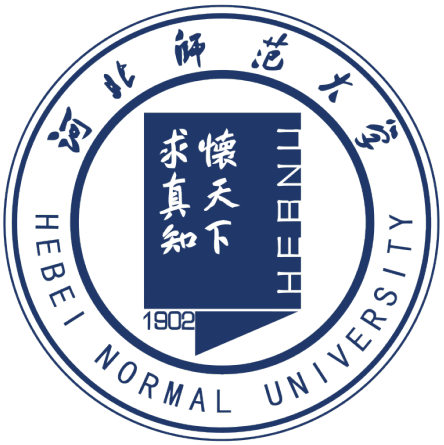
School of Mathematical Sciences, Hebei Normal University

Genesis of Finite Simple Groups: 66 and 6

Shijiazhuang, China, December 1–5, 2024

Abstracts



Shijiazhuang, China – 2024

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Alexander Ivanov, Hebei Normal University
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General Information

Venue: The International Conference "Genesis of Finite Simple Groups: 66 and 6" will take place at Huayang Holiday Hotel, Zhengding County, Shijiazhuang, China on December 1–5, 2024.

The main goal: On September 1st, 2024 Alexander Ivanov joined the School of Mathematical Sciences of Hebei Normal University, Shijiazhuang, China. The conference aims to cover modern aspects of group theory, to make that the leading experts would know the new center of research in finite groups and related topics, and to mark a sort of anniversary of Alexander Ivanov who turns 66 years and 6 months with the number 666 being of some importance in Chinese culture.

Language: The official language of the event is English.

Program: The program includes 50-minute plenary talks and 25-minute contributed talks.

Organizers:
Sergey Goryainov, Hebei Normal University
Alexander Ivanov, Hebei Normal University
Jing Xin, Hebei Normal University
Liping Yuan, Hebei Normal University

Organized by: Hebei Normal University, School of Mathematical Sciences

Sponsors:
National Natural Science Foundation of China
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School of Mathematical Sciences, Hebei Normal University

Website: `http://app.hebtu.edu.cn/2024gfsg/`

Timetable

The International Conference "Genesis of Finite Simple Groups: 66 and 6", December 1-5, 2024, Shijiazhuang, China						
Saturday November 30	Sunday December 1	Monday December 2	Tuesday December 3	Wednesday December 4	Thursday December 5	Friday December 6
9:00-21:00 Registration	7:00-9:00 Breakfast		Excursion	7:00-9:00 Breakfast		Departure
	9:15-9:30 Opening conference					
	Morning sessions			Morning sessions		
	9:30-10:20 Akihiro Munemasa	9:30-10:20 Andrey Vasil'ev		9:30-10:20 Xiaoye Liang	9:30-10:20 Jack Koolen	
	10:20-10:40 Coffee/tea break			10:20-10:40 Coffee/tea break		
	10:40-11:30 Da Zhao	10:40-11:30 Ilya Gorshkov		10:40-11:30 Albert Gevorgyan	10:40-11:30 Wei-Juan Zhang	
	11:30-13:00 Lunch			11:30-13:00 Lunch		
	Afternoon sessions			Afternoon sessions		
	14:00-14:50 Yan Zhu	14:00-14:50 Mario Mainardis		14:00-14:50 Antonio Pasini	14:00-14:50 Jin-Xin Zhou	
	14:50-15:10 Coffee/tea break			14:50-15:10 Coffee/tea break		
	15:10-16:00 Andrey Mamontov	15:10-16:00 Clara Franchi		15:10-16:00 Shaofei Du	15:10-16:00 Sergey Shpectorov	
		16:00-16:10 Break		16:00-16:10 Break		
		16:10-17:00 Jozef Van Bon		16:10-16:35 Wenjuan Luo		
		17:00-17:15 Conference photo		16:35-17:00 Hao Yu		
				17:00-17:10 Break		
				17:10-17:35 Tianlei Zhou		
				17:35-18:00 Salvatore Tringali		
	18:00-20:00 Dinner			18:00-20:00 Dinner		

Program

Sunday, December 1

07:00 - 09:00	Breakfast
09:15 - 09:30	Opening conference
09:30 - 10:20	Akihiro Munemasa: *The regular two-graph on 276 vertices revisited*
10:20 - 10:40	Coffee/tea break
10:40 - 11:30	Da Zhao: *Construction of spherical designs and unitary designs*
11:30 - 13:00	Lunch
14:00 - 14:50	Yan Zhu: *Multivariate P- and/or Q-polynomial association schemes*
14:50 - 15:10	Coffee/tea break
15:10 - 16:00	Andrey Mamontov: *On finiteness conditions in groups*
18:00 - 20:00	Dinner

Monday, December 2

07:00 - 09:00	Breakfast
09:30 - 10:20	Andrey Vasil'ev: *On the closures of finite permutation groups*
10:20 - 10:40	Coffee/tea break
10:40 - 11:30	Ilya Gorshkov: *On 4-generated axial algebras of Jordan type half*
11:30 - 13:00	Lunch
14:00 - 14:50	Mario Mainardis: *Majorana representations of finite groups*
14:50 - 15:10	Coffee/tea break
15:10 - 16:00	Clara Franchi: *2-generated axial algebras of Monster type*
16:00 - 16:10	Break
16:10 - 17:00	Jozef Van Bon: *Locally s-arc transitive graphs*
17:00 - 17:15	Conference photo
18:00 - 20:00	Dinner

Tuesday, December 3

Excursion

Wednesday, December 4

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10:20 - 10:40	Coffee/tea break
10:40 - 11:30	Albert Gevorgyan: *Monster embeddings of 3-transposition groups via Majorana rerpesentations*
11:30 - 13:00	Lunch
14:00 - 14:50	Antonio Pasini: *Projective embeddings of long root geometries*
14:50 - 15:10	Coffee/tea break
15:10 - 16:00	Shaofei Du: *Decomposition of groups and Cayley maps*
16:00 - 16:10	Break
16:10 - 16:35	Wenjuan Luo: *Edge-transitive graphs of valency twice a prime have a semiregular automorphism*
16:35 - 17:00	Hao Yu: *Group factorizations and product groups*
17:00 - 17:10	Break
17:10 - 17:35	Tianlei Zhou: *Hamiltonian cycles in connected vertex-transitive graphs*
17:35 - 18:00	Salvatore Tringali: *The class of groups is globally closed*
18:00 - 20:00	Dinner

Thursday, December 5

07:00 - 09:00	Breakfast
09:30 - 10:20	Jack Koolen: *Distance-regular graphs with classical parameters*
10:20 - 10:40	Coffee/tea break
10:40 - 11:30	Wei-Juan Zhang: *Constructing chiral polytopes with Coxeter groups*
11:30 - 13:00	Lunch
14:00 - 14:50	Jin-Xin Zhou: *On automorphism groups of bi-quasiprimitive 2-arc-transitive graphs*
14:50 - 15:10	Coffee/tea break
15:10 - 16:00	Sergey Shpectorov: *Algebras of Jordan and Monster type*
18:00 - 20:00	Dinner

Friday, December 6

Departure

Abstracts

Plenary and Contributed talks are listed alphabetically with respect to the Presenting Author

Plenary Talks

Decomposition of Groups and Cayley Maps

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A (topological) map is a cellular decomposition of a closed surface. A common way to describe maps is to view them as 2-cell embeddings of graphs. A Cayley map is an embeddings of a Cayley graph. The studies of regular (Cayley-) maps are related to decomposition of groups. In this paper, some recent results on decomposition of groups will be introduced.

References

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2-generated axial algebras of Monster type

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Extending earlier work by A.A. Ivanov [6] on Majorana algebras, axial algebras of Monster type were introduced in 2015 by Hall, Rehren and Shpectorov [5] in order to axiomatise some key features of certain classes of algebras related to large families of finite simple groups, such as the weight-2 components of OZ-type vertex operator algebras, Jordan algebras, and Matsuo algebras.

In this talk I'll present the current status of the classification of the 2-generated primitive axial algebras of Monster type. This is a joint project with Mario Mainardis, Justin McInroy and Sergey Spectorov.

References

[1] Clara Franchi, Mario Mainardis, Classifying 2-generated symmetric axial algebras of Monster type, *J. Algebra* **596** (2022), 200–218.

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Monster embeddings of 3-transposition groups via Majorana rerpesentations

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The Monster group M is the largest sporadic simple group with more than $8 \cdot 10^{53}$ elements. In addition, it is the group of automorphisms of the $196,884$-dimensional Fischer-Griess algebra V_M, which is equipped with a positive definite inner product $(\cdot,\cdot)$, and a commutative, non-associative algebra $\cdot$, which satisfy to the relation $(x \cdot y, z) = (x, y \cdot z)$. The algebra V_M is generated by a set of axial vectors A. In 2009, A. A. Ivanov axiomatized some properties of the axes $a \in A$ and introduced the notions of Majorana algebra and Majorana representation. Later, Majorana theory proved to be a powerful machinery to study the subgroup structure of M, and the subalgebra structure of V_M.

The 3-transposition groups with a trivial center and simple derived subgroups are categorized by B. Fischer. In addition, the Monster group M contains subgroups isomorphic to quite big 3-transposition groups, or their subgroups of index 2. Therefore, there is a motivation to study Majorana representations of 3-transposition groups.

Firstly, we find the sizes of the maximal symmetric subgroups of the groups from the Fischer list, generated by the transpositions. Then, we use this information to find all pairs of 3-transposition groups from the Fischer list, which can be embedded into each other. Furthermore, we find groups from the Fischer list, which admit a standard Majorana representation. The main result is that a group from the Fischer list, except possibly Fi_{24}, admits a standard Majorana representation if and only if it can be embedded in the Monster group.

On 4-generated axial algebras of Jordan type half

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Axial algebras are a class of non-associative commutative algebras whose properties are defined in terms of the fusion law. When this fusion law is graded, the algebra has a naturally associated automorphism group, and thus axial algebras are related to group theory. Examples of axial algebras include most Jordan algebras and the Grice algebra. In this talk, we introduce the notion of axial algebra and concentrate on axial algebras of Jordan type half.

Distance-regular graphs with classical parameters

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In this talk we study distance-regular graphs with classical parameters (D, b, α, β). There are many examples of distance-regular graphs with classical parameters. For $b = 1$ they were classified by Terwilliger in the the 1990's. So from now on we assume $b \geq 2$.

It is known that $\alpha \leq b^3$ if the diameter D is at least 9. In 1999 Metsch showed that $\beta \leq b^{5+2D}$, or the graph is known.

In this talk we will improve it to $\beta \leq b^{5+D}$, or the graph is known. We will also show that this bound is close to be tight.

(This talk is based on joint work with Chenhui Lv.)

The Terwilliger algebra of the q-Johnson graph

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Q-polynomial distance-regular graphs are important research objects in algebraic combinatorics: Q-polynomial distance-regular graphs are not only interesting for their own sake but also important as underlying spaces for coding/design theory. Terwilliger introduced the subconstituent algebra, which is also called Terwilliger algebra (denoted by T), as a combinatorial analog of the centralizer algebra (denoted by S) of the one-point stabilizer of the automorphism group. He posed the question of how many examples of Q-polynomial distance-regular graphs exist where T coincides with S. This talk will focus on two typical Q-polynomial distance-regular graphs, namely the Johnson graph and the q-Johnson graph, and will explore the relationship between the algebras T and S.

This is based on joint work with Tatsuro Ito, Yuta Watanabe and Ying-Ying Tan.

Majorana Representations of Finite Groups

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Introduced by A.A. Ivanov in [1] Majorana representations provide an axiomatic framework for studying the embeddings of certain finite groups into the Monster. I will give a brief introduction to this theory and give an account of the recent results on Majorana representations of the alternating groups and of the methods involved.

References

[1] Alexander A. Ivanov, The Monster group and Majorana involutions, Cambridge Tracts in Mathematics, **176**, Cambridge Univ. Press, Cambridge, 2009.

On finiteness conditions in groups

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Some of the properties of finite groups may have analogues in broader classes of groups satisfying some restrictions weaker than the finiteness of the number of elements. Such restrictions are called *finiteness conditions*, two classical examples are local-finiteness and periodicity. A group is called *locally finite* if every its finitely generated subgroup is finite. A group is called *periodic* if every its element is of finite order. Obviously, locally finite groups are periodic, and the famous Burnside problem discusses when the opposite is true.

Another example of the finiteness condition would be to state that G is a group of 3-transpositions, i.e. G is generated by a normal set of involutions D such that the order $|xy| \leq 3$ for any $x, y \in D$. This is because a group of 3-transpositions is locally finite, by the classical result.

In the talk I want to give some review on the recent research on finiteness conditions: in particular, on groups with the given set of element orders; on 6-transposition groups, and related research on axial and Majorana algebras; and on groups, generated by a conjugacy class C of elements of order 3 satisfying some restrictions on 2-generated subgroups.

The regular two-graph on 276 vertices revisited

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The McLaughlin graph Γ is the unique strongly regular graph with parameters $(275, 162, 106, 81)$. Its automorphism group contains the sporadic finite simple group McL (see [4]) as a subgroup of index 2. The switching class of the graph $\Delta = K_1 \cup \Gamma$ is a regular two-graph on 276 vertices, whose uniqueness was shown by Goethals and Seidel [2]. It is known that there are a number of strongly regular graphs with parameters $(276, 140, 58, 84)$ contained in this switching class (see [3, 5]).

The set of 276 equiangular lines represented by this regular two-graph is commonly understood as a hyperplane section of the Leech lattice. In our earlier work [1], we introduced the concept of a switching root for a set of equiangular lines. Using this idea, it becomes possible to represent the vertices of the graphs in the switching class as a subset of norm 3 vectors in some lattice L of dimension 24. We classify graphs in the switching class whose representing vectors generate a proper sublattice of L. The obvious example of such a graph is Δ itself. It turns out that, there are only four such graphs other than Δ itself, none of which is regular, and all of which generate a sublattice of index 2 in L.

This is joint work with Jack Koolen.

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Projective embeddings of long root geometries

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According to a widely held belief, nothing unexpected can occur with projective embeddings of Lie geometries, except possibly when they are defined over a very small field (e.g., over $\mathbb{F}_2$). In particular, it is supposed that all of them admit the absolutely universal embedding (from which all other projective embeddings of the given geometry can be obtained as projections) and this absolute embedding is the one hosted by the appropriate Weyl module. In my talk I will present two results which disprove this belief. (1) The long-root geometry $A_{n,\{1,n\}}(\mathbb{F})$ for $\mathrm{SL}(n+1,\mathbb{F})$ (where the points are the point-hyperplane flags of $\mathrm{PG}(n,\mathbb{F})$) admits the absolutely universal embedding only if the field $\mathbb{F}$ admits no non-trivial automorphism. (2) The embedding of $A_{n,\{1,n\}}(\mathbb{F})$ in (the projective geometry of the underlying vector space of) the lie Algebra $\mathfrak{sl}(n+1,\mathbb{F})$ is relatively universal, namely it is not a projection from a larger embedding, if and only if $\mathbb{F}$ admits no non-trivial derivation. When $\mathrm{char}(\mathbb{F}) \neq 2$ the same holds for the projective embeddings of the long root geometries $B_{n,2}(\mathbb{F})$ and $D_{n,2}(\mathbb{F})$ in the Lie algebras $\mathfrak{o}(2n+1,\mathbb{F})$ and $\mathfrak{o}(2n,\mathbb{F})$ respectively.

References

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Algebras of Jordan and Monster type

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The class of axial algebras is a broad generalisation of the Majorana algebras of Ivanov. The big idea behind this is to build a theory of a of group-related non-associative algebras combining examples for classical, exceptional and sporadic groups.

In the talk we will review the recent advances in this area. This includes the Jordan components in the algebras of Jordan type, showing how the discrete structures related to (finite) 3-transposition groups fuse seamlessly with continuous structures related to algebraic groups. We will also briefly review the current state of the classification of 2-generated algebras of Monster type and 6-transposition groups.

Locally s-arc transitive graphs

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A G-graph is a connected simple graph Δ, together with a subgroup $G \leq \mathrm{Aut}(\Delta)$. The vertex set of Δ is denoted by $V\Delta$ and the edge set is $E\Delta$. The stabilizer G of a vertex $X_0 \in V\Delta$ is denoted by G_{x_0}. An *s-arc* emanating from a vertex $x_0 \in V\Delta$ is a path $(x_0, x_1, \ldots, x_s)$ with $x_{i-1} \neq x_{i+1}$ for $1 \leq i \leq s-1$.

A G-graph Δ is called *locally s-arc transitive* if for any vertex x_0 the stabilizer G_{x_0} is transitive on the set of s-arcs emanating from x_0, and is called *locally finite* if all vertex stabilizers are finite groups. For an 1-arc (x_1, x_2) of Δ the triple $(G_{x_1}, G_{x_2}; G_{x_1,x_2})$ is called the *vertex stabilizer amalgam* with respect to that arc.

Let Δ be a locally finite G-graph with $s \geq 1$. Then G has at most two orbits on the vertex set $V\Delta$ and is transitive on the set of edges $E\Delta$. Therefore, the vertex stabilizer amalgam does not depend on the choice of the edge, and describes the graph and group locally. In general, not much can be said about the vertex stabilizer amalgam of a locally finite G-graph with $s \geq 1$. However, when $s \geq 6$, it known by [1] that vertex stabilizer amalgam has to be a weak BN-pair.

In this talk, we will give a brief overview of the theory of locally finite and locally s-arc transitive graphs, and will discuss some recent results on the structure of their vertex stabilizer amalgams when $s \geq 4$.

References

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On the closures of finite permutation groups

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Let m be a positive integer and let Ω be a finite set. The *m-closure* $G^{(m)}$ of a permutation group $G \leq \mathrm{Sym}(\Omega)$ is the largest permutation group on Ω having the same orbits as G in its induced action on the cartesian power Ω^m. The m-closure of a permutation group can be considered as the full automorphism group of the set of all m-ary relations invariant with respect to G. So one of the motivations of studying m-closures comes from a computational problem in which one needs to find efficiently the automorphism group $\mathrm{Aut}(\mathfrak{S})$ of a given set $\mathfrak{S}$ of relations (generally speaking of different arities). In the case when all the relations of $\mathfrak{S}$ are binary, this problem is equivalent to the famous Graph Isomorphism Problem and can be solved by the Babai algorithm [1] in quasipolynomial time in the size of $\mathfrak{S}$. It is currently unknown whether the automorphism group of a graph can be found in polynomial time.

The notion of m-closure were suggested by Helmut Wielandt in the framework of the method of invariant relations which he considered as the one of main tools for studying actions of a group on a set, see [2]. In view of [2, Theorem 4.3],

$$\mathrm{Sym}(\Omega) \geq G^{(1)} \geq G^{(2)} \geq \cdots \geq G^{(m)} = G^{(m+1)} = \cdots = G, \tag{1}$$

for some $m < \deg G$, so the closures of the group G can be considered as its successive approximations.

It is clear that $G^{(1)}$ hardly provides a nice approximations of G, because the 1-closure of any transitive group is the full symmetric group $\mathrm{Sym}(\Omega)$ (the same holds true for the m-closure of any m-transitive group for all m). However, for $m \geq 2$, if G is an abelian group (respectively, a p-group, a group of odd order), then $G^{(m)}$ is an abelian group (respectively, a p-group, a group of odd order), see [2]. Recently, it was proved [3] that a similar statement is true for solvable groups if $m \geq 3$ (the example of 2-transitive solvable groups shows that $m = 2$ cannot be taken here).

From the computational point of view, the m-closure problem consists in finding the m-closure of a permutation group given by its generating set. Polynomial-time algorithms for finding the m-closure were constructed for the nilpotent groups [4], groups of odd order [5], and supersolvable groups [6].

Quite recently we solved the problem of finding m-closure for solvable permutation groups provided $m \geq 3$ [7]. The proof was based on the above mentioned result [3]. One of the key ingredients of the algorithm depends on controlling the order of the m-closure of a primitive group lying in the class under consideration. It follows from the main result of [8] that there is a polynomial upper bound on the order of a primitive group if its nonabelian composition factors are restricted. Thus, a natural generalization of our result on solvable groups would be the transition from the class of solvable groups to the class of groups with restricted nonabelian composition factors. The following result obtained jointly with Ilia Ponomarenko and Saveliy Skresanov is a step in this direction. Recall that a group G is $\mathrm{Alt}(d)$*-free*, if G does not contain a section isomorphic to the alternating group of degree d.

Theorem. *If G is an $\mathrm{Alt}(d)$-free group for $d \geq 25$, then $G^{(m)}$ is $\mathrm{Alt}(d)$-free group for $m \geq 4$.*

Note that the constant 4 in the theorem is the best possible and, if $m = 4$, then the same holds true for the constant 25, as the following examples show:

(i) The affine group $G = \mathrm{AGL}_n(2)$ is 3-transitive in its natural action on a linear space of dimension $n \geq 2$ over the field of order 2. It follows that $G^{(3)} = \mathrm{Sym}(2^n)$, so the theorem does not hold for $m \leq 3$.

(ii) The Mathieu group $G = M_{24}$ is $\mathrm{Alt}(9)$-free and acts on 24 points 5-transitively, so $G^{(4)} = \mathrm{Sym}(24)$ is not $\mathrm{Alt}(24)$-free.

The work is supported by the Russian Science Foundation, https://rscf.ru/en/project/24-11-00127/

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Constructing Chiral Polytopes with Coxeter Groups

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Abstract polytopes are partially ordered sets of elements, which obey certain axioms. The most symmetrical are regular polytopes, where all maximal chains of elements (called flags) form a single orbit under the automorphism group. Chiral polytopes, a less symmetric but equally fascinating class, have two distinct flag orbits, with adjacent flags lie in different orbits.

Coxeter groups, known for their geometric and algebraic elegance, play a central role in understanding symmetries of abstract polytopes. While regular polytopes are well-studied, chiral polytopes remain challenging to construct, with many open questions persist. This talk will present recent advances in constructing new examples of chiral polytopes using group-theoretic approaches.

Construction of spherical designs and unitary designs

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The existence of spherical designs for arbitrary dimension d and strength t is proved by Seymour–Zaslavsky [1] in 1980s. A bound on the size of spherical designs is given by Bondarenko–Radchenko–Viazovska [2, 3] in last decade. Recently Xiang [4] provides the first explicit construction of spherical designs. The existence of unitary designs follows from Seymour–Zaslavsky approach directly. The Clifford groups stand as a family of unitary 3-designs [5]. Bannai–Navarro–Rizo–Tiep summarize the finite groups which serve as unitary t-designs [6]. The first unitary 4-design on U(4) for 2-qubits is given in [7]. We provide an explicit construction of unitary designs for arbitrary dimension d and strength t [8], which gives another explicit construction of spherical designs as a byproduct. Recently we find a new construction of unitary designs reversely from spherical designs.

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On automorphism groups of bi-quasiprimitive 2-arc-transitive graphs

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Let G be a connected $(X, 2)$-arc-transitive bipartite graph with parts B_0 and B_1, where $X \leq \mathrm{Aut}(G)$. Let X^+ be the subgroup of X fixing B_0 setwise. In this talk, I will discuss the characterization of the automorphism group of G in case X^+ quasiprimitive on B_0. We first prove that if X^+ is primitive and faithful on B_0 and B_1, then $(X^+)^{B_0} \cong (X^+)^{B_1}$ is not of type PA. This is then used to prove that if X^+ is quasiprimitive on B_0 of type HA or TW, then either $\mathrm{soc}(X^+) \cong \mathrm{Aut}(G)$, or $G \cong K_{q,q}$ (q a prime power) or $K_{2^r,2^r} - 2^r K_2 (r \geq 2)$.

This talk is based on [1].

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Multivariate P- and/or Q-polynomial association schemes

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The study of P-polynomial association schemes (distance-regular graphs) and Q-polynomial association schemes, and in particular P- and Q-polynomial association schemes, has been a central theme not only in the theory of association schemes but also in the whole study of algebraic combinatorics in general. Leonard's theorem says that the spherical functions of P- and Q-polynomial association schemes are described by Askey-Wilson orthogonal polynomials or their relatives, which are one-variable orthogonal polynomials. It seems that the new attempt to define and study multivariate P- and Q-polynomial association schemes had been hoped for, but had gotten only limited success. Recently, Bernard, Crampé, d'Andecy, Vinet, and Zaimi defined bivariate P- and/or Q-polynomial association schemes [3].

In this talk, we will first introduce our new modified definition for multivariate P- and/or Q-polynomial association schemes with respect to a general monomial order [1]. We will also present several interesting families of multivariate P- and/or Q-polynomial association schemes, including nonbinary Johnson schemes and association schemes from attenuated spaces [2].

This is joint work with Eiichi Bannai, Hirotake Kurihara and Da Zhao.

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Contributed talks

Edge-transitive graphs of valency twice a prime have a semiregular automorphism

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The Polycirculant conjecture asserts that every vertex-transitive digraph has a semiregular automorphism whose cycles all have the same length. Similarly, in [1] the authors asked if every connected regular edge-transitive graph admits a semiregular automorphism. So we investigate wether edge-transitive graphs of valency twice a prime have a semiregular automorphism. We prove that G-half-arc-transitive graphs of valency twice a prime have a semiregular automorphism where G is a automorphism subgroup of the graph. Moreover, we prove that G-semisymmetric graphs of order twice a square-free integer with valency twice a prime have a semiregular automorphism.

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The class of groups is globally closed

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The non-empty subsets of a (multiplicatively written) semigroup S form themselves a semigroup, hereinafter denoted by $\mathcal{P}(S)$, when endowed with the binary operation of setwise multiplication

$$(X, Y) \mapsto XY := \{xy \colon x \in X,\, y \in Y\}.$$

Accordingly, a semigroup H is globally isomorphic to a semigroup K if $\mathcal{P}(H)$ is isomorphic (in the usual sense of semigroups) to $\mathcal{P}(K)$; and a class $\mathcal{C}$ of semigroups is globally closed if, whenever a semigroup $H \in \mathcal{C}$ is globally isomorphic to a semigroup K, then $K \in \mathcal{C}$.

We will demonstrate that the class of groups is globally closed and, time permitting, discuss a couple of related questions.

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Group factorizations and product groups

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A group X is said to be properly factorizable if $X = GH$ for two proper subgroups G and H of X. In this case, X is the product group of G and H. In particular, X has an exact factorization if $G \cap H = 1$. In 1937, Ore asked if it was possible to describe and classify all exact factorizations for a given finite group X. In fact, there is a dual version of this issue: for two given finite groups G and H, describe and classify all exact product groups of G and H. In this talk, some recent results on group factorizations and product groups will be introduced.

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Hamiltonian cycles in connected vertex-transitive graphs

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A Hamiltonian cycle(path) of a graph is a cycle(path) that visits each vertex exactly once. There are 5 known examples of vertex-transitive graphs with no Hamiltonian cycles. In 1969, Lovász asked that is there any finite connected vertex-transitive graph of order more than 3 without a Hamilton path. In fact, Another version of Lovász conjecture states that every finite connected vertex-transitive graph contains a Hamiltonian cycle except the five known examples. In this talk, some recent results on Hamiltonian cycles of connected vertex-transitive graphs will be introduced.

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Hebei Normal University (HEBNU)

From its inception, Hebei Normal University has embraced the mission of reform and innovation, aiming to enlighten the public and fostering a strong red gene and revolutionary tradition. The university has been deeply involved in the great journey of national rejuvenation, always sharing the same destiny with the Chinese nation' s struggle for independence, freedom, democracy, and prosperity. Distinguished figures such as revolutionaries Deng Yingchao, Liu Qingyang, Guo Longzhen, Yang Xiufeng, Kang Shien, Rong Gaotang, patriotic scholars Liang Shuming, Zhang Shenfu, Tang Yongtong, academicians Yan Luguang, Hao Bolin, Li Shushen, He Hong, and sports elites Xu Shaofa, Cai Zhenhua, along with Li Zhanshu, a member of the Standing Committee of the 19th CPC Central Committee Politburo and Chairman of the 13th National People's Congress Standing Committee, have all studied or worked at HEBNU. From its early days as a "school" to its current status as a prestigious academic institution, Hebei Normal University, born in the era of "educating the nation to save the country", upholds the school motto of "Caring for the World and Seeking True Knowledge", continuously nurturing talents dedicated to national rejuvenation and patriotism.

The university firmly upholds the great banner of Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, adheres to the comprehensive leadership of the Party, fully implements the Party's educational policies for the new era, and remains committed to the socialist direction of running schools, leading the development of the university's endeavors with high-quality Party building. The university has been awarded titles such as "Flagship Unit of Grassroots Party Building", "Advanced Grassroots Party Organization", and "Civilized Unit" by the Provincial Party Committee and Government. One college has been recognized as a national benchmark for Party building work, and five Party branches have been selected as national model Party branches in higher education institutions.

In 2011, the university moved to a new campus covering 1,829 acres, with a library collection of 3.3 million volumes and access to over 70 Chinese and foreign language databases. The university currently has 24,936 undergraduate students, 5,870 master's students, 644 doctoral students, and 11,198 students in continuing education programs, spread across 23 schools and departments, along with an independent college (Huihua College).

HEBNU offers 86 undergraduate majors, 26 master's degree programs in first-level disciplines, 23 professional master's degree programs, 11 doctoral degree programs in first-level disciplines, 1 professional doctoral degree program, and 10 postdoctoral research stations. The disciplines span 11 fields: philosophy, economics, law, education, literature, history, science, engineering, medicine, management, and art. The university has one national key discipline, seven disciplines under the Hebei Province "Double First-Class" initiative, one national key discipline cultivation project in provincial universities, four strong characteristic disciplines (clusters) in provincial universities, and 14 key disciplines in provincial universities. In the 2023 Soft Science China University Ranking, 80 programs of HEBNU were listed, with 39 ranked among the top 50 nationwide and 7 ranked among the top 10.

The university has made continuous progress in scientific research, undertaking several significant research projects, including the National Key R&D Program, Major Projects of New Transgenic Organisms Breeding, Major Science and Technology Infrastructure Projects of the National Development and Reform Commission, National Natural Science Foundation Key Projects, Key International (Regional) Cooperation Research Projects, Regional Innovation Development Joint Fund Projects, Excellent Youth Science Fund Projects, National Social Science Foundation Major Bidding Projects, and key projects of the National Qing History Compilation Project, among others. The research group led by Academician Sun Daye won the National Natural Science Award, marking a significant achievement for Hebei Province.

HEBNU is committed to advancing research innovation platforms and think tank construction. The university currently hosts 1 Ministry of Education Key Laboratory, 2 Ministry of Education Humanities and Social Sciences Key Research Bases, 1 National Language and Literature Promotion Base, 1 Ministry of Education Collaborative Innovation Center co-established by the Ministry and Province, and 3 Ministry of Education National and Regional Research Filing Centers. Additionally, the university has 19 Hebei Provincial Key Laboratories, Technology Innovation Centers, Engineering Research Centers, and Fundamental Discipline Research Centers, 16 Key Research Bases for Humanities and Social Sciences, 2 International Cooperation Bases, 3 Collaborative Innovation Centers, and 3 New Think Tanks at the provincial level and above, totaling over 50 research and innovation platforms. The university's ability to

serve economic construction and social development has been significantly enhanced.

The university remains focused on its fundamental task of cultivating virtue and nurturing talents, always remembering its original mission of "educating people for the Party and the nation". It continuously improves its educational standards, striving to cultivate a new generation of talents committed to national rejuvenation. HEBNU has been recognized as a National Key Marxist College, with 14 programs passing the second-level certification for teacher education programs. The university boasts 34 national first-class undergraduate program construction sites, 21 national first-class courses, 1 innovative talent cultivation experimental zone, 6 special program construction sites, 4 comprehensive reform pilot projects for programs, 6 high-quality resource-sharing courses, 1 high-quality video open course, 4 high-quality online open courses, 4 experimental teaching demonstration centers, 1 virtual simulation experimental teaching project, and 3 professional degree graduate training practice bases. The university has been recognized as one of the "Top 50 Universities in China for Graduate Employment" and is included in the Ministry of Education's "Excellence in Secondary School Teacher Training" reform project. In recent years, HEBNU has won 6 national teaching achievement awards (1 first prize, 5 second prizes).

The university has established a comprehensive teacher education system covering preschool, basic, higher, vocational, ethnic, and special education, emphasizing all six educational levels equally. HEBNU actively engages in the "Rural Teacher Internship Support Program", effectively serving the development of rural basic education and contributing to rural revitalization. The university hosts the National Primary and Secondary School Key Teacher Training Base, the National Key Construction Vocational Education Teacher Training Base, the Ministry of Education Higher Education Counselors Training and Research Base, the Hebei Provincial Vocational Education Research Institute, the Education Science Research Institute, the Discipline Education Research Institute, the Hebei Province Primary and Secondary School Teacher Continuing Education Center, the Hebei Province Higher Education Teacher Training Center, the Hebei Province Modern Educational Technology Center, and the Hebei Province Main Node of the China Education and Research Network. The university remains attuned to the forefront of the times, seizing opportunities in the development of artificial intelligence, and has been approved for the Ministry of Education's projects for "AI-Enhanced Teacher Workforce", "5G+Smart Education", and the "AI Education Research and Application Center", supporting the transformation and high-quality development of teacher education in Hebei Province. By developing non-teacher education programs in response to social demands, HEBNU has established a new talent cultivation model that integrates teacher education with non-teacher education programs.

HEBNU currently employs 2,601 faculty and staff members, including 1,633 full-time teachers. Among the staff, 382 hold senior titles, and 919 hold associate senior titles. The university has 1 academician of the Chinese Academy of Sciences, 1 National High-Level Talent Team, 1 National Teaching Team, 1 National Teaching Master, 1 National "Ten Thousand Talents Plan" Teaching Master, 2 National Youth Talents, 16 experts receiving special government allowances from the State Council, and 1 National "Hundred Thousand Talent Project" recipient and expert with outstanding contributions to the nation. Additionally, HEBNU has 2 recipients of the National Excellent Young Scientists Fund and 213 provincial and above-level outstanding experts.

Hebei Normal University is committed to high-level international cooperation and exchanges with over 200 foreign universities. It is a recipient of the "Chinese Government Scholarship" and the "International Chinese Language Teachers Scholarship" programs and offers undergraduate, master's, doctoral education, and Chinese language education in cooperation with more than 40 countries. The university has established 2 Confucius Institutes, 1 Confucius Classroom, 1 Portuguese-Chinese Bilingual High School, 1 Overseas College, and 2 Overseas Preparatory Academies. It has also sent Chinese language teacher volunteers to more than 20 countries, actively participating in the international promotion of the Chinese language.

河北师范大学简介

河北师范大学是河北省人民政府与教育部共建的省属重点骨干大学，河北省“双一流”建设一层次高校。学校起源于 1902 年创建于北京的顺天府学堂和 1906 年创建于天津的北洋女师范学堂，具有 120 多年的发展历史和光荣的办学传统。1996 年 6 月，原河北师范大学、河北师范学院与创建于 1952 年的河北教育学院、创建于 1984 年的河北职业技术师范学院合并，组建成新的河北师范大学。2014 年，河北省人民政府、教育部决定共建河北师范大学。

建校之初，河北师范大学就以革故鼎新、开启民智为使命，奠定鲜亮红色基因，积淀光荣革命传统，笃行于民族复兴伟大征程，始终同中华民族争取独立、自由、民主、富强的进步事业同呼吸、共命运。老一代革命家邓颖超、刘清扬、郭隆真、杨秀峰、康世恩、荣高棠，著名爱国主义学者梁漱溟、张申府、汤用彤，两院院士严陆光、郝柏林、李树深、贺泓，体育界精英许绍发、蔡振华，中共十九届中央政治局常委、十三届全国人大常委会委员长栗战书等都曾在师大工作学习。从创办初期的“学堂”到今天誉满燕赵的学术殿堂，诞生于“兴教救国”时代大潮中的河北师范大学秉承“怀天下、求真知”的校训精神，薪火相传，弦歌不辍，培养了一大批致力于民族振兴、爱国报国的栋梁之才。

学校高举习近平新时代中国特色社会主义思想伟大旗帜，坚持党的全面领导，全面贯彻新时代党的教育方针，坚持社会主义办学方向，以高质量党建引领学校事业高质量发展。学校先后被省委、省政府授予基层党建红旗单位、先进基层党组织、文明单位等称号。1 个学院入选全国党建工作标杆院系，5 个党支部入选全国高校党建工作样板党支部。2011 年，学校整体迁入新校区办学。新校区占地 1829 亩，馆藏图书 330 万册，中外文数据库 70 余个。在校本科生 24936 人、硕士研究生 5870 人、博士研究生 644 人，成人教育学生 11198 人。设有 23 个学院（系），1 个独立学院（汇华学院）。

学校现有本科专业 86 个，硕士一级学科学位授权点 26 个、硕士专业学位授权点 23 个，博士一级学科学位授权点 11 个、博士专业学位授权点 1 个，博士后科研流动站 10 个。学科专业覆盖哲学、经济学、法学、教育学、文学、历史学、理学、工学、医学、管理学、艺术学等 11 个学科门类。现有国家重点学科 1 个，河北省“双一流”建设学科 7 个、省高校国家重点学科培育项目 1 个、省高校强势特色学科（群）4 个、省高校重点学科 14 个。2023 软科中国大学专业排名中，学校共 80 个专业上榜，其中 39 个专业位居全国前 50 名，7 个专业位居全国前 10 名。

学校科学研究不断取得新进展。承担了一批国家重点研发计划，国家转基因生物新品种培育重大专项，国家发改委重大科技基础设施项目，国家自然科学基金重点项目、重点国际（地区）合作研究项目、区域创新发展联合基金项目、优秀青年科学基金项目，国家社科基金重大招标项目和国家清史纂修工程主体类项目等具有较大影响的科研项目。孙大业院士课题组获国家自然科学二等奖，填补了河北省的空白。

学校大力推进科研创新平台和智库建设。现有教育部重点实验室 1 个、教育部人文社会科学重点研究基地 2 个、国家语言文字推广基地 1 个、教育部省部共建协同创新中心 1 个、教育部国别和区域研究备案中心 3 个；河北省学科重点实验室、技术创新中心、工程研究中心、基础学科研究中心 19 个、人文社会科学重点研究基地 16 个、国际合作基地 2 个、协同创新中心 3 个、新型智库 3 个。省部级以上科研创新平台 50 余个，服务经济建设和社会发展能力明显增强。

学校聚焦立德树人根本任务，牢记“为党育人、为国育才”初心使命，不断提高办学水平，着力培养担当民族复兴大任的时代新人。获批全国重点马克思主义学院，14 个专业通过师范类专业第二级认证，拥有国家级一流本科专业建设点 34 个、一流本科课程 21 门、人才培养模式创新实验区 1 个、特色专业建设点 6 个、专业综合改革试点项目 4 项，精品资源共享课程 6 门、精品视频公开课 1 门、精品在线开放课程 4 门，实验教学示范中心 4 个、虚拟仿真实验教学项目 1 项、专业学位研究生培养实践基地 3 个，中国专业学位案例中心案例库收录教学案例 34 篇；省级一流专业建设点 18 个、一流本科课程 47 门、本科教育创新高地 7 个、品牌特色专业 8 个、专业综合改革试点项目 5 项、精品在线开放课程 14 门、虚拟仿真实验教学项目 10 项、课程思政示范课程 9 门、实验教学示范中心 5 个、虚拟仿真实验教学中心 2 个、课程思政教学研究示范中心 1 个。学校获评“全国毕业生就业典型经验高校 50 强”，入选教育部“卓越中学教师培养计划”改革项目实施院校。近年来，共获得 6 项国家级教学成果奖（一等奖 1 项，二等奖 5 项）。

学校建立了涵盖学前教育、基础教育、高等教育、职业教育、民族教育、特殊教育“六教并重”的全学段、全学科教师教育体系。深入开展顶岗实习支教工程，有效服务农村基础教育发展，助力乡村振兴。设有全国中小学骨干教师培训基地、全国重点建设职业教育师资培训基地、教育部高校辅导员培训和研修基地、河北省职业教育研究所、教育科学研究所、学科教育研究所、河北省中小学教师继续教育中心、河北省高等学校师资培训中心、河北省高校现代教育技术中心、中国教育科研网河北省主节点等机构。学校紧盯时代发展前沿，抢抓人工智能发展机遇，获批教育部“人工智能助推教师队伍建设”“5G+ 智慧教育”“人工智能教育研究与应用中心”建设项目，助力我省教师教育模式变革和高质量发展。面向社会需求发展非师范专业，形成了师范专业与非师范专业共同发展的人才培养新格局。

学校现有在职教职工 2601 人，其中专任教师 1633 人。在职教职工中，正高职人员 382 人，副高职人

员 919 人。其中中国科学院院士 1 人，拥有全国高校黄大年式教师团队 1 个、国家级教学团队 1 个、国家教学名师 1 人，国家“万人计划”教学名师 1 人，国家青年人才 2 人，国务院特殊津贴专家 16 人、国家“百千万人才工程”入选者、国家有突出贡献的中青年专家 1 人，国家优秀青年基金获得者 2 人，省级以上各类优秀专家 213 人次。河北师范大学坚持高水平开放合作，和 200 多所国外大学开展交往，是“中国政府奖学金”和“国际中文教师奖学金”项目接收单位，与 40 多个国家开展本、硕、博学历教育和汉语语言教育。建有 2 所孔子学院、1 所孔子课堂、1 所葡中双语高中、1 所海外学院、2 所海外预科学院。向 20 多个国家选派汉语教师志愿者，积极参与汉语国际推广。

进入新时代，开启新征程。全校上下正以党的二十大精神为指引，坚守师范教育初心，赓续百廿办学荣光，落实立德树人根本任务，踔厉奋发、笃行不怠，向着建设高水平综合性师范大学的目标稳步迈进，为奋力谱写中国式现代化建设河北篇章、实现中华民族伟大复兴作出新的更大贡献。

（相关数据截止至 2024 年 3 月）

School of Mathematical Sciences

Historical Evolution

The School of Mathematical Sciences at Hebei Normal University has three origins: the former Mathematics Department of Hebei Normal University, the Mathematics Department of the former Hebei Teachers College, and the Mathematics Department of the former Hebei College of Education. The Mathematics Department of Hebei Normal University was established in early 1950, evolving from the Department of Physics and Chemistry of Hebei Normal College in Tianjin. In August 1956, it was relocated to Shijiazhuang and became the Mathematics Department of Shijiazhuang Teachers College, later renamed the Mathematics Department of Hebei Normal University in 1962. The Mathematics Department of Hebei Teachers College originated from the Mathematics Department of Hebei Normal Junior College in 1951, renamed as the Mathematics Department of Hebei Beijing Teachers College in 1956, and incorporated the Mathematics Department of Beijing Railway Teachers College in 1961. After relocating to Xuanhua, Zhangjiakou in 1969, it was renamed the Mathematics Department of Hebei Teachers College and moved to Shijiazhuang City in 1981. The Mathematics Department of Hebei College of Education was established in 1986. In 1996, the four schools merged to form the new Hebei Normal University, and in November 1998, the Mathematics Departments of the former Hebei Normal University, Hebei Teachers College, and Hebei College of Education merged to form the Mathematics Department of Hebei Normal University. In January 2000, it merged with the Computer Science Department to form the School of Mathematics and Information Science. In April 2019, after the separation of the Computer Science Department into the School of Computer and Cyber Security, the School of Mathematics and Information Science was renamed the School of Mathematical Sciences in October 2019.

Disciplinary Development

The Mathematics discipline of Hebei Normal University was among the first to be authorized to confer master's degrees after the formal establishment of the degree system in China in the early 1980s. It was authorized to confer doctoral degrees in Basic Mathematics and Applied Mathematics in 1998 and 2006, respectively. It established a postdoctoral research station in 2007 and was approved as a first-level doctoral degree-granting discipline in 2011, becoming the first in Hebei Province. Over the years, with key support from Hebei Province and the university, the Mathematics discipline has achieved significant development. In 2005, it was selected as a prominent characteristic discipline in Hebei Province. In 2013, it was identified as a national key discipline cultivation discipline by Hebei universities, and in 2016, it was identified as a "Double First-Class" discipline construction site in Hebei Province. In the fourth round of national disciplinary assessment announced by the Ministry of Education, Mathematics was classified as a Category B discipline, especially achieving new breakthroughs in the fifth round. While advancing academic development, Mathematics has actively served societal needs, establishing platforms for basic theoretical research and applied R&D. Currently, it has several provincial-level research platforms, including the Hebei Province Basic Mathematics Basic Discipline Research Center, Hebei Applied Mathematics Center, Hebei Province Key Laboratory of Computational Mathematics and Applications, Hebei Province Collaborative Innovation Center for Digital Education, Hebei Province International Joint Research Center for Mathematics and Interdisciplinary Sciences, and Hebei Province Foreign Academician Workstation. Additionally, the Hebei Mathematical Society is affiliated with our college.

Scientific Research

The Mathematics discipline has distinctive research teams in operator algebra and operator theory, intelligent computing and applications, combinatorial mathematics, differential equations, and dynamical systems. Since 2018, it has undertaken 58 projects funded by the National Natural Science Foundation of China, including one key project, one international (regional) cooperation and exchange key project, and one National Science Fund for Distinguished Young Scholars project. It has undertaken 44 provincial and ministerial projects, winning one second prize and two third prizes of the Hebei Provincial Natural Science Award; it has hosted 25 high-level international and national academic conferences. In terms of scientific research, Mathematics has created several firsts for the university: the first National Science Fund for Distinguished Young Scholars project, the first introduction of overseas high-level talent program awardees, the first introduction of winners of the National Science Fund for Distinguished Young Scholars, and the only national excellent doctoral dissertation.

Talent Cultivation

The Mathematics discipline is an important talent cultivation base for middle school mathematics teachers in Hebei Province. It has maintained a high-quality tradition of education over the years, with significant achievements in undergraduate and graduate education and a continuous emergence of talented individuals. Currently, the discipline offers three undergraduate majors: Mathematics and Applied Mathematics, Applied Statistics, and Data Computing and Applications, enrolling over 370 undergraduates annually, with the Mathematics and Applied Mathematics major being a national first-class undergraduate major construction point. The first-level discipline of Mathematics enrolls over 10 doctoral students and over 70 master' s students annually. The college sends hundreds of doctoral and master's graduates to research institutes at home and abroad every year, many of whom have become key forces in universities and research institutions. Notable alumni include Liu Jianya, Distinguished Young Scholar of China and Vice President of Shandong University; Li Zenghu, Distinguished Young Scholar of China and Professor at Beijing Normal University; Liu Peidong, Distinguished Young Scholar of China and Professor at Peking University; Guo Junyi, Vice Chairman of the 12th Council of the Chinese Mathematical Society and Professor at Nankai University; Feng Rongquan, Secretary of the Mathematics Discipline Appraisal Group of the Seventh Academic Degrees Committee of the State Council and Professor at Peking University; Wang Yanfei, Distinguished Young Scholar of China and Researcher at the Institute of Geology and Geophysics, Chinese Academy of Sciences; Zhang Meizhi, Vice Chairman of the Standing Committee of the Hebei Provincial People's Congress and Chairman of the Hebei Provincial Committee of the China Democratic League; and Liu Minghui, President of China Gas Holdings Limited. Currently, in the field of basic education in Hebei Province, more than a hundred graduates of the Mathematics discipline hold school-level leadership positions, and over 90 are special-grade teachers and senior teachers.

Faculty Strength

The Mathematics discipline has a strong faculty, currently comprising 34 professors, 41 associate professors, 4 foreign full-time and part-time teachers (including 1 high-end foreign expert from the National Bureau of Foreign Experts), and 25 teachers with overseas experience. The faculty team includes 2 national distinguished experts, 2 experts receiving the State Council Special Allowance, 2 recipients of the National Natural Science Foundation of China Overseas Joint Fund (Outstanding Young B), 2 recipients of the National Science Fund for Distinguished Young Scholars, 2 awardees of the Ministry of Education's New Century Excellent Talents, 1 Chinese Academy of Sciences Hundred Talents Program awardee, 1 recipient of the National Excellent Doctoral Dissertation, 1 Hebei Yan Zhao Scholar, 2 recipients of the Hebei Province Outstanding Youth Fund, 2 Hebei Province outstanding young and middle-aged experts with significant contributions, 1 Hebei Province teaching master, and 1 Hebei Province outstanding returned personnel.

Applied Research

While achieving fruitful results in basic research, the discipline has also made breakthroughs in applied research. Relying on the Mathematics discipline, the college has established the Software College and the Internet of Things Research Institute through school-enterprise cooperation, providing a platform for the integration of Mathematics with Information, Geography, Electronics, and other disciplines. In 2013, it was approved as Hebei Province's first collaborative innovation center focused on educational technology –the "Hebei Province Collaborative Innovation Center for Digital Education". In 2015, the center's "Smart City and Educational Equity" project won the Global Smart City Project Award at the 5th Barcelona Smart City Expo and Global Summit, becoming the only Chinese project to receive this honor. Its E • School educational product, through digital and networked transformation of "teaching" and "learning", has effectively promoted reform and educational equity in basic education, currently being piloted in 24 primary and secondary schools in Hebei Province. Currently, the college is undertaking the development of the "BeitaiTianyuan" national general-purpose scientific computing software –Image Processing Toolbox research and development project, expected to achieve new breakthroughs in applied research.

河北师范大学数学科学学院简介

历史沿革

河北师范大学数学科学学院的起源有三个分支，即原河北师范大学数学系、原河北师范学院数学系、原河北教育学院数学系。原河北师范大学数学系成立于 1950 年初，是从天津河北师范学院理化系分立发展起来的，1956 年 8 月迁至石家庄，建立石家庄师范学院数学系，1962 年更名为河北师范大学数学系。河北师范学院数学系发端于 1951 年河北师范专科学校的数学科，1956 年更名为河北北京师范学院数学系，1961 年北京铁道师范学院数学系并入，1969 年迁至张家口宣化后，更名为河北师范学院数学系，1981 年随原河北师范学院迁至石家庄市。河北教育学院数学系成立于 1986 年。1996 年四校合并成立新的河北师范大学，1998 年 11 月原河北师范大学数学系、原河北师范学院数学系、原河北教育学院数学系合并成立了河北师范大学数学系，2000 年 1 月与计算机系合并组建数学与信息科学学院。2019 年 4 月，计算机系从数学与信息科学学院分离并入计算机与网络空间安全学院后，数学与信息科学学院于 2019 年 10 月更名为数学科学学院。

学科发展

河北师范大学数学学科是上世纪 80 年代初我国正式建立学位制度后首批获得硕士学位授予权的学科，1998 年和 2006 年分别获得基础数学和应用数学博士学位授予权，2007 年设立博士后科研流动站，2011 年获批博士学位授权一级学科，是目前河北省首个的数学学科博士学位授权点。多年来，在河北省及学校的重点建设下，数学学科得到了长足发展。2005 年数学学科入选河北省强势特色学科，2013 年被确定为河北省高校国家重点学科培育学科，2016 年被确定为河北省“双一流”建设世界一流学科建设点。在教育部公布的全国第四轮学科评估结果中，数学学科进入 B 类学科，特别是在第五轮学科评估中取得新突破。数学学科在推进学术发展的同时积极服务社会需求，建立了基础理论研究、应用研发等多个平台，目前拥有河北省基础数学基础学科研究中心、河北应用数学中心、河北省计算数学与应用重点实验室、河北省数字教育协同创新中心、河北省数学与交叉科学国际联合研究中心、河北省外国院士工作站等省级科研平台。此外，河北省数学会也挂靠在我院。

科学研究

数学学科建有算子代数与算子理论、智能计算及应用、组合数学、微分方程与动力系统等特色研究团队，2018 年以来承担国家自然科学基金项目 58 项，其中包括国家自然科学基金重点项目 1 项，国际（地区）合作与交流重点项目 1 项，国家优秀青年科学基金项目 1 项。承担省部级项目 44 项，获河北省自然科学奖二等奖 1 项、三等奖 2 项；举办高水平国际和全国性学术会议 25 次。在科学研究方面，数学学科创造了多项学校第一：首次获批国家自然科学基金优秀青年基金项目，首次引进海外高层次人才计划入选者，首次引进国家优秀青年科学基金项目获得者，获得了唯一一篇全国优秀博士学位论文。

人才培养

数学学科是河北省中学数学师资的重要人才培养基地，多年来一直保持高质量的育人传统，在本科教育和研究生教育方面成果显著，人才辈出。目前，数学学科设有数学与应用数学、应用统计学和数据计算及应用三个本科专业，年招收本科生 370 余人，其中数学与应用数学专业是国家级一流本科专业建设点；数学一级学科每年招收博士研究生 10 余人、硕士研究生 70 余人。学院每年为国内外科研院所输送博士、硕士研究生百余人，其中，许多已成为国内外高校和科研机构的骨干力量。国家杰出青年基金获得者、山东大学副校长刘建亚，国家杰出青年基金获得者、北京师范大学教授李增沪，国家杰出青年基金获得者、北京大学教授刘培东，中国数学会第十二届理事会副理事长、南开大学教授郭军义，第七届国务院学位委员会数学学科评议组秘书、北京大学教授冯荣权，国家杰出青年基金获得者、中国科学院地质与地球物理研究所研究员王彦飞，河北省人大常委会副主任、民进河北省委主委张妹芝，中国燃气控股有限公司总裁刘明辉等都是我校数学专业的优秀毕业生。目前，在河北省基础教育领域，数学学科毕业生中有百余人担任校级领导职务，特级教师及正高级教师 90 余人。

师资力量

数学学科师资力量雄厚，目前有正高职称教师 34 人，副高职称人员 41 人，外籍专兼职教师 4 人（含国家外专局高端外国专家 1 人），具有海外经历教师 25 人。教师团队中有国家级特聘专家 2 人、国务院特殊津贴专家 2 人、国家自然科学基金海外联合基金（杰青 B）获得者 2 人、国家优秀青年基金获得者 2 人、教育部新世纪优秀人才 2 人、中科院百人计划 1 人、全国百篇优博论文获得者 1 人、河北省燕赵学者 1 人、河北省杰出青年基金获得者 2 人、河北省有突出贡献的中青年专家 2 人、河北省教学名师 1 人、河北省优秀回国人员 1 人。

应用研究

在基础研究取得丰硕成果的同时，应用研究也取得了突破性进展。依托数学学科，通过校企合作方式创建了软件学院、物联网研究院，为数学与信息、地理以及电子等学科的交叉融合提供了平台。2013 年获批了河北省第一个面向教育技术领域的协同创新中心——“河北省数字教育协同创新中心”。2015 年该中心申报的“智慧城市与教育公平”荣获第五届巴塞罗那智慧城市博览会暨全球峰会全球智慧城市项

目大奖，成为我国唯一获此殊荣的项目；开发的 E • School 教育产品，通过“教”与“学”方式的数字化、网络化变革，有力推动了基础教育领域改革和教育公平，目前已被河北省教育厅在 24 所中小学试用。目前，学院承担了“北太天元”国产通用型科学计算软件—图像处理工具箱研发项目的研发工作，有望在应用研究领域取得新突破。