Rota-Baxter 代数及其相关课题研讨会
—— 纪念陈省身先生诞辰 110 周年

服务指南

会议日程

报告摘要

会议通讯录

南开大学陈省身数学研究所
中国 • 天津

2021 年 10 月 22 — 25 日

会 议 组 织 者

白承铭　（南开大学）　　郭　锂　（Rutgers University）
高　兴　（兰州大学）　　喻厚义　（西南大学）
黎允楠　（广州大学）　　裴　俊　（西南大学）
郑上华　（江西师范大学）

致 谢

衷心感谢以下单位对本次会议的大力支持：

- 南开大学
- 南开大学陈省身数学研究所
- 国家自然科学基金委

服 务 指 南

1. 10 月 22 日会议报到，地点：嘉园；10 月 23-24 日会议报告，地点：省身楼 216 教室；10 月 25 日离会。
2. 10 月 23 日上午 8:10 在省身楼前合影。
3. 会议利用腾讯会议线上同步进行，会议 ID：856 5721 6892，会议链接：

   https://meeting.tencent.com/dm/L8Bl79acsPQu

4. 住在嘉园的外地参会代表会议期间请在嘉园用早餐，时间 7:00-8:00。
5. 所有参会代表会议期间请在嘉园用午餐和晚餐，具体时间为：

   10 月 22 日晚餐，时间为 18:00-19:00，自助餐；

   10 月 23 日午餐，时间为 12:00-12:40，自助餐；

   10 月 23 日晚餐，时间为 18:00 开始，会议桌餐；

   10 月 24 日午餐，时间为 12:00-12:40，自助餐;

   10 月 24 日晚餐，时间为 18:00-19:00，自助餐。

6. 如有需要会议通知的代表，请在报到处或茶歇处领取。
7. 为做好疫情防控工作，报到时请您出示 **48 小时以内的核酸检测阴性证明、14 天行程卡和天津健康码**，配合测量体温，科学佩戴口罩。
8. 为保证会场秩序，会议期间请将通讯工具设置为振动或静音模式。
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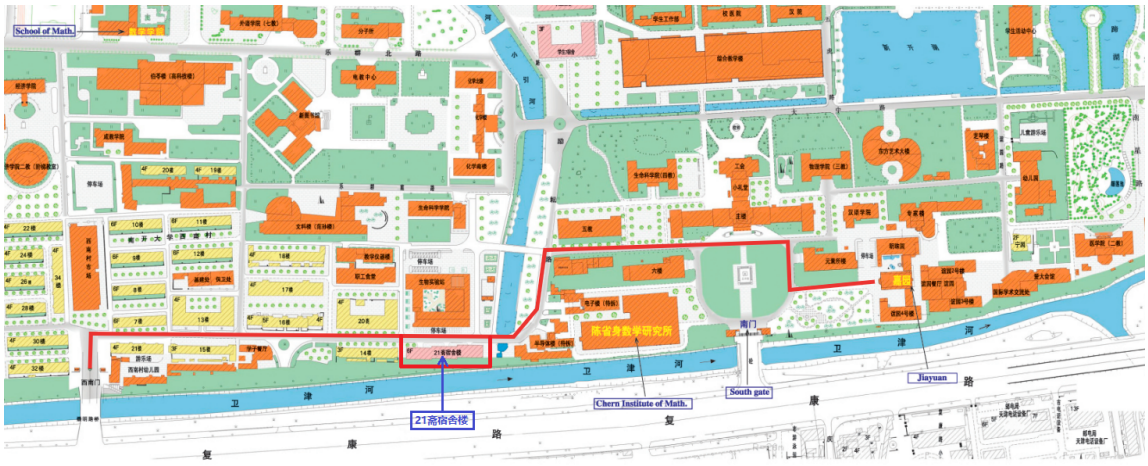

会 议 日 程

10 月 22 日（星期五）

会议报到，地点：嘉园

10 月 23 日（星期六）

会议报告，地点：省身楼 216 教室，腾讯会议 ID：856 5721 6892

时间	报告人	报告题目	主持人
08:10-08:20	合影，地点：省身楼前		
08:20-08:30	开幕致辞		高　兴
08:30-09:05	景乃桓	Lattice structure of modular vertex algebras	王顶国
09:05-09:40	胡乃红	Some related work on the classification of finite fusion categories and finite-dimensional Hopf algebras	
09:40-10:00	茶休		
10:00-10:35	张良云	Rota-Baxter operators on weak Hopf algebras	胡乃红
10:35-11:10	郎红蕾	Integration and Geometrization of Rota-Baxter Lie algebras	
11:10-11:45	郑上华	Rota-Baxter type operators, rewriting systems and Gröbner-Shirshov bases	
12:00-12:40	午餐		
14:30-15:05	周国栋	Deformations and homotopy theory of Rota-Baxter algebras	生云鹤
15:05-15:40	张　毅	Matching (multiple) Rota-Baxter algebras	
15:40-16:00	茶休		
16:00-16:35	李利平	Sheaves of modules on atomic sites and discrete representations of topological groups	周国栋
16:35-17:10	刘杰锋	Deformations and cohomologies of relative Rota-Baxter operators on Lie algebroids and Koszul-Vinberg structures	
17:10-17:45	喻厚义	Renormalization of quasisymmetric functions	
18:00-20:00	晚餐		

10 月 24 日（星期日）

会议报告，地点：省身楼 216 教室，腾讯会议 ID：856 5721 6892

时间	报告人	报告题目	主持人
08:30-09:05	张　斌	Renormalization of Feynman amplitudes on Riemannian manifolds	李利平
09:05-09:40	王顶国	Hopf algebra actions on Artin-Schelter regular algebras	
09:40-10:00	茶休		
10:00-10:35	赵显贵	Gelfand-Kirillov dimension of operads	张良云
10:35-11:10	张泽锐	Some new applications of Groebner-Shirshov bases theory	
11:10-11:40	黎允楠	An algebraic study of Volterra integral equations and their operator linearity	
12:00-12:40	午餐		
14:30-15:05	杨立波	Incidence algebras and Kazhdan-Lusztig polynomials	梁　力
15:05-15:40	甘爱萍	On differential lattices	
15:40-16:00	茶休		
16:00-16:35	唐　荣	Deformations and homotopy theory of relative Rota-Baxter Lie algebras	杨立波
16:35-17:10	王　凯	The deformation theory and homotopy theory for differential algebras of any weight	
17:10-17:45	张虎虎	Compatible structures of homogeneous operads	
18:00-20:00	晚餐		

10 月 25 日（星期一）

离会

感谢大家参会，欢迎再次光临南开大学陈省身数学研究所交流访问!

报 告 摘 要

Lattice structure of modular vertex algebras

景乃桓
North Carolina State University

Abstract: The integral lattice of VOA was constructed by Dong and Griess for finite automorphism group of the VOA. We will show that the general divided powers of vertex operators preserve the integral form spanned by Schur functions indexed by partition-valued functions, which generate an analog of the Kostant-Lusztig Z-form for the lattice VOA. In particular, we show that the Garland operators, counterparts of divided powers of Heisenberg elements in affine Lie algebras, also preserve the integral form. We also study the irreducible modules for the modular lattice vertex algebra.

Some related work on the classification of finite fusion categories and finite-dimensional Hopf algebras

胡乃红
华东师范大学

Abstract: In the past two decades, finite tensor category has developed into a new research subject. I will give a brief introduction to the aspects of this subject which are related to the studies of finite-dimensional Hopf algebras including some results of ours, as well as my former Ph. D. student Dr. Zhiqiang Yu.

Rota-Baxter operators on weak Hopf algebras

张良云
南京农业大学

Abstract: In this report, we introduce the conception of a Rota-Baxter operator on a weak Hopf Algebra, and give some basic properties about it. Moreover, we construct Rota-Baxter operators on a weak Hopf algebra from its antipode, source map and normalized integral. In the end, we construct a kind of new weak Hopf algebra from a Rota-Baxter operator on a weak Hopf algebra.

Integration and Geometrization of Rota-Baxter Lie algebras

郎红蕾
中国农业大学

Abstract: Rota-Baxter operators on Lie algebras were first studied by Belavin, Drinfeld and Semenov-Tian-Shansky as operator forms of the classical Yang-Baxter equation. Integrating the Rota-Baxter operators on Lie algebras, we introduce the notion of Rota-Baxter operators on Lie groups and more generally on groups. The factorization theorem for Lie groups is obtained. For geometrization, the notions of Rota-Baxter Lie algebroids and Lie groupoids are introduced. A Rota-Baxter Lie algebroid naturally gives rise to a post-Lie algebroid. Examples and applications are provided for these new notions. This is a joint work with Li Guo and Yunhe Sheng.

Rota-Baxter Type Operators, Rewriting Systems and Gröbner-Shirshov bases

郑上华
江西师范大学

Abstract: In this talk, we apply the methods of rewriting systems and Gröbner-Shirshov bases to give a unified approach to study a class of linear operators on associative algebras. These operators resemble the classic Rota-Baxter operator, and we call them Rota-Baxter type operators. For any given Rota-Baxter type operator P, we consider the category $\mathcal{C}_P$ of associative algebras R on which such an operator is defined and study its free objects. We characterize P by the simultaneous convergency of certain rewriting systems on all free objects in $\mathcal{C}_P$. By relating the operator to Gröbner-Shirshov bases of the free objects, we also obtain uniformly canonical bases for these free operated algebras. We prove there are exactly 14 Rota-Baxter type operators, and these include as special cases several known ones, such as the Rota-Baxter and the Nijenhuis operators.

Deformations and homotopy theory of Rota-Baxter algebras

周国栋
华东师范大学

Abstract: We study the formal deformations and homotopy of Rota-Baxter algebras of any given weight. We define an L_∞-algebra that controls simultaneous the deformations of the associative product and the Rota-Baxter operator of a Rota-Baxter algebra. As a consequence, we develop a cohomology theory of Rota-Baxter algebras of any given weight and justify it by interpreting the lower degree cohomology groups as formal deformations and abelian extensions. The notion of homotopy Rota-Baxter algebras is introduced and it is shown that the operad governing homotopy Rota-Baxter algebras is a minimal model of the operad of Rota-Baxter algebras.

Matching (multiple) Rota-Baxter algebras

张　毅
南京信息工程大学

Abstract: We introduce the notion of a matching Rota-Baxter algebra motivated by the recent work on multiple pre-Lie algebras arising from the study of algebraic renormalization of regularity structures. This notion is also related to iterated integrals with multiple kernels and solutions of the associative polarized Yang-Baxter equation. Generalizing the natural connection of Rota-Baxter algebras with dendriform algebras to matching Rota-Baxter algebras, we obtain the notion of matching dendriform algebras. As in the classical case of one operation, matching Rota-Baxter algebras and matching dendriform algebras are related to matching pre-Lie algebras which coincide with the aforementioned multiple pre-Lie algebras. More general notions and results on matching tridendriform algebras and matching PostLie algebras are also obtained. This is a joint work with Xing Gao and Li Guo.

Sheaves of modules on atomic sites and discrete representations of topological groups

李利平
湖南师范大学

Abstract: It is well known that the category of discrete G-sets of a topological group G is equivalent to the category of sheaves of sets over certain atomic sites, establishing a close relation between representation theory of topological groups and topos theory. In this talk we interpret notions in sheaf theory in the language of representation theory of categories, and obtain equivalences between sheaf categories and Serre quotients of representation categories. Furthermore, via applying the Nakayama functor, we classify simple discrete representations of a few important topological groups such as infinite symmetric groups, infinite general linear groups over a finite field, the automorphism group of the poset of rational numbers.

This work is joint with Zhenxing Di (Northwest Normal Univ.), Li Liang (Lanzhou Jiaotong Univ.), and Fei Xu (Shantou Univ.).

Deformations and cohomologies of relative Rota-Baxter operators on Lie algebroids and Koszul-Vinberg structures

刘杰锋
东北师范大学

Abstract: Given a Lie algebroid with a representation, we construct a graded Lie algebra whose Maurer-Cartan elements characterize relative Rota-Baxter operators on Lie algebroids. We give the cohomology of relative Rota-Baxter operators and study infinitesimal deformations and extendability of order n deformations to order n+1 deformations of relative Rota-Baxter operators in terms of this cohomology theory. We also construct a graded Lie algebra on the space of multi-derivations of a vector bundle whose Maurer-Cartan elements characterize left-symmetric algebroids. We show that there is a homomorphism from the controlling graded Lie algebra of relative Rota-Baxter operators on Lie algebroids to the controlling graded Lie algebra of left-symmetric algebroids. Consequently, there is a natural homomorphism from the cohomology groups of a relative Rota-Baxter operator to the deformation cohomology groups of the associated left-symmetric algebroid. As applications, we give the controlling graded Lie algebra and the cohomology theory of Koszul-Vinberg structures on left-symmetric algebroids.

Renormalization of quasisymmetric functions

喻厚义
西南大学

Abstract: In this talk, we will adapt the method of renormalization in quantum field theory to deal with the divergency of weak quasisymmetric functions. The algebra of renormalized quasisymmetric functions thus obtained turns out to be isomorphic to the Hopf algebra of weak compositions. This isomorphism gives the free commutative Rota-Baxter algebra a power series realization, in support of a suggestion of Rota that Rota-Baxter algebra should provide a broad context for generalizations of symmetric functions. This is joint work with Li Guo and Bin Zhang.

Renormalization of Feynman amplitudes on Riemannian manifolds

张　斌
四川大学

Abstract: In this talk, we study a spectral regularization for Feynman amplitudes on Riemannian manifolds. The aim is to build mathematical foundations for the renormalization of perturbative interacting quantum fi eld theories. Our main result shows that spectrally regularized Feynman amplitudes admit an analytic continuation as meromorphic germs with linear poles. We also give

position of possible poles. Our proof relies on suitable resolution of singularities of products of heat kernels. As an application of the analytic continuation result, we build renormalization maps which satisfy the consistency conditions introduced in the work of Nikolov-Todorov-Stora. This is joint work with V. Dang.

Hopf algebra actions on Artin-Schelter regular algebras

王顶国
曲阜师范大学

Abstract: In this talk, we review some recent results of Hopf actions on algebras. Then we classify all inner-faithful of a non-semisimple Hopf algebra actions on noetherian Koszul Artin-Schelter regular algebras of global dimension up to three. This is based on a joint work with Hui-Xiang Chen and James J. Zhang.

Gelfand-Kirillov dimension of operads

赵显贵
惠州学院

Abstract: We study the Gelfand-Kirillov dimension of operads. An analogue of Bergman's gap theorem is proved, namely, no finitely generated locally finite nonsymmetric (resp., symmetric) operad has GK-dimension strictly between 1 and 2. For every $r \in \{0\} \cup \{1\} \cup [2, \infty)$ or $r = \infty$, we construct a single-element generated nonsymmetric operad with Gelfand-Kirillov dimension r. We also provide counterexamples to two expectations of Khoroshkin and Piontkovski about the generating series of operads.

Some new applications of Groebner-Shirshov bases theory

张泽锐
华南师范大学

Abstract: We shall introduce some new applications of Groebner-Shirshov bases theory in various kind of algebras. More precisely, by applying Groebner-Shirshov bases theory, we construct a shuffle operad of Gelfand-Kirillov dimension strictly between 1 and 2; we offer fast algorithms for calculating the Gelfand-Kirillov dimension of finitely presented bicommutative algebras; we show that the varieties of Lie-admissible algebras and Lie algebras form a PBW pair;and we construct free dibands (i.e. free idempotent dimonoids) and free tribands (i.e. free idempotent trioids) generated by an arbitrary set.

An algebraic study of Volterra integral equations and their operator linearity

黎允楠
广州大学

Abstract: The algebraic study of special integral operators led to the notions of Rota Baxter operators and shuffle products which have found broad applications such as iterated integrals. In this talk we point out that there are rich algebraic structures underlying Volterra integral operators and the corresponding equations.

First Volterra integral operators with separable kernels can produce a matching twisted Rota-Baxter algebra satisfying twisted integration-by-parts operator identities. To provide a universal space to express general integral equations, we construct free (relative) operated algebras in terms of bracketed words or rooted trees with decorations on the vertices and edges.

Utilizing the free construction of matching Rota-Baxter algebras by Gao Guo-Zhang, further explicit constructions of the free objects in the category of matching twisted Rota-Baxter algebras are given, providing a universal space for separable Volterra equations. As an application, we show that any separable Volterra integral equation is operator linear in the sense that it can be simplified to a linear combination of iterated integrals.

This is joint work with Li Guo and Richard Gustavson.

Incidence algebras and Kazhdan-Lusztig polynomials

杨立波
南开大学

Abstract: The Kazhdan-Lusztig polynomial of a matroid was introduced by Elias, Proudfoot and Wakefield, analogous to the classical Kazhdan-Lusztig polynomial of the symmetric group. Proudfoot pointed out that the Kazhdan-Lusztig polynomials of matroids can also be considered as a special case of the Kazhdan-Lusztig-Stanley polynomials with respect to the incidence algebra of the lattice of flats. This point of view is very helpful for studying the matroid Kazhdan-Lusztig polynomials. In this talk we will show how to use this to compute the Kazhdan-Lusztig polynomials for uniform matroids.

On differential lattices

甘爱萍
江西师范大学

Abstract: This paper studies the differential lattice, defined to be a lattice L equipped with a map $d : L \to L$ that satisfies a lattice analog of the Leibniz rule for a derivation. Isomorphic

differential lattices are studied and classifications of differential lattices are obtained for some basic lattices. Several families of derivations on a lattice are explicitly constructed, giving realizations of the lattice as lattices of derivations. Derivations on a finite distributive lattice are shown to have a natural structure of lattice. Moreover, derivations on a complete infinitely distributive lattice form a complete lattice. For a general lattice, it is conjectured that its poset of derivations is a lattice that uniquely determines the given lattice. This is joint work with Li Guo.

Deformations and homotopy theory of relative Rota-Baxter Lie algebras

唐　荣
吉林大学

Abstract: We determine the L-infty-algebra that controls deformations of a relative Rota-Baxter Lie algebra and show that it is an extension of the dg Lie algebra controlling deformations of the underlying LR pair by the dg Lie algebra controlling deformations of the relative Rota-Baxter operator. Consequently, we define the cohomology of relative Rota-Baxter Lie algebras and relate it to their infinitesimal deformations. A large class of relative Rota-Baxter Lie algebras is obtained from triangular Lie bialgebras and we construct a map between the corresponding deformation complexes. Next, the notion of a homotopy relative Rota-Baxter Lie algebra is introduced. We show that a class of homotopy relative Rota-Baxter Lie algebras is intimately related to pre-Lie-infty-algebras.

The deformation theory and homotopy theory for differential algebras of any weight

王凯
华东师范大学

Abstract: In this talk, we will recall the cohomology theory for differential algebras of any weight defined by Guo, Li, Sheng and Zhou, which controls the formal deformations of differential algebras of any weight. Then we will introduce an L-infinity algebra such that the cohomology theory for differential algebras can be realized as twisting procedure in this L-infinity algebras. Precisely, a differential algebra structure of any weight is equivalent to a Maurer-Cartan element in this L-infinity algebra and the twisting L-infinity algebra by a Maurer-Cartan element is exactly the cochain complex of the corresponding differential algebra. Then we will introduce the notion of homotopy differential algebras of any weight and we will see the differential graded operad governing homotopy differential algebras is the minimal model for the operad governing differential algebras. This talk is based on joint work with Li Guo and Guodong Zhou.

Compatible structures of homogeneous operads

张虎虎
兰州大学

Abstract: Various compatibility conditions among replicated copies of operations in a given algebraic structure have appeared in broad contexts in recent years. Taking an uniform approach, we give an operadic study of compatibility conditions for homogenous operads. This generalizes the previous studies for binary quadratic symmetric operads and unary binary quadratic\cubic nonsymmetric operads. We consider three compatibility conditions, namely the linear compatibility, matching compatibility and total compatibility, with increasingly strict restraints among the replicated copies. This is a joint work with Xing Gao and Li Guo.

会 议 通 讯 录

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