). We also give the construction of a cluster character in this setting. This is a joint work with Bernhard Keller (arXiv:2307.12279).