2019 Zassenhaus Group Theory and Friends Conference
Binghamton University, Binghamton NY
May 31–June 2, 2019

In Honor of Stephen Gagola Jr.

PROGRAM & ABSTRACTS

ORGANIZERS

Fernando Guzman, Binghamton University, Binghamton, New York
Luise-Charlotte Kappe, Binghamton University, Binghamton, New York
Hung P Tong Viet, Binghamton University, Binghamton, New York
Zekeriya (Yalcin) Karatas, University of Cincinnati Blue Ash College, Cincinnati, Ohio
Arturo Magidin, University of Louisiana at Lafayette, Lafayette, Louisiana
Elizabeth Wilcox, State University of New York at Oswego, Oswego, New York

2019 Zassenhaus Group Theory and Friends Conference
Binghamton University, Binghamton NY
May 31–June 2, 2019

Conference Program

Friday, May 31, 2019; Afternoon Session

Location: Whitney Hall - Room G-002

12:00 - 12:50 PM	Registration Whitney Hall Lobby
1:00 - 1:20 PM	Nicholas WERNER (SUNY Old Westbury) **Fuchs's problem for 2-groups**
1:30 - 1:50 PM	Joseph KIRTLAND (Marist College) **Finite groups with a Frattini subgroup property satisfied by nilpotent groups**
2:00 - 2:20 PM	Ryan McCULLOCH (University of Bridgeport) **On the Chermak-Delgado lattice of a finite group**
2:30 - 2:55 PM	**COFFEE BREAK** Whitney Hall Lobby
3:00 - 3:20 PM	Tuval FOGUEL (Adelphi University) **Groups with no abelian partition**
3:30 - 3:50 PM	Casey DONOVEN (Binghamton University) **Groups that are the union of two semigroups**
4:00 - 4:20 PM	Bret BENESH (College of St Benedict & St John's University) **On the number of elements with order divisible by m in a group**
4:30 - 4:50 PM	Stephen GAGOLA III (University of South Carolina) **Pairwise covering numbers of groups**

Saturday, June 1st, 2019; Morning Session

Location: Whitney Hall - Room G-002

7:30 - 8:20 AM	**Coffee and pastries**
8:30 - 8:50 AM	Eric SWARTZ (College of William and Mary) **Locally 2-transitive generalized quadrangles**
9:00 - 9:20 AM	Joe CYR (Binghamton University) **Quandles and modes**
9:30 - 9:50 AM	Eran CROCKETT (Ripon College) **A generalization of affine algebras**
10:00 - 10:20 AM	Matt EVANS (Binghamton University) **Spectra of BCK-algebras**
10:30 - 10:55 AM	**COFFEE BREAK** Whitney Hall Lobby
11:00 - 11:20 AM	Bach NGUYEN (Temple University) **Action of Hopf algebras and noncommutative prime spectra**
11:30 - 11:50 AM	Karl LORENSEN (Penn State Altoona) **Group-graded rings satisfying the strong rank condition**
12:00 - 12:20 AM	E.I. KOMPANTSEVA (Moscow Pedagogical State University) **Filial rings on torsion-free abelian groups**
12:20 - 12:30 AM	**CONFERENCE PHOTOGRAPH**
12:30 - 1:50 PM	**LUNCH** Atrium, Old Champlain (across from Whitney Hall)

Saturday, June 1st, 2019; Afternoon Session

Location: Whitney Hall - Room G-002

2:00 - 2:20 PM	Mark LEWIS (Kent State) **Groups with vanishing class size** p
2:30 - 2:50 PM	David COSTANZO (Kent State) **Central Camina pairs**
3:00 - 3:20 PM	Alexandre TURULL (University of Florida) p**-basic groups and the invariant of a character**
3:30 - 3:55 PM	**COFFEE BREAK** Whitney Hall Lobby
4:00 - 4:20 PM	Clifton E. EALY (Western Michigan University) **Some remarks on die Verlagerung**
4:30 - 4:50 PM	Tom WOLF (Ohio University) **Group actions and non-vanishing characters**
5:00 - 5:20 PM	Shawn BURKETT (Kent State) **Characterizations of nested GVZ groups by central series**
5:30 - 5:50 PM	Kenneth JOHNSON (Penn State Abington) **Group matrices and group determinants corresponding to projective representations**
6:30 - 8:30 PM	**CONFERENCE DINNER** Chenango Room (short walk from Whitney Hall)

Sunday June 2, 2019; Morning Session

Location: Whitney Hall - Room G-002

7:30 - 8:20 AM	**Coffee and pastries**
8:30 - 8:50 AM	Dmytro SAVCHUK (University of South Florida) **On the connection between Mealy and Moore automata via d-adic dynamics**
9:00 - 9:20 AM	Zoran SUNIC (Hofstra University) **On the rigid kernel of branch groups**
9:30 - 9:50 AM	Amanda TAYLOR (Alfred University) **A family of locally solvable subgroups of Thompson's group F**
10:00 - 10:20 AM	**COFFEE BREAK** Whitney Hall Lobby
10:30 - 10:50 AM	Jay ZIMMERMAN (Towson University) **The genus spectrum of certain classes of groups**
11:00 - 11:20 AM	Yalcin KARATAS (University of Cincinnati Blue Ash College) **Groups with all subgroups permutable or polycyclic**
11:30 - 11:50 AM	Jeffrey RIEDL (University of Akron) **Subgroups of wreath product 2-groups**
12:00 - 12:20 PM	Luise-Charlotte KAPPE (Binghamton University) **On the nonabelian tensor product of cyclic groups of p-power order**
12:20 PM	**Closing Remarks**

Conference Information

Venue: All talks will take place in Whitney Hall Room WH G-002. A campus map with Whitney Hall circled appears at the end of this program.

The room has:

- White boards (we will provde markers and erasers).
- Projector.
- Document camera.
- DHMI and VGA connectors.
- A computer with USB port for memory sticks.

Parking: The Conference has reserved parking space in Lot B, near Whitney Hall; it is just to the west (left) of Whitney Hall in the map.

Conference photograph: We will take the conference photograph on Saturday, at the end of the morning session.

Saturday lunch: The Conference has organized lunch for Saturday 12:30 - 1:50 pm, at the Atrium in Old Champlain, across from the conference venue; it is scheduled for right after the photograph.

Conference Dinner: The Conference Dinner is on Saturday 6:30–8:30 pm, in the Chenango Room, about a 5 minute walk from Whitney Hall. Participants are invited to walk there after the last talk on Saturday afternoon.

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Abstracts

In order of presentation

Fuchs's problem for 2-groups

Nicholas Werner, SUNY Old Westbury

We call a group G *realizable* if there exists a ring R such that the group of units of R is isomorphic to G. The question of determining whether a group or family of groups is realizable has come to be called *Fuchs' Problem* after László Fuchs, who in 1960 posed the problem of characterizing the groups that can occur as the group of units of a commutative ring. In recent years, Fuchs' problem has been solved for several families of finite groups, including symmetric groups, alternating groups, dihedral groups, and finite simple groups. In this talk, we examine Fuchs' problem for finite 2-groups. For such a group G, the exponent of G plays an important role in determining whether G is realizable. We prove that any finite 2-group of exponent at most 4 is realizable, and that a group of order 2^n that is realizable in characteristic 2^m has exponent at most $2^{\lceil \log_2(n+1) \rceil - m+1}$. In general, 2-groups of exponent at least 8 may or may not be realizable, and it is not at all clear how to classify such groups. We will discuss several intriguing examples and open questions on these topics. This is joint work with Eric Swartz.

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Finite groups with a Frattini subgroup property satisfied by nilpotent groups

Joseph Kirtland, Marist College

Given a finite group G and a Sylow p-subgroup P of G, then $P \cap \mathrm{Frat}(G) = \mathrm{Frat}(P)$. This talk will investigate finite groups that share this property.

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On the Chermak-Delgado lattice of a finite group

RYAN MCCULLOCH, University of Bridgeport

The Chermak-Delgado lattice of a finite group, G, denote $\mathrm{CD}(G)$, is a modular, self-dual sublattice of the lattice of subgroups of G. $\mathrm{CD}(G)$ has nice properties and has been studied a great deal in recent years. By imposing bounds on the index of a maximum order self-centralizing subgroup, A, of G, we classify $\mathrm{CD}(G)$. We apply this to obtain a classification of the Chermak-Delgado lattices of metabelian p-groups of maximal class. This is joint work with Marius Tarnauceanu of Al.I. Cuza University.

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Groups with no abelian partition

TUVAL FOGUEL, Adelphi University

A nonabelian group G has an Abelian Partition if there is a set theoretic partition of G into disjoint commutative subsets $A_0, A_1, \ldots, A_n$ where $| A_i |> 1$ for all i. The problem of classifying Abelian Partition was recently introduced in a paper by F. Salehzadeh A. Mahmoudifar, A. R. Moghaddamfar who classied all groups with $n = 2$ and 3. The motivation for this problem can be found in graph theory where partitions of graphs into induced complete subgraphs is of great importance. This talk will look at groups with no Abelian Partition.

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Groups that are the union of two semigroups

CASEY DONOVEN, Binghamton University

Given a group G, one can ask what is the minimum number of proper subsemigroups needed to cover G. I will prove the following theorem: G is the union of two proper subsemigroups if and only if G has a left-orderable quotient (that is not trivial). The main arguments involve identifying where inverses are found in the two semigroups and using Zorn's lemma to identity a normal subgroup that produces the necessary quotient.

cdonoven@binghamton.edu

On the number of elements with order divisible by m in a group

Bret Benesh, College of St. Benedict & St. John's University

Let G be a (not necessarily finite) group and let m be a natural number. Suppose that there are exactly n elements with order divisible by m for some finite number n. Then we can bound the order of the group by $|G| \leq \frac{m}{\phi(m)} n^2$, where ϕ is Euler's totient function. In particular, if G is infinite, then G has either 0 elements of order divisible by m or an infinite number of elements of order divisible by m.

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Pairwise covering numbers of groups

Stephen Gagola III, University of South Carolina

The covering number of a non-cyclic group G, denoted by $\sigma(G)$, is the size of a minimal collection of proper subgroups of G whose set-theoretic union is G. The first question dealing with finite covers of groups came about in 1926 by G. Scorza who determined exactly which groups are the union of three proper subgroups. It was then a paper of J.H.E. Cohn in 1994 that brought back the attention of coverings of groups. In this talk we will look at a similar concept to that of covering numbers of groups by looking at pairwise covering numbers. We will also be using incidence geometry and taking a look at incidence structures that satisfy certain properties to help us determine certain integers n that turn out to be pairwise covering numbers.

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Locally 2-transitive generalized quadrangles

Eric Swartz, College of William and Mary

A finite generalized quadrangle is a finite incidence geometry such that two points are incident with at most one line, and, given any point P and line ℓ not incident with P, there is a unique point incident with ℓ that is collinear with P. A flag is an incident point-line pair, and a conjecture of Kantor, made in print in 1991, says that there are two non-classical examples of flag-transitive generalized quadrangles up to duality. This talk will be about recent progress toward this conjecture: the classification of locally 2-transitive generalized quadrangles, which have an automorphism group that is transitive both on pairs of collinear points and pairs of concurrent lines. This is joint work with John Bamberg and Cai Heng Li.

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Quandles and modes

Joe Cyr, Binghamton University

Much has been written about quandles in the past decade. In particular, a very nice structure theorem has been developed for medial quandles. But medial quandles are a subclass of binary modes, so does this structure extend to this broader class of objects? I will explore some of my attempts to do so and what the goals of having such a structure are.

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A generalization of affine algebras

Eran Crockett, Ripon College

Affine algebras are in some sense the "abelian groups of universal algebra." I define a new generalization of affine algebras that I hope encompasses a large class of nilpotent Mal'cev algebras. Pending a positive answer to an open question on finite nilpotent loops, we show that these two classes coincide for algebras whose cardinality is the product of two distinct primes.

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Spectra of BCK-algebras

Matt Evans, Binghamton University

BCK-algebras are algebraic structures which arise from a non-classical logic, and they are associated with several other classes of structures: e.g., lattice-ordered Abelian groups, Boolean algebras, distributive lattices, MV-algebras, BCI-algebras, and more. Mimicking a well-known construction from ring theory (as well as Boolean algebras and distributive lattices), one can put a topology on the set of prime ideals of a BCK-algebra; we call this the spectrum of a BCK-algebra. As one might expect, there is an interplay between the properties of the algebra and the properties of its spectrum. In this talk I will discuss what is known as well as some open problems.

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Action of Hopf algebras and noncommutative prime spectra

Bach Nguyen, Temple University

Let H be a Hopf algebra, and A be any associative unital algebra. Suppose A is a left H-module algebra. Then the spectrum of A admits a stratification with its strata indexed by H-prime ideals of A. Using this stratification to study A was initiated by K. Goodearl and E. Letzter, then M. Lorenz, where they considered group actions. In this talk, we will discuss a generalization of their results to the setting of cocommutative Hopf algebra, where the H-strata can be described in term of the prime spectrum of certain commutative algebra. This is a joint work with M. Lorenz and R. Yammine.

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Group-graded rings satisfying the strong rank condition

Karl Lorensen, Penn State Altoona

A ring R is said to satisfy the strong rank condition if, for every natural number n, there is no right R-module monomorphism from R^{n+1} to R^n. We discuss this property for rings graded by groups, identifying hypotheses under which it is equivalent to the group used for the grading being amenable.

In addition, we point out how this new characterization of amenability sheds light on a famous conjecture of Reinhold Baer about groups with Noetherian group rings, as well as on a more recent conjecture of Wolfgang Lueck concerning the group von Neumann algebra.

(joint work with Peter Kropholler)

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Filial rings on torsion-free abelian groups

E.I. Kompantseva, Moscow Pedagogical State University

A subring A of an associative ring R is called a metaideal of index n if there exist subrings $A = A_0 \subset A_1 \subset \cdots \subset A_n = R$, such that $A_i \lhd A_{i+1}$ for all $i = 0, \cdots, n-1$. An associative ring is called filial if every its metaideal of finite index is an ideal. Abelian groups on which every associative ring is filial, is called a TI-group. In 2014, R. Andruszkiewicz and M. Woronowicz formulated the problem of the study of TI-groups. They described torsion TI-groups and torsion part of mixed TI-groups.

This work is devoted to the study of TI-groups in some classes of torsion-free abelian groups: separable groups, vector groups and algebraically compact groups.

(Joint work with T.Q.T. Nguyen)

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Groups with vanishing class size p

Mark Lewis, Kent State

Let G be a finite group. A conjugacy class of G is said to be vanishing if there exists an irreducible character of G which takes the value 0 on the elements of this class. In this note, we describe the groups whose vanishing classes all have size p for some prime p. This is joint work with Mariagrazia Bianchi and Emmanuele Pacifici.

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Central Camina pairs

David Costanzo, Kent State

Let G be a finite group, and let N be a nontrivial proper normal subgroup of G. The pair (G, N) is called a **Camina pair** if $|\mathbf{C}_G(x)| = |\mathbf{C}_{G/N}(Nx)|$ for every $x \in G \setminus N$. We will consider the case when $N = \mathbf{Z}(G)$. In this situation, the group G is a p-group of nilpotence class at least 2. When the group G has class 2, the bound $|G : \mathbf{Z}(G)| \geq |\mathbf{Z}(G)|^2$ holds. M.L. Lewis conjectured that this bound holds whenever $(G, \mathbf{Z}(G))$ forms a Camina pair, and he laid the groundwork for proving this statement. We have been able to resolve this conjecture when the group G has nilpotence class at least 4. In our talk, we will discuss some ideas behind the proof. We will also mention the best that we can do for class 3 groups.

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p-basic groups and the invariant of a character

Alexandre Turull, University of Florida

Let K be a finite extension of $\mathbf{Q}_p$, the field of p-adic numbers. Let G be a finite group, and let $\chi \in Irr_K(G)$ be an irreducible character of G with values in K. The invariant $[\chi]_K$ is an element of $\mathbf{Q}/\mathbf{Z}$, and its order is the Schur index of χ over K. We discuss p-basic groups. These are finite groups of types 0 to 4. In the case when G is p-basic, we discuss a formula to calculate $[\chi]_K$. We also discuss how these formulas allow us to compute of $[\chi]_K$ in all cases.

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Some remarks on die Verlagerung

Clifton E. Ealy, Western Michigan University

In this talk, I will recall the transfer map. In addition, I will give a proof of a special case of a theorem of Frobenius which to this date has only been proved by the use of character theory. It is based on and is a slight generalization of Shaw's 1952 proof as given in Endliche Gruppen I by Huppert.

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Group actions and non-vanishing characters

Tom Wolf, Ohio University

An element g of a finite group is non-vanishing if $\chi(g)$ is not zero for all irreducible characters χ of G. It is conjectured for solvable groups that all non-vanishing elements lies in the Fitting subgroup $F(G)$ of G. A theorem of Gaschutz says that for G solvable, $F(G)/\Phi(G)$ is a direct sum of irreducible modules. If each of these modules is primitive, we show that all non-vanishing elements of G indeed lie in $F(G)$.

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Characterizations of nested GVZ groups by central series

Shawn Burkett, Kent State

Many properties of groups can be defined by the existence of a particular normal series. The classic examples being solvability, supersolvability and nilpotence. Among the nilpotent groups are the so-called nested GVZ groups — groups where the centers of the irreducible characters form a chain (nested), and where every irreducible character vanishes off of its center (GVZ). In this talk we show that nested GVZ groups can be characterized by the existence of a certain ascending central series, as well as by the existence of a descending central series. This is joint work with Mark L. Lewis.

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Group matrices and group determinants corresponding to projective representations

Kenneth Johnson, Penn State Abington

The group matrix and group determinant for a finite group offer a different way of approaching representations. These are very symmetrical objects and have made appearances in a variety of situations. Recently in the theory of finite frames with a symmetry group, which is part of the theory of wavelets, projective group matrices have been introduced.

A projective representation κ assigns to each element g of a finite group G a matrix $\kappa(g)$ such that $\kappa(g)\kappa(h) = \alpha(g,h)\kappa(gh)$ where $\alpha : G \times G \to \mathbb{C}$ is a factor set, satisfying a cocycle condition (this leads to the cohomology of groups).

Already in his original paper on projective representations Schur defined a projective group matrix corresponding to a cocycle α, but this has not been taken up (as far as I know) until the work mentioned above. I will survey the theory of projective group matrices and the corresponding projective group determinants and discuss some of the open questions.

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On the connection between Mealy and Moore automata via d-adic cynamics

Dmytro Savchuk, University of South Florida

The ring $\mathbb{Z}_d$ of d-adic integers has a natural interpretation as the boundary of a rooted d-ary tree. Endomorphisms of this tree are in one-to-one correspondence with 1-Lipschitz mappings from $\mathbb{Z}_d$ to itself. Therefore, one can use the language of endomorphisms of rooted trees and, in particular, the language and techniques of Mealy automata, to study such mappings. It was shown by Anashin that such a transformation is defined by a finite Mealy automaton if and only if the sequence of its van der Put coefficients is made of eventually periodic d-adic integers and is d-automatic. In this talk we give an explicit connection between the Moore automata accepting such a sequence and the Mealy automaton inducing the corresponding transformation. This gives a way to construct Mealy automata of mappings that are defined by automatic sequences, like Thue-Morse, for example. This is a joint work with Rostislav Grigorchuk.

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On the rigid kernel of branch groups

Zoran Sunic, Hofstra University

We discuss a simple approach to proving the existence of regular branch groups with nontrivial rigid kernel. The criterion easily applies to the Hanoi Towers group.

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A family of locally solvable subgroups of Thompson's group F

AMANDA TAYLOR, Alfred University

We will discuss an uncountable family of locally solvable, hence elementary amenable, subgroups of Thompson's Group F. The isomorphism types of the groups are distinguished by the order types of their towers of generators. These groups have very nice geometric representations, they are limits of solvable subgroups, and they exhibit the richness of the subgroup structure problem in F.

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The genus spectrum of certain classes of groups

JAY ZIMMERMAN, Towson University

Finite groups can act faithfully as a group of automorphisms of a Riemann surface. Each Riemann surface has a genus associated with it. Any particular group will act on many such surfaces, each with their associated genus and this gives an infinite set of positive integers associated with each group. The minimal element of this set is the genus of the group. If the action is orientation preserving, then we have the strong symmetric genus and if not then we have the symmetric genus. The genus spectrum is the set of positive integers that is the genus of some group. It is known that all positive integers occur as the strong symmetric genus of some group. The corresponding result for the symmetric genus is an open question. This talk will look at results on the asymptotic density of the positive integers which occur as the genus of certain classes of groups (specifically abelian and nilpotent groups) for both the symmetric and strong symmetric genus.

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Groups with all subgroups permutable or polycyclic

Yalcin Karatas, University of Cincinnnati Blue Ash College

Structure of the groups whose subgroups have certain properties has been a very trending subject in recent decades in group theory. Many researchers obtained interesting results for different classes of such groups. In this talk, I will give a brief history of some significant results, and give some recent results on groups whose non-permutable subgroups satisfy various conditions. This is a joint work with Martyn R. Dixon and Marco Trombetti.

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Subgroups of wreath product 2-groups

Jeffrey Riedl, University of Akron

Consider the regular wreath product $W = Z_{2^e} \wr (Z_2 \times Z_2)$ for an integer $e > 1$. So W is the semidirect product of B with $Z_2 \times Z_2$ where B is the direct product of 4 copies of the cyclic group Z_{2^e}. Let A denote the subgroup of the automorphism group $\mathrm{Aut}(W)$ consisting of all those automorphisms that act trivially on the quotient W/B. Let N be an arbitrary nontrivial normal subgroup of W that is contained in B. One can show that N is A-invariant. As a consequence the group A acts naturally on the set $\mathcal{H}(N)$ consisting of all the subgroups H of W such that $BH = W$ and $H \cap B = N$. We have a computational method to identify all such normal subgroups N in case e is small. We have recently discovered a computational method to identify the members of $\mathcal{H}(N)$. Using our knowledge of what the automorphisms in A look like, we are currently developing a computational method to determine the A-orbits in $\mathcal{H}(N)$ and to determine the corresponding stabilizer subgroups.

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On the nonabelian tensor product of cyclic groups of p-power order

Luise-Charlotte Kappe, Binghamton University

The non-abelian tensor product of a pair of groups was introduced by R. Brown and J.-L. Loday. It arises in the applications in homotopy theory of a generalized Van Kampen theorem.

Let G and H be groups which act on each other via automorphisms and which act on themselves via conjugation. The actions are said to be compatible if ${}^{{}^g h}g' = {}^g({}^h({}^{g^{-1}}g'))$ and ${}^{{}^h g}h' = {}^h({}^g({}^{h^{-1}}h'))$ for all $g, g' \in G$ and $h, h' \in H$. The nonabelian tensor product $G \otimes H$ is defined provided G and H act compatibly. In such a case $G \otimes H$ is the group generated by the symbols $g \otimes h$ with relations $gg' \otimes h = ({}^g g' \otimes {}^g h)(g \otimes h)$ and $g \otimes hh' = (g \otimes h)({}^h g \otimes {}^h h')$ for $g, g' \in G$ and $h, h' \in H$.

If $G = H$, we call $G \otimes G$ the tensor square of G. Here the action is conjugation which is always compatible. Good progress has been made in determining the nonabelian tensor square for large classes of groups.

However in the case of nonabelian tensor products the enigma of compatible actions has prevented such progress. Only in a few cases the nonabelian tensor product of two groups with nontrivial compatible actions has been determined. One such case is the nonabelian tensor product of two infinite cyclic groups, where the mutual actions are inversion. In 1989 Gilbert and Higgins showed that the nonabelian tensor product was isomorphic to the free abelian group of rank 2, contradicting an earlier conjecture that the nonabelian tensor product of two cyclic groups is cyclic.

We were able to show that the minimal number of generators of a nonabelian tensor product of two cyclic groups does not exceed two. Furthermore, we established a necessary and sufficient condition that a pair of actions on two cyclic groups is a compatible pair. With its help we classified all compatible actions in the case of cyclic p-groups. The resulting nonabelian tensor products turn out to be cyclic p-groups with the exception of some 2-groups with certain actions of order 2.

This is joint work with M.P. Visscher, M.S. Mohamad, and Raimundo Bastos.

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Abstracts

Alphabetical by Speaker

On the number of elements with order divisible by m in a group

Bret Benesh, College of St. Benedict & St. John's University

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bbenesh@csbsju.edu

Characterizations of nested GVZ groups by central series

Shawn Burkett, Kent State

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sburket1@kent.edu

Central Camina pairs

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Let G be a finite group, and let N be a nontrivial proper normal subgroup of G. The pair (G, N) is called a **Camina pair** if $|\mathbf{C}_G(x)| = |\mathbf{C}_{G/N}(Nx)|$ for every $x \in G \setminus N$. We will consider the case when $N = \mathbf{Z}(G)$. In this situation, the group G is a p-group of nilpotence class at least 2. When the group G has class 2, the bound $|G : \mathbf{Z}(G)| \geq |\mathbf{Z}(G)|^2$ holds. M.L. Lewis conjectured that this bound holds whenever $(G, \mathbf{Z}(G))$ forms a Camina pair, and he laid the groundwork for proving this statement. We have been able to resolve this conjecture when the group G has nilpotence class at least 4. In our talk, we will discuss some ideas behind the proof. We will also mention the best that we can do for class 3 groups.

zcostan1@binghamton.edu

A generalization of affine algebras

Eran Crockett, Ripon College

Affine algebras are in some sense the “abelian groups of universal algebra.” I define a new generalization of affine algebras that I hope encompasses a large class of nilpotent Mal’cev algebras. Pending a positive answer to an open question on finite nilpotent loops, we show that these two classes coincide for algebras whose cardinality is the product of two distinct primes.

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Quandles and modes

Joe Cyr, Binghamton University

Much has been written about quandles in the past decade. In particular, a very nice structure theorem has been developed for medial quandles. But medial quandles are a subclass of binary modes, so does this structure extend to this broader class of objects? I will explore some of my attempts to do so and what the goals of having such a structure are.

jcyr2@binghamton.edu

Groups that are the union of two semigroups

Casey Donoven, Binghamton University

Given a group G, one can ask what is the minimum number of proper subsemigroups needed to cover G. I will prove the following theorem: G is the union of two proper subsemigroups if and only if G has a left-orderable quotient (that is not trivial). The main arguments involve identifying where inverses are found in the two semigroups and using Zorn's lemma to identity a normal subgroup that produces the necessary quotient.

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Clifton E. Ealy, Western Michigan University

In this talk, I will recall the transfer map. In addition, I will give a proof of a special case of a theorem of Frobenius which to this date has only been proved by the use of character theory. It is based on and is a slight generalization of Shaw's 1952 proof as given in Endliche Gruppen I by Huppert.

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Spectra of BCK-algebras

Matt Evans, Binghamton University

BCK-algebras are algebraic structures which arise from a non-classical logic, and they are associated with several other classes of structures: e.g., lattice-ordered Abelian groups, Boolean algebras, distributive lattices, MV-algebras, BCI-algebras, and more. Mimicking a well-known construction from ring theory (as well as Boolean algebras and distributive lattices), one can put a topology on the set of prime ideals of a BCK-algebra; we call this the spectrum of a BCK-algebra. As one might expect, there is an interplay between the properties of the algebra and the properties of its spectrum. In this talk I will discuss what is known as well as some open problems.

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Groups with no abelian partition

TUVAL FOGUEL, Adelphi University

A nonabelian group G has an Abelian Partition if there is a set theoretic partition of G into disjoint commutative subsets $A_0, A_1, \ldots, A_n$ where $\mid A_i \mid > 1$ for all i. The problem of classifying Abelian Partition was recently introduced in a paper by F. Salehzadeh A. Mahmoudifar, A. R. Moghaddamfar who classied all groups with $n = 2$ and 3. The motivation for this problem can be found in graph theory where partitions of graphs into induced complete subgraphs is of great importance. This talk will look at groups with no Abelian Partition.

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Pairwise covering numbers of groups

STEPHEN GAGOLA III, University of South Carolina

The covering number of a non-cyclic group G, denoted by $\sigma(G)$, is the size of a minimal collection of proper subgroups of G whose set-theoretic union is G. The first question dealing with finite covers of groups came about in 1926 by G. Scorza who determined exactly which groups are the union of three proper subgroups. It was then a paper of J.H.E. Cohn in 1994 that brought back the attention of coverings of groups. In this talk we will look at a similar concept to that of covering numbers of groups by looking at pairwise covering numbers. We will also be using incidence geometry and taking a look at incidence structures that satisfy certain properties to help us determine certain integers n that turn out to be pairwise covering numbers.

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Group matrices and group determinants corresponding to projective representations

Kenneth Johnson, Penn State Abington

The group matrix and group determinant for a finite group offer a different way of approaching representations. These are very symmetrical objects and have made appearances in a variety of situations. Recently in the theory of finite frames with a symmetry group, which is part of the theory of wavelets, projective group matrices have been introduced.

A projective representation κ assigns to each element g of a finite group G a matrix $\kappa(g)$ such that $\kappa(g)\kappa(h) = \alpha(g,h)\kappa(gh)$ where $\alpha : G \times G \to \mathbb{C}$ is a factor set, satisfying a cocycle condition (this leads to the cohomology of groups).

Already in his original paper on projective representations Schur defined a projective group matrix corresponding to a cocycle α, but this has not been taken up (as far as I know) until the work mentioned above. I will survey the theory of projective group matrices and the corresponding projective group determinants and discuss some of the open questions.

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On the nonabelian tensor product of cyclic groups of p-power order

Luise-Charlotte Kappe, Binghamton University

The non-abelian tensor product of a pair of groups was introduced by R. Brown and J.-L. Loday. It arises in the applications in homotopy theory of a generalized Van Kampen theorem.

Let G and H be groups which act on each other via automorphisms and which act on themselves via conjugation. The actions are said to be compatible if ${}^{{}^g h}g' = {}^g({}^h({}^{g^{-1}}g'))$ and ${}^{{}^h g}h' = {}^h({}^g({}^{h^{-1}}h'))$ for all $g, g' \in G$ and $h, h' \in H$. The nonabelian tensor product $G \otimes H$ is defined provided G and H act compatibly. In such a case $G \otimes H$ is the group generated by the symbols $g \otimes h$ with relations $gg' \otimes h = ({}^g g' \otimes {}^g h)(g \otimes h)$ and $g \otimes hh' = (g \otimes h)({}^h g \otimes {}^h h')$ for $g, g' \in G$ and $h, h' \in H$.

If $G = H$, we call $G \otimes G$ the tensor square of G. Here the action is conjugation which is always compatible. Good progress has been made in determining the nonabelian tensor square for large classes of groups.

However in the case of nonabelian tensor products the enigma of compatible actions has prevented such progress. Only in a few cases the nonabelian tensor product of two groups with nontrivial compatible actions has been determined. One such case is the nonabelian tensor product of two infinite cyclic groups, where the mutual actions are inversion. In 1989 Gilbert and Higgins showed that the nonabelian tensor product was isomorphic to the free abelian group of rank 2, contradicting an earlier conjecture that the nonabelian tensor product of two cyclic groups is cyclic.

We were able to show that the minimal number of generators of a nonabelian tensor product of two cyclic groups does not exceed two. Furthermore, we established a necessary and sufficient condition that a pair of actions on two cyclic groups is a compatible pair. With its help we classified all compatible actions in the case of cyclic p-groups. The resulting nonabelian tensor products turn out to be cyclic p-groups with the exception of some 2-groups with certain actions of order 2.

This is joint work with M.P. Visscher, M.S. Mohamad, and Raimundo Bastos.

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Groups with all subgroups permutable or polycyclic

YALCIN KARATAS, University of Cincinnnati Blue Ash College

Structure of the groups whose subgroups have certain properties has been a very trending subject in recent decades in group theory. Many researchers obtained interesting results for different classes of such groups. In this talk, I will give a brief history of some significant results, and give some recent results on groups whose non-permutable subgroups satisfy various conditions. This is a joint work with Martyn R. Dixon and Marco Trombetti.

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Finite groups with a Frattini subgroup property satisfied by nilpotent groups

JOSEPH KIRTLAND, Marist College

Given a finite group G and a Sylow p-subgroup P of G, then $P \cap \text{Frat}(G) = \text{Frat}(P)$. This talk will investigate finite groups that share this property.

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Filial rings on torsion-free abelian groups

E.I. KOMPANTSEVA, Moscow Pedagogical State University

A subring A of an associative ring R is called a metaideal of index n if there exist subrings $A = A_0 \subset A_1 \subset \cdots \subset A_n = R$, such that $A_i \lhd A_{i+1}$ for all $i = 0, \cdots, n-1$. An associative ring is called filial if every its metaideal of finite index is an ideal. Abelian groups on which every associative ring is filial, is called a TI-group. In 2014, R. Andruszkiewicz and M. Woronowicz formulated the problem of the study of TI-groups. They described torsion TI-groups and torsion part of mixed TI-groups.

This work is devoted to the study of TI-groups in some classes of torsion-free abelian groups: separable groups, vector groups and algebraically compact groups.

(Joint work with T.Q.T. Nguyen)

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Groups with vanishing class size p

Mark Lewis, Kent State

Let G be a finite group. A conjugacy class of G is said to be vanishing if there exists an irreducible character of G which takes the value 0 on the elements of this class. In this note, we describe the groups whose vanishing classes all have size p for some prime p. This is joint work with Mariagrazia Bianchi and Emmanuele Pacifici.

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Group-graded rings satisfying the strong rank condition

Karl Lorensen, Penn State Altoona

A ring R is said to satisfy the strong rank condition if, for every natural number n, there is no right R-module monomorphism from R^{n+1} to R^n. We discuss this property for rings graded by groups, identifying hypotheses under which it is equivalent to the group used for the grading being amenable.

In addition, we point out how this new characterization of amenability sheds light on a famous conjecture of Reinhold Baer about groups with Noetherian group rings, as well as on a more recent conjecture of Wolfgang Lueck concerning the group von Neumann algebra.

(joint work with Peter Kropholler)

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On the Chermak-Delgado lattice of a finite group

Ryan McCulloch, University of Bridgeport

The Chermak-Delgado lattice of a finite group, G, denote $\mathrm{CD}(G)$, is a modular, self-dual sublattice of the lattice of subgroups of G. $\mathrm{CD}(G)$ has nice properties and has been studied a great deal in recent years. By imposing bounds on the index of a maximum order self-centralizing subgroup, A, of G, we classify $\mathrm{CD}(G)$. We apply this to obtain a classification of the Chermak-Delgado lattices of metabelian p-groups of maximal class. This is joint work with Marius Tarnauceanu of Al.I. Cuza University.

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Action of Hopf algebras and noncommutative prime spectra

Bach Nguyen, Temple University

Let H be a Hopf algebra, and A be any associative unital algebra. Suppose A is a left H-module algebra. Then the spectrum of A admits a stratification with its strata indexed by H-prime ideals of A. Using this stratification to study A was initiated by K. Goodearl and E. Letzter, then M. Lorenz, where they considered group actions. In this talk, we will discuss a generalization of their results to the setting of cocommutative Hopf algebra, where the H-strata can be described in term of the prime spectrum of certain commutative algebra. This is a joint work with M. Lorenz and R. Yammine.

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Subgroups of wreath product 2-groups

Jeffrey Riedl, University of Akron

Consider the regular wreath product $W = Z_{2^e} \wr (Z_2 \times Z_2)$ for an integer $e > 1$. So W is the semidirect product of B with $Z_2 \times Z_2$ where B is the direct product of 4 copies of the cyclic group Z_{2^e}. Let A denote the subgroup of the automorphism group $\mathrm{Aut}(W)$ consisting of all those automorphisms that act trivially on the quotient W/B. Let N be an arbitrary nontrivial normal subgroup of W that is contained in B. One can show that N is A-invariant. As a consequence the group A acts naturally on the set $\mathcal{H}(N)$ consisting of all the subgroups H of W such that $BH = W$ and $H \cap B = N$. We have a computational method to identify all such normal subgroups N in case e is small. We have recently discovered a computational method to identify the members of $\mathcal{H}(N)$. Using our knowledge of what the automorphisms in A look like, we are currently developing a computational method to determine the A-orbits in $\mathcal{H}(N)$ and to determine the corresponding stabilizer subgroups.

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On the connection between Mealy and Moore automata via d-adic cynamics

Dmytro Savchuk, University of South Florida

The ring $\mathbb{Z}_d$ of d-adic integers has a natural interpretation as the boundary of a rooted d-ary tree. Endomorphisms of this tree are in one-to-one correspondence with 1-Lipschitz mappings from $\mathbb{Z}_d$ to itself. Therefore, one can use the language of endomorphisms of rooted trees and, in particular, the language and techniques of Mealy automata, to study such mappings. It was shown by Anashin that such a transformation is defined by a finite Mealy automaton if and only if the sequence of its van der Put coefficients is made of eventually periodic d-adic integers and is d-automatic. In this talk we give an explicit connection between the Moore automata accepting such a sequence and the Mealy automaton inducing the corresponding transformation. This gives a way to construct Mealy automata of mappings that are defined by automatic sequences, like Thue-Morse, for example. This is a joint work with Rostislav Grigorchuk.

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On the rigid kernel of branch groups

Zoran Sunic, Hofstra University

We discuss a simple approach to proving the existence of regular branch groups with nontrivial rigid kernel. The criterion easily applies to the Hanoi Towers group.

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Locally 2-transitive generalized quadrangles

Eric Swartz, College of William and Mary

A finite generalized quadrangle is a finite incidence geometry such that two points are incident with at most one line, and, given any point P and line ℓ not incident with P, there is a unique point incident with ℓ that is collinear with P. A flag is an incident point-line pair, and a conjecture of Kantor, made in print in 1991, says that there are two non-classical examples of flag-transitive generalized quadrangles up to duality. This talk will be about recent progress toward this conjecture: the classification of locally 2-transitive generalized quadrangles, which have an automorphism group that is transitive both on pairs of collinear points and pairs of concurrent lines. This is joint work with John Bamberg and Cai Heng Li.

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A family of locally solvable subgroups of Thompson's group F

Amanda Taylor, Alfred University

We will discuss an uncountable family of locally solvable, hence elementary amenable, subgroups of Thompson's Group F. The isomorphism types of the groups are distinguished by the order types of their towers of generators. These groups have very nice geometric representations, they are limits of solvable subgroups, and they exhibit the richness of the subgroup structure problem in F.

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p-basic groups and the invariant of a character

Alexandre Turull, University of Florida

Let K be a finite extension of $\mathbf{Q}_p$, the field of p-adic numbers. Let G be a finite group, and let $\chi \in Irr_K(G)$ be an irreducible character of G with values in K. The invariant $[\chi]_K$ is an element of $\mathbf{Q}/\mathbf{Z}$, and its order is the Schur index of χ over K. We discuss p-basic groups. These are finite groups of types 0 to 4. In the case when G is p-basic, we discuss a formula to calculate $[\chi]_K$. We also discuss how these formulas allow us to compute of $[\chi]_K$ in all cases.

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Fuchs's problem for 2-groups

Nicholas Werner, SUNY Old Westbury

We call a group G *realizable* if there exists a ring R such that the group of units of R is isomorphic to G. The question of determining whether a group or family of groups is realizable has come to be called *Fuchs' Problem* after László Fuchs, who in 1960 posed the problem of characterizing the groups that can occur as the group of units of a commutative ring. In recent years, Fuchs' problem has been solved for several families of finite groups, including symmetric groups, alternating groups, dihedral groups, and finite simple groups. In this talk, we examine Fuchs' problem for finite 2-groups. For such a group G, the exponent of G plays an important role in determining whether G is realizable. We prove that any finite 2-group of exponent at most 4 is realizable, and that a group of order 2^n that is realizable in characteristic 2^m has exponent at most $2^{\lceil \log_2(n+1) \rceil - m + 1}$. In general, 2-groups of exponent at least 8 may or may not be realizable, and it is not at all clear how to classify such groups. We will discuss several intriguing examples and open questions on these topics. This is joint work with Eric Swartz.

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Group actions and non-vanishing characters

TOM WOLF, Ohio University

An element g of a finite group is non-vanishing if $\chi(g)$ is not zero for all irreducible characters χ of G. It is conjectured for solvable groups that all non-vanishing elements lies in the Fitting subgroup $F(G)$ of G. A theorem of Gaschutz says that for G solvable, $F(G)/\Phi(G)$ is a direct sum of irreducible modules. If each of these modules is primitive, we show that all non-vanishing elements of G indeed lie in $F(G)$.

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The genus spectrum of certain classes of groups

JAY ZIMMERMAN, Towson University

Finite groups can act faithfully as a group of automorphisms of a Riemann surface. Each Riemann surface has a genus associated with it. Any particular group will act on many such surfaces, each with their associated genus and this gives an infinite set of positive integers associated with each group. The minimal element of this set is the genus of the group. If the action is orientation preserving, then we have the strong symmetric genus and if not then we have the symmetric genus. The genus spectrum is the set of positive integers that is the genus of some group. It is known that all positive integers occur as the strong symmetric genus of some group. The corresponding result for the symmetric genus is an open question. This talk will look at results on the asymptotic density of the positive integers which occur as the genus of certain classes of groups (specifically abelian and nilpotent groups) for both the symmetric and strong symmetric genus.

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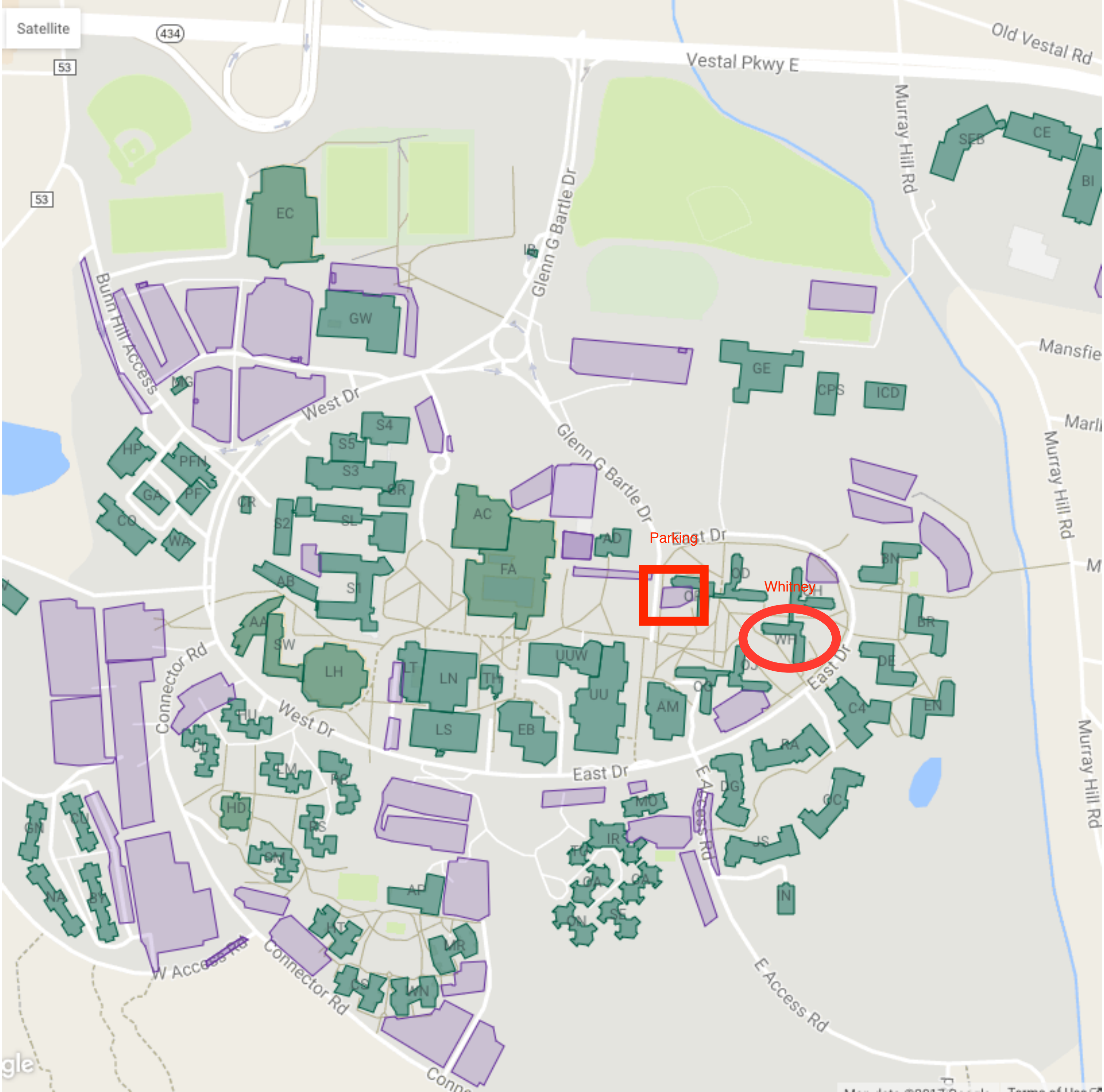
Notes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