# Schedule of Lectures

## March 21st (Friday)

| Time | Speaker | Title | Host |
|---|---|---|---|
| 9:00-9:20 | 开幕式 Opening Ceremony | | |
| 9:20-10:00 | 惠昌常<br>Changchang Xi | Tachikawa's second conjecture and derived recollements | 白承铭<br>Chengming Bai |
| 10:00-10:30 | 茶歇 Tea Break | | |
| 10:30-11:10 | 邱宇<br>Yu Qiu | From cluster mutation to X-evolution | 马天水<br>Tianshui Ma |
| 11:10-11:50 | 李宁<br>Ning Li | Branching laws for tempered representation of rank-one unitary groups | |
| 12:00 | 午餐 Lunch | | |
| 14:30-15:10 | 汪永杰<br>Yongjie Wang | A Drinfeld Presentation of the Queer Super-Yangian | 何校<br>Xiao He |
| 15:10-15:50 | 郎红蕾<br>Honglei Lang | Poisson homogeneous spaces of Poisson 2-groups | |
| 15:50-16:20 | 茶歇 Tea Break | | |
| 16:20-17:00 | 章璞<br>Pu Zhang | Homotopy categories and fibrant model structures | 郭向前<br>Xiangqian Guo |
| 17:00-17:40 | 周国栋<br>Guodong Zhou | Groebner-Shirshov bases for (pre)momoidal categories | |
| 18:00 | 晚餐 Dinner | | |

# March 22nd (Saturday)

| Time | Speaker | Title | Host |
|---|---|---|---|
| 8:50-9:00 | 合影 Group Photo | | |
| 9:00-9:40 | 单芃<br>Peng Shan | Bridging affine vertex algebras and affine Springer fibres | Vyacheslav Futorny |
| 9:40-10:20 | 叶郁<br>Yu Ye | On locally gentle maps | |
| 10:20-10:40 | 茶歇 Tea Break | | |
| 10:40-11:20 | 徐晓濛<br>Xiaomeng Xu | Stokes phenomenon and combinatorics of Young tableaux | 邓少强<br>Shaoqiang Deng |
| 11:20-12:00 | 吴泉水<br>Quanshui Wu | Numerical Homological Regularities over Graded Algebras | |
| 12:00 | 午餐 Lunch | | |
| 14:00-14:40 | 于世卓<br>Shizhuo Yu | Bott-Samelson atlas and Lusztig's total positivity on flag varieties | 王艳<br>Yan Wang |
| 14:40-15:20 | 胡志广<br>Zhiguang Hu | 矩阵方法在李代数上的几个应用 | |
| 15:20-15:40 | 茶歇 Tea Break | | |
| 15:40-16:20 | 肖呼斯冷<br>Husileng Xiao | Quantization of super nilpotent orbits and its application | 林元昌<br>Yuanchang Lin |
| 18:00 | 晚餐 Dinner | | |

# Abstracts

1. **Speaker:** Zhiguang Hu (Tianjin Normal University)

**Title:** 矩阵方法在李代数上的几个应用

**Abstract.** 矩阵与李代数有紧密的联系。本报告主要介绍近几年来用矩阵方法在李代数得到的几个有意思的结论，包括可解李代数的矩阵束刻画，可解可裂线性李代数结构的初等证明，三维单李代数的满表示分类等。

2. **Speaker:** Honglei Lang (China Agricultural University)

**Title:** Poisson homogeneous spaces of Poisson 2-groups

**Abstract.** Drinfeld classified Poisson homogeneous spaces of a Poisson Lie group in terms of Dirac structures of the Lie bialgebra. In this talk, we study homogeneous spaces of a 2-group and develop Drinfeld theorem in the Poisson 2-group context. This is a joint work with Zhangju Liu.

3. **Speaker:** Ning Li (Nankai University)

**Title:** Branching laws for tempered representation of rank-one unitary groups

**Abstract.** The branching problem is a fundamental problem in representation theory. On the other hand, the philosophy of Kirillov's orbit method implies that one can study irreducible unitary representations of real reductive groups via the geometry of coadjoint orbits. Later, Duflo formulated precise conjectures on the description of the restriction of discrete series to a subgroup in terms of the moment map. In this talk, we will focus on the conjecture for rank-one unitary groups. This is based on an ongoing joint work with Jun Yu and Yoshiki Oshima.

4. **Speaker:** Yu Qiu (Tsinghua University)

**Title:** From cluster mutation to X-evolution

**Abstract.** We introduce X-evolution flows on cluster complexes Cpx associated to 2-Calabi-Yau categories with cluster tilting objects. We show that there are families of

induced X-foliations on Cpx, parameterized by the unique sink/source. As applications, we show that in the Dynkin/Euclidean case, Cpx is spherical/contractible, respectively, and the cluster exchange graphs are generated by squares and pentagons. This is a joint work with my student Tang Liheng.

5. **Speaker:** Peng Shan (Tsinghua University)

**Title:** Bridging affine vertex algebras and affine Springer fibres

**Abstract.** I will explain a new conjecture describing associated varieties of simple affine vertex algebras, some examples, and relation to affine Springer theory. This is a joint work with Wenbin Yan and Qixian Zhao.

6. **Speaker:** Yongjie Wang (Hefei University of Technology)

**Title:** A Drinfeld Presentation of the Queer Super-Yangian

**Abstract.** We introduce a Drinfeld presentation for the super Yangian $Y(q_n)$ associated with the queer Lie superalgebra $q_n$. The Drinfeld generators of $Y(q_n)$ are obtained by a block version Gauss decomposition of the generator matrix in its RTT presentation, and the Drinfeld relations are explicitly computed by utilizing a block version of its RTT relations. This is a joint work with Zhihua Chang.

7. **Speaker:** Quanshui Wu (Fudan University)

**Title:** Numerical Homological Regularities over Graded Algebras

**Abstract.** Inspired by the studies in algebraic geometry and commutative algebra, Jorgensen defined CM-regularities for graded modules over noncommutative noetherian connected graded algebras. Two fundamental results in commutative case are generalized to non-commutative case: a vanishing-theorem by Mumford, and a theorem on linear resolutions and syzygies by Eisenbud and Goto. Subsequently, Jorgensen established two inequalities relating CM-regularity to Tor-regularity, which spurred numerous intriguing research efforts. For example, Romer gave a characterization that a commutative standard graded algebra is a polynomial algebra if and only if either of the two of Jorgensen's inequalities is always an equality for any

finitely generated graded module. Dong and Wu generalized Romer's result, and showed that the CM-regularity of an algebra A can be considered as an invariant that measures how far away A is from being AS-regular for any Koszul noetherian connected graded algebra A with a balanced dualizing complex. In the last two years, Kirkman-Won-Zhang did a lot of work about the regularities, in particular they gave a far-reaching generalization of Dong-Wu's result by introducing another numerical homological invariant ASreg(A) for any noetherian connected graded k-algebra A. Recently, Wu and Yi defined more numerical homological invariants over positively graded algebras and studied the relations between them. This talk is based on a joint work with Bojuan Yi.

8. **Speaker:** Changchang Xi (Capital Normal University)

**Title:** Tachikawa's second conjecture and derived recollements

**Abstract.** In the representation theory of algebras the famous but not yet solved Nakayama conjecture was decomposed into two conjectures by Hiroyuki Tachikawa in 1970s, where the second conjecture says that if $M$ is an orthogonal module over a self-injective algebra then $M$ is projective. Up to date, all conjectures mentioned remain open. In this talk, we investigate Tachikawa's second conjecture for symmetric algebras. This is done by establishing recollements of triangulated (or derived module) categories. We show that Tachikawa's second conjecture holds true for all symmetric algebras if and only if each indecomposable symmetric algebra has no stratifying ideals apart from itself and $0$. Moreover, we show that the Nakayama conjecture is true for Morita-Gorenstein algebras. The details of this talk can be found in [Compos. Math. 160 (2024) 2704-2737].

9. **Speaker:** Husileng Xiao (Harbin Engineering University)

**Title:** Quantization of super nilpotent orbits and its application

**Abstract.** In this talk, we first classify the filtered and deformation quantization of super nilpotent orbits of a basic Lie superalgebras $\mathfrak{g} = \mathfrak{g}_0 + \mathfrak{g}_1$. We then establish a Morita equivalence between a subcategory of g-mod and that of $\mathfrak{g}_0$-mod.

10. **Speaker:** Xiaomeng Xu (Peking University)

**Title:** Stokes phenomenon and combinatorics of Young tableaux

**Abstract.** Stokes phenomenon states that the asymptotic behaviour of a complex function can jump along different directions at a singularity. In this talk, we use the Stokes phenomenon, of the solutions of linear differential equations at a second order pole, to derive various combinatroics of Young tableaux that originally come from representation theory.

11. **Speaker:** Yu Ye (University of Science and Technology of China)

**Title:** On locally gentle maps

**Abstract.** In this talk I will give an introduction to the notion of locally gentle maps, which is a natural generalization of combinatorial maps, and show the one-to-one correspondence between equivalence classes of locally gentle maps and isomorphism classes of locally gentle algebras. Under this correspondence, many properties of locally gentle algebras are discussed by using locally gentle maps.

12. **Speaker:** Shizhuo Yu (Nankai University)

**Title:** Bott-Samelson atlas and Lusztig's total positivity on flag varieties

**Abstract.** On a flag variety, Kazhdan-Lusztig isomorphisms can be defined on shifted big cells and applied to construct the Bott-Samelson atlas. In this talk, we introduce the compatibility between the standard Poisson structures and the Lusztig's total positivity on flag varieties based on Bott-Samelson atlas. This is the joint work with Jiang-Hua Lu.

13. **Speaker:** Pu Zhang (Shanghai Jiao Tong University)

**Title:** Homotopy categories and fibrant model structures

**Abstract.** The homotopy category of a model structure on a weakly idempotent complete additive category is proved to be equivalent to the additive quotient of the category of cofibrant-fibrant objects with respect to the subcategory of cofibrant-

fibrant-trivial objects. A model structure on pointed category is fibrant, if every object is a fibrant object. Fibrant model structures is explicitly described by trivial cofibrations, and also by fibrations. Fibrantly weak factorization systems are introduced, fibrant model structures are constructed via fibrantly weak factorization systems, and a one-one correspondence between fibrantly weak factorization systems and fibrant model structures is given. Applications are given to rediscover the $\omega$-model structures and the $W$-model structures, and their relations with exact model structures are discussed.

14. **Speaker:** Guodong Zhou (East China Normal University)

**Title:** Groebner-Shirshov bases for (pre)momoidal categories

**Abstract.** We introduce a Groebner-Shirshov basis theory for (pre)momoidal categories and present some well-known applications to Lie theory. This is a joint work in progress with Ziling Li.