Schedule of Lectures

November 3 (Sunday)

14:00-	Registration	**Jiayuan Hotel**
16:00-17:00	Informal discussion and problem session	
18:00-	**Dinner**	

November 4 (Monday)

Time	**Speaker**	**Title**	**Chair**
08:10-08:30	**Welcome Speech**		Yan-Hong Bao
08:30-09:20	Michael Batanin	Coherence for operadic categories	James J. Zhang
09:30-10:00	**Coffee Break**		
10:00-10:50	Lander Hermans	A minimal model for prestacks via a Koszul duality for box operads	James J. Zhang
11:00-11:50	Hong-Lei Lang	Rota-Baxter Lie Bialgebras and Rota-Baxter Poisson Lie Groups	
12:00-	**Lunch**		
14:30-15:20	Vladimir Dotsenko	Finite basis property and distributivity questions for varieties of Novikov algebras	Yu Ye
15:30-16:20	Xian-Gui Zhao	Growth and Gelfand-Kirillov dimension of operads	
16:30-17:00	**Coffee Break**		
17:00-17:50	Ze-Rui Zhang	Symmetric operads of Gelfand-Kirillov dimension 1	Yu Ye
18:00-	**Dinner**		

November 5 (Tuesday)

Time	Speaker	Title	Chair
08:30-09:20	Si Li	Homological Method in Topological/Holomorphic QFT	Yun-He Sheng
09:30-10:00	**Coffee Break and Group Photo**		
10:00-10:50	Yan-Yong Hong	Infinite-dimensional Lie bialgebras via affinization of Novikov bialgebras and Koszul duality	Yun-He Sheng
11:00-11:50	Jun-Wu Tu	Feynman compactifications of S^1-equivariant modular operads	
12:00-	**Lunch**		
14:30-15:20	Zheng-Wei Liu	Functional Integral Construction of Topological Quantum Field Theory	Yong-Jun Xu
15:30-16:20	Yi-Long Wang	3-alterfolds and their TQFTs	
16:30-17:00	**Coffee Break**		
17:00-17:50	Rong Tang	Homotopy theory of post-Lie algebras	Yong-Jun Xu
18:00-	**Dinner**		

November 6 (Wednesday)

Time	Speaker	Title	Chair
08:30-09:20	Chris Brav	The cyclic Deligne conjecture and Calabi-Yau structures	Yan-Hong Bao
09:30-10:00		**Coffee Break**	
10:00-10:50	Veronica Pasquarella	Advancements in Functorial Homological Mirror Symmetry	Yan-Hong Bao
11:00-11:50	Jie-Feng Liu	Flato-Gerstenhaber-Voronov cohomology vs classical cohomology for Poisson vertex algebras	
12:00-		**Lunch**	
		Free Discussion	
18:00-		**Dinner**	

November 7 (Thursday)

Time	Speaker	Title	Chair
08:30-09:20	Philip Hackney	The dendroidal approach to higher cyclic operads	Ding-Guo Wang
09:30-10:00	**Coffee Break**		
10:00-10:50	Jun Chen	(De)Coloring in operad theory with applications to homotopy theory of relative Rota-Baxter algebras	Ding-Guo Wang
11:00-11:50	Victor Roca i Lucio	Homotopical operadic calculus in positive characteristic	
12:00-	**Lunch**		
14:30-15:20	Fo-Ling Zou	Unital operads, monoids and monads	Guo-Dong Zhou
15:30-16:20	Zheng-Ping Gui	Chiral Algebras and Operads: Homology, Deformations, and Dualities	
16:30-17:00	**Coffee Break**		
17:00-17:50	Andrea Solotar	Gentle algebras, skew-gentle algebras, surfaces and homological mirror symmetry	Guo-Dong Zhou
18:00-	**Dinner**		

Abstracts

1. **Speaker:** Michael Batanin (Czech Academy of Science)

Title: Coherence for operadic categories

Abstract. Operadic categories were introduced by Batanin and Markl as a tool for handling various kind of generalised operads. These are categories over the category of finite sets equipped with some additional structures of which the most important is the existence of abstract fiber functors for morphisms. These structures must satisfy some finite number of axioms which are necessary to associate a category of generalised operads for each operadic category.

In my talk I will show how to assign a pseudosimplicial symmetric monoidal groupoid to each operadic category which we call operadic nerve. Conversely I will give a characterization of pseudosimplicial symmetric monoidal groupoids which are operadic nerves of operadic categories. I also explain what is an operad over an operadic category in this intrinsic simplicial language. This approach allows a generalization to \infty-groupoidal setting and so a definition of \infty-operadic categories and corresponding \infty-operads. This is joint work with Joachim Kock, Martin Markl and Mark Weber.

2. **Speaker:** Chris Brav (Shanghai Institute for Mathematics and Interdisciplinary Sciences)

Title: The cyclic Deligne conjecture and Calabi-Yau structures

Abstract: The Deligne conjecture, many times a theorem, states that for a dg category C, the dg endomorphisms End(Id_C) of the identity functor-- that is, the Hochschild cochains-- carries a natural structure of 2-algebra. When C is endowed with a Calabi-Yau structure, then Hochschild cochains and Hochschild chains are identified up to a shift, and we may transport the circle action from Hochschild chains onto Hochschild cochains. The cyclic Deligne conjecture states that the 2-algebra structure and the circle action together give a framed 2-algebra structure on Hochschild cochains. We establish the cyclic Deligne conjecture, as well as a variation that works for relative Calabi-Yau structures on dg functors D --> C, more generally for functors between stable infinity categories. We discuss examples coming from oriented manifolds with boundary, Fano varieties with anticanonical divisor, and doubled quivers with preprojective relation. This is joint work with Nick Rozenblyum.

3. **Speaker:** Jun Chen (Nanjing University)

Title: (De)Coloring in operad theory with applications to homotopy theory of relative Rota-Baxter algebras

Abstract: In this talk, I will introduce a (de)coloring method in operad theory which is compatible with Koszul duality theory. More specific, we developed the coloring process from (ordinary) operads to colored operads via the "nice coloring" of operads. It is proved that the coloring process is compatible with taking minimal models and Koszul duality theory. Finally, I will give its application to the minimal model of the colored operad of relative Rota-Baxter Lie algebras.

4. **Speaker**: Vladimir Dotsenko (Université de Strasbourg)

Title: Finite basis property and distributivity questions for varieties of Novikov algebras

Abstract: Novikov algebras are important nonassociative algebras that originally appeared in the study of Hamiltonian operators in the formal calculus of variations by Gelfand and Dorfman, and then rediscovered by Balinskii and Novikov in the context of classification of linear Poisson brackets of hydrodynamical type. In this talk, I shall present two recent results about varieties of Novikov algebras over a field of zero characteristic: first, I shall explain that every variety of Novikov algebras is defined by finitely many identities (that is, has the Specht property), and second, I shall present a classification of all varieties of Novikov algebras whose lattice of subvarieties is distributive. These results are obtained in collaboration with N. Ismailov and U. Umirbaev (the first one) and with B. Zhakhayev (the second one).

5. **Speaker:** Zheng-Ping Gui (The Institute of Mathematical Sciences, The Chinese University of Hong Kong)

Title: Chiral Algebras and Operads: Homology, Deformations, and Dualities

Abstract: In this talk, we will discuss the theory of chiral algebras through the framework of operads. We start by introducing chiral operads and define chiral algebras, connecting them to vertex algebras. Next, we review the theory of chiral homology which can be seen as the Hochschild homology theory in the chiral world. We will then discuss the deformation theory of chiral algebras, especially the formality conjecture. Subsequently, we will turn to chiral Koszul duality and quadratic duality, emphasizing their roles in understanding the structure of chiral algebras. If time permits, we will briefly touch on higher-dimensional chiral operads and their implications.

6. **Speaker**: Philip Hackney (University of Louisiana at Lafayette)

Title: The dendroidal approach to higher cyclic operads

Abstract: Pioneering work by Cisinski, Moerdijk and Weiss investigated the homotopy theory of infinity operads (a higher categorical generalization of operads)

using dendroidal objects, which are presheaves over a category of rooted trees. Our aim is to extend these homotopy theories from operads to cyclic operads. In a cyclic operad, the arity m operations have an additional action by a rotation (of order m+1), which transforms the output of an operation into an input, and one of the inputs into the output. They are the genus zero part of modular operads. Cyclic operads may be described as certain presheaves on the cyclic dendroidal category, which is a category of unrooted trees.

In this talk, we will provide background on dendroidal and cyclic dendroidal objects, as well as some of the primary models for infinity operads. We will introduce technology developed with Drummond-Cole for efficiently lifting Quillen model structures and Quillen equivalences in the presence of adjoint strings. These tools will be applied to establish and compare new models for cyclic infinity operads. This talk is based on joint work with Brandon Doherty.

7. **Speaker:** Lander Hermans (Universiteit Antwerpen)

Title: A minimal model for prestacks via a Koszul duality for box operads

Abstract: Prestacks generalize presheaves of associative algebras and appear in algebraic geometry as noncommutative deformations of the structure sheaf of schemes, as observed by Lowen and Van den Bergh. Presheaves are in the algebraic world often called diagrams of algebras, and they can be encoded by an operad that is notoriously nonquadratic. As a result, classical Koszul duality for operads does not apply. This prompted Markl to pose the question whether there exists a minimal model, and associated deformation complex, governing diagrams of algebras. For prestacks the situation is even more dire: they have besides the quadratic-cubic relations present for presheaves, also cubic-quartic relations.
In this talk, we will generalize (nonsymmetric) operads to box operads and sketch key components from our main result: a Koszul duality for box operads that is able to deal with the nonquadratic relations appearing for prestacks. In particular, we will associate to every box operad a L-infinity algebra generalizing the classical dg Lie-structure from Gerstenhaber. Interestingly, this result also endows the Gerstenhaber-Schack complex for prestacks with a L-infinity structure governing its deformations. In the second part of the talk, we will apply these results to the box operad encoding a lax version of prestacks in order to obtain its minimal model. If time permits, we will show how this sheds a new light on the question by Markl.

8. **Speaker**: Yan-Yong Hong (Hangzhou Normal University)

Title: Infinite-dimensional Lie bialgebras via affinization of Novikov bialgebras and Koszul duality

Abstract: Balinsky and Novikov showed that the affinization of a Novikov algebra naturally defines a Lie algebra, a property that in fact characterizes the Novikov

algebra. It is also an instance of the operadic Koszul duality. In this talk, I will introduce a bialgebra theory for the Novikov algebra, namely the Novikov bialgebra, which is characterized by the fact that its affinization (by a quadratic right Novikov algebra) gives an infinite-dimensional Lie bialgebra, suggesting a Koszul duality for properads. If time permites, I will also introduce a construction of Novikov bialgebras from commutative and cocommutative admissible differential antisymmetric infinitesimal bialgebras. This talk is based on joint works with Cheng-Ming Bai and Li Guo.

9. **Speaker**: Hong-Lei Lang (China Agricultural University)

Title: Rota-Baxter Lie Bialgebras and Rota-Baxter Poisson Lie Groups

Abstract: First we introduce the notion of quadratic Rota-Baxter Lie algebras of arbitrary weight, and show that there is a one-to-one correspondence between factorizable Lie bialgebras and quadratic Rota-Baxter Lie algebras of nonzero weight. Then we introduce the notions of matched pairs, bialgebras and Manin triples of Rota-Baxter Lie algebras, and show that Rota-Baxter Lie bialgebras, Manin triples of Rota-Baxter Lie algebras and certain matched pairs of Rota-Baxter Lie algebras are equivalent. Finally, we present some results on Rota-Baxter Poisson Lie groups. This is joint work in progress with Yunhe Sheng.

10. **Speaker**: Si Li (Tsinghua University)

Title: Homological Method in Topological/Holomorphic QFT

Abstract: We discuss basic ideas and various recent mathematical developments about quantization that arises from topologically/holomorphically twisted quantum field theory. We illustrate some applications in topological/chiral algebraic index, mirror symmetry, and twisted gauge/gravity duality.

11. **Speaker**: Jie-Feng Liu (Northeast Normal University)

Title: Flato-Gerstenhaber-Voronov cohomology vs classical cohomology for Poisson vertex algebras

Abstract: Poisson vertex algebras can be seen as a certain semi-classical limits of vertex algebras and play an important role in integrable system of PDE. In this talk, we introduce the Flato-Gerstenhaber-Voronov cohomology of Poisson vertex algebras, which is a bicomplex induced by the Lie conformal algebra cohomology and the differential Harrison cohomology. As applications, we show that the infinitesimal deformations and abelian extensions of Poisson vertex algebras can be classified by the second cohomology group. Furthermore, we study the relationships between

Flato-Gerstenhaber-Voronov cohomology and the classical Poisson vertex algebra cohomology defined by Bakalov, De Sole, Heluani and Kac. The later cohomology is given by the operad for Poisson vertex algebras. We show that the Flato-Gerstenhaber-Voronov cohomology complex can be induced by the classical Poisson vertex algebra cohomology complex.

12. **Speaker**: Zheng-Wei Liu (Beijing Institute of Mathematical Sciences and Application)

Title: Functional Integral Construction of Topological Quantum Field Theory

Abstract: In the recent paper arXiv:2409.17103v1, we propose a new program to address a long-standing open problem: how to construct a meaningful unitary topological quantum field theory (TQFT) in arbitrary dimension. We construct a unitary n+1 alterfold TQFT from a linear functional on labelled regular stratified piecewise linear n-manifolds. This can be considered as a n-dimensional lattice model. An unitary n-category from higher representations emerges as its local quantum symmtry. The n+1 alterfold TQFT captures its global symmetry. In particular, we construct a non-invertible unitary 3+1 alterfold TQFT from a linear functional and derive its local quantum symmetry as a unitary spherical 3-category of Ising type with explicit 20j-symbols, so that the scalar invariant of 2-knots in piecewise linear 4-manifolds could be computed explicitly.

13. **Speaker:** Victor Roca i Lucio (EPFL)

Title: Homotopical operadic calculus in positive characteristic

Abstract: Algebraic operads provide a powerful tool to understand the homotopy theory of the types of (co)algebras they encode. So far, the principal results and methods that this theory provides were only available in characteristic zero. The main reason is that operads carry an action of all the symmetric groups, whose representation theory is involved in positive characteristic. The goal of this talk will be to explain how one can extend these results and methods over a positive characteristic field. This is joint work with Brice Le Grignou.

14. **Speaker**: Veronica Pasquarella (Shanghai Institute for Mathematics and Interdisciplinary Sciences)

Title: Advancements in Functorial Homological Mirror Symmetry

Abstract: After briefly overviewing the state of the art of the functorial formulation of Homological Mirror Symmetry (HMS), I will explain the importance of further generalising the mathematical structure underlying it. The main motivation comes from its applicability to String Theory, with quiver gauge theories playing a crucial

role in the setting. However, as we shall see, generalising functorial HMS also constitutes a promising setting for pure mathematics advancements in their own right.

15. **Speaker:** Andrea Solotar (University of Buenos Aires)

Title: Gentle algebras, skew-gentle algebras, surfaces and homological mirror symmetry

Abstract: Derived categories are in general not easy to describe. However, in certain cases, combinatorial models give a good picture of these categories. This is the case of the bounded derived categories of gentle algebras which can be represented in terms of curves and crossings of curves on surfaces. I will also talk about skew-gentle algebras.
In this talk I will give an outskirt of the construction of these surface models and briefly explain how they are connected to homological mirror symmetry.

16. **Speaker**: Rong Tang (Jilin University)

Title: Homotopy theory of post-Lie algebras

Abstract: Guided by Koszul duality theory, we consider the graded Lie algebra of coderivations of the cofree conilpotent graded cocommutative cotrialgebra generated by V. We show that in the case of V being a shift of an ungraded vector space W, Maurer-Cartan elements of this graded Lie algebra are exactly post-Lie algebra structures on W. The cohomology of a post-Lie algebra is then defined using Maurer-Cartan twisting. The second cohomology group of a post-Lie algebra has a familiar interpretation as equivalence classes of infinitesimal deformations. Next we define a post-Lie$_\infty$ algebra structure on a graded vector space to be a Maurer-Cartan element of the aforementioned graded Lie algebra. Post-Lie$_\infty$ algebras admit a useful characterization in terms of L_∞-actions (or open-closed homotopy Lie algebras). Finally, we introduce the notion of homotopy Rota-Baxter operators on open-closed homotopy Lie algebras and show that certain homotopy Rota-Baxter operators induce post-Lie$_\infty$ algebras.

17. **Speaker**: Jun-Wu Tu (ShanghaiTech University)

Title: Feynman compactifications of S^1-equivariant modular operads

Abstract: We shall review a theorem proved by Drummond-Cole in his thesis (following a suggestion of Kontsevich) which states that an action of the framed little disks operad and a trivialization of the circle action is the same information as an action of the Deligne-Mumford-Knudsen operad. Then we relate this theorem with the so-called Feynman compactification construction, which allows generalization of

D-C's theorem to the higher genus setup. This is partially a joint work with Lino Amorim.

18. **Speaker:** Yi-Long Wang (Beijing Institute of Mathematical Sciences and Application)

Title: 3-alterfolds and their TQFTs

Abstract: In this talk, we introduce the notion of 3-alterfolds as a generalization of the planar algebra of Jones. We then explain how we get invariants of 3-alterfolds from local moves and the spherical graphical calculus of a spherical fusion category that generalizes the Reshetikhin-Turaev and the Turaev-Viro invariants/TQFTs, and how their equivalence follows easily from the alterfold calculus.

19. **Speaker:** Ze-Rui Zhang (South China Normal University)

Title: Symmetric operads of Gelfand-Kirillov dimension 1

Abstract: We first study the equivalence of categories involving (prime) saturated symmetric operads. Then we classify finitely generated prime symmetric operads of Gelfand-Kirillov dimension 1 and finitely generated saturated linear symmetric operads. This is a joint work with Yu Li, Zihao Qi, Yongjun Xu, James J. Zhang and Xiangui Zhao.

20. **Speaker:** Xian-Gui Zhao (Huizhou University)

Title: Growth and Gelfand-Kirillov dimension of operads

Abstract: In this talk, we study the growth and Gelfand-Kirillov dimension (GK-dimension) of operads. In particular, analogues of Bergman's gap theorem are proved for operads, namely, no finitely generated locally finite nonsymmetric (resp., symmetric) operad has GK-dimension strictly between 1 and 2. On the contrary, for an arbitrary real number $r\geq 1$, there exist shuffle operads of GK-dimension r. This is a joint work with Yu Li, Zihao Qi, Yongjun Xu, James Zhang, and Zerui Zhang.

21. **Speaker:** Fo-Ling Zou (Chinese Academy of Sciences)

Title: Unital operads, monoids and monads
Abstract: Operads have played an important role in both topology and algebra. It is well known that operads may be viewed as monoids in symmetric sequences. In topology, it is often sensible to work with unital operads and their (reduced) monads. I will discuss a variant of symmetric sequences in which monoids give unital operads. This is joint work with Peter May and Ruo-Qi Zhang.