2026 Zassenhaus Groups and Friends Conference
Kent State University, Kent OH
May 30 and 31, 2026

# *PROGRAM & ABSTRACTS*

**2026 Zassenhaus Groups and Friends Conference**
**Kent State University, Kent OH**
**May 30–31, 2026**

# Conference Program

## Saturday, May 30, 2026; Morning Session

Location: Room 228 MSB

Session Chair: Jeff Riedl

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|---|---|
| 7:00 AM - 7:45 AM | **Conference registration** |
| 8:00 AM - 8:10 AM | **Opening Remarks:** Jenya Soprunova<br>Kent State Department Chair |
| 8:20 AM - 8:40 AM | Mandi SCHAEFFER FRY (University of Denver)<br>**Isaacs-Navarro's Galois Refinement of the McKay Conjecture** |
| 8:50 AM - 9:10 AM | Hanlim JANG (Binghamton University)<br>**The building associated to a BN-pair** |
| 9:20 AM - 9:40 AM | Eden KETCHUM (University of Denver)<br>**Characters and Sylow subgroup generation** |
| 9:50 AM - 10:10 AM | **COFFE BREAK** |
| 10:10 AM - 10:30 AM | Alexander BORISOV (Binghamton University)<br>**On the problem of faithfulness of the Burau representation of $B_4$** |
| 10:40 AM - 11:00 AM | Inna SYSOEVA (Binghamton University)<br>**Welded braid groups, their (irreducible) representations, and linearity questions** |
| 11:10 AM - 11:30 AM | Casey DONOVEN (Montana State University Northern)<br>**2-coverings of semigroups** |
| 11:40 AM - 12:00 PM | Shannon TEFFT (Rose-Hulman Institute of Technology)<br>**Examining Ducci sequences on $\mathbb{Z}_m^n$ where $m, n$ are powers of 2** |
| 12:10 PM - 12:15 PM | Conference photograph |

**LUNCH BREAK**

12:15 - 2:00 PM

## Saturday May 30, 2026; Afternoon Session

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|---|---|
| | Location: Room 228 MSB |
| Session Chair | Don White |

2:00 PM - 2:20 PM — Thomas KELLER (Texas State University)
**Gruenberg-Kegel graphs of $T$-solvable groups**

2:30 PM - 2:50 PM — Alexa RENNER (Rose-Hulman Institute of Technology)
**Prime graphs of infinite groups**

3:00 PM - 3:20 PM — Andrew SUMMERS (Kent State)
**Classifying character degree graphs with eight vertices**

3:30 PM - 4:00 PM — **COFFEE BREAK**

4:00 PM - 4:20 PM — Tuval FOGUEL (Adelphi University)
**Trivial-intersection transitivity in finite groups**

4:30 PM - 4:50 PM — Arturo MAGIDIN (University of Louisiana at Lafayette)
**Dominions and nonsurjective epimorphisms in varieties of groups**

**CONFERENCE BANQUET**
6:00 – 9:00 PM
Laziza's – Downtown Kent

## Sunday, May 31, 2026; Morning Session

Location: Room 228 MSB

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|---|---|
| Session Chair | Hung Tong-Viet |
| 8:00 AM - 8:20 AM | Alexandre TURULL (University of Florida)<br>**The linear characters of basic characters** |
| 8:30 AM - 8:50 AM | Thomas WOLF (Ohio University)<br>**Group properties determined by 2-generator subgroups** |
| 9:00 AM - 9:20 AM | Nic BEIKE (Kent State)<br>**Non-nilpotent solvable groups with four prime power character degrees and derived length four** |
| 9:30 AM - 9:50 AM | Wil COCKE (U.S. Army and Carnegie Mellon University)<br>**The category of centralizer lattices** |
| 10:00 AM - 10:30 AM | **COFFEE BREAK** |
| 10:30 AM - 10:50 AM | JP COSSEY (University of Akron)<br>**The number of ordinary characters containing a Brauer character in a solvable group** |
| 11:00 AM - 11:20 AM | Ryan McCULLOCH (Binghamton University)<br>**Finite groups with many elements of the same order** |
| 11:30 AM - 11:50 AM | Brandon MARTIN (Kent State)<br>**Groups with a fixed character degree** |
| 12:00 PM - 12:20 PM | Thu QUAN (Binghamton University)<br>**A generalization of Camina pairs and orders of elements in cosets** |
| 12:30 PM - 12:50 PM | Samantha WYLER (Kent State)<br>**Semi extra special groups of order $p^{12}$ and center $p^2$** |
| 12:50 PM - 1:00 PM | Closing Remarks |

## Conference Information

**Venue:** All talks will be at Room 228 in the Mathematical Sciences Building (MSB)

**Equipment:** The room has a computer, a whiteboard, overhead projector, and a laptop hookup. If your laptop needs an adaptor, please bring one.

**Parking:** Lot R5 on Summit, in front of the MSB. Parking is free on the weekend.

**Conference photograph:** We will take the conference photograph at the end of the Saturday Morning Session.

**Saturday lunch:** There are a number of restaurants near campus and downtown for lunch on Saturday.

**Conference Dinner:** Laziza's in Downtown Kent.

**Campus map:** A map is available at `https://tinyurl.com/3unvevwa` A printout of the map, with MSB circled, is attached to this program.

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# Abstracts

**In order of presentation**

**Isaacs–Navarro's Galois refinement of the McKay Conjecture**

Mandi Schaeffer Fry, University of Denver

The McKay Conjecture (now a theorem due to Cabanes and Säth) says that there is a bijection between the irreducible characters of a finite group with degree not divisible by $p$ and the corresponding set for the normalizer of a Sylow $p$-subgroup. Several Galois refinements of this Conjecture exist, positing that such a bijection should exist that is compatible with fields of values. In this talk, I will discuss joint work with Lucas Ruhstorfer, in which we complete the proof of the original of these Galois refinements, proposed by Isaacs and Navarro in 2002. I will also discuss several consequences, giving additional relationships between character-theoretic properties and the local structure of a finite group.

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**The building associated to a BN-pair**

Hanlim Jang, Binghamton University

In mathematics, buildings are geometric structures primarily representing groups of Lie type. Jacques Tits introduced a Tits system which is called a BN-pair. He studied the relation between groups having a BN-pair and buildings. In the talk, I will explain briefly what are buildings and BN-pair and show that a group $G$ having a BN-pair is essentially the same thing as $G$ acting strongly transitively on an associated building.

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**Characters and Sylow subgroup generation**

Eden Ketchum, University of Denver

Given an almost simple group $A$, we algorithmically show that the character table of $A$ determines whether or not the Sylow 3-subgroups of $A$ are 2-generated. We show this property is equivalent to a condition involving the Galois action on characters in the principal 3-block. This result would be a consequence of the Alperin-McKay-Navarro conjecture.

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**On the problem of faithfulness of the Burau representation of $B_4$**

Alexander Borisov, Binghamton University

Burau representation is the oldest known non-trivial representation of Artin braid group $B_n$. It is known to be faithful for $n = 2$, 3 and not faithful for $n \geq 5$. While linearity of Artin braid groups was famously established around 2000 independently by Bigelow and Krammer, the question of faithfullness of (reduced) Burau representation of $B_4$ is still open. This problem has a reputation of being very hard, with only partial results known. By the classical result of Birman, it is equivalent to faithfulness of a certain representation of a free group $F_2$ over the ring of Laurent polynomials $\mathbb{C}[t^{\pm 1}]$. In our attempt to get to the bottom of this mystery, we discovered a sequence of words in $F_2$ whose length grows exponentially, but the length of whose outputs grows linearly. Extensive numerical evidence suggests that this is the "worst case" scenario of cancellation, and this suggests a possible approach to proving faithfulness of the Burau representation of $B_4$. Joint work with Inna Sysoeva.

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**Welded braid groups, their (irreducible) representations and linearity questions**

Inna Sysoeva, Binghamton University

Welded braid group $WB_n$ is a generalization of a classical braid group $B_n$. It contains $B_n$ as a subgroup, and is isomorphic to a subgroup of the group of automorphisms $Aut(F_n)$ of a free group $F_n$.

It is known (S. Bigelow, 2001; D. Krammer, 2002) that $B_n$ is linear for all $n$; it is also known (E. Formanek, C. Procesi, 1992) that the $Aut(F_n)$ is not linear for $n \geq 3$. It is still an open problem whether $WB_n$ is linear or not for $n \geq 3$.

In this talk I will define welded braid groups, give their topological interpretation, and discuss their finite-dimensional representations. I will also give overview of some of my recent results on the classification of the irreducible representations of $WB_n$ of dimension $\leq n$.

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## 2-coverings of semigroups

Casey Donoven, Montana State University Northern

A 2-covering of a group $G$ is a collection of proper subgroups of $G$ such that each pair of elements of $G$ is contained in a subgroup within collection. The 2-covering number of group $G$ is the minimum size of such a 2-covering, and these have been recently studied by Gagola III, Kirkland, and Lucchini. In this talk, I will generalize this definition to semigroups and present initial findings on 2-covering numbers of semigroups. Of particular interest, I will show that 'a lot' of semigroups have 2-covering number equal to 3 and construct group-like semigroups with specific 2-covering numbers.

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## Examining Ducci sequences on $\mathbb{Z}_m^n$ when $m, n$ are Powers of 2

Shannon Tefft, Rose-Hulman Institute of Technology

Let the Ducci function $D : \mathbb{Z}_m^n \to \mathbb{Z}_m^n$ be defined as

$$D(x_1, x_2, \ldots, x_n) = (x_1 + x_2 \bmod m, x_2 + x_3 \bmod m, \ldots, x_n + x_1 \bmod m)$$

and let the Ducci sequence of $\mathbf{u}$ be the sequence $\{D^\alpha(\mathbf{u})\}_{\alpha=0}^{\infty}$. Since $\mathbb{Z}_m^n$ is a finite group, every Ducci sequence must enter a cycle. In the case where both $n, m$ are powers of 2, the cycle for these Ducci sequences is always $(0, 0, \ldots, 0)$. We will examine this, as well as how long it takes for Ducci sequences to reach this tuple, depending on what exactly $n, m$ are.

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**Gruenberg-Kegel graphs of T-solvable groups**

Thomas Keller, Texas State University

For a finite group $G$, the prime graph $\mathcal{P}(G)$ is defined as follows: The vertices are the prime divisors of $|G|$, and there is an edge between primes $p$ and $q$ if and only if there is an element of order $pq$ in $G$. This graph has received quite a bit attention since its inception in the 1970s. In 2015 the prime graphs of solvable groups were characterized as follows:

> **Theorem:** *An unlabeled simple graph is isomorphic to the prime graph of a solvable group if and only if its complement is* 3*-colorable and triangle-free.*

Since then, many extensions of this result have been obtained by "allowing in" one simple group at a time. In the talk we will present the latest development on these classifications which were obtained in collaboration with undergraduate students.

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**Prime graphs of infinite groups**

Alexa Renner, Rose-Hulman Institute of Technology

The prime graph of a finite group $G$ is the graph $\Gamma(G)$ with vertex set the set of prime divisors $\pi(G)$ of $|G|$ and an edge between vertices $p, q \in \pi(G)$ if and only if there exists an element $g \in G$ with order $o(g) = pq$. Given a finite nonabelian simple group $T$, a group $G$ is $T$-solvable if there exists a composition series of $G$ such that every composition factor is either abelian or isomorphic to $T$. In this paper, we introduce the prime graph of an infinite group, the graph $\Gamma(G)$ with vertex set $\pi(G) = \{o(g) : g \in G \text{ and } o(g) \text{ is prime}\}$ and an edge between $p, q \in \pi(G)$ if and only if there exists an element $g \in G$ with order $pq$, and generalize several results on the prime graphs of finite solvable and $T$-solvable groups to results on the prime graphs of members of certain classes of infinite solvable and $T$-solvable groups.

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**Classifying character degree graphs with eight vertices**

Andrew Summers, Kent State

An algorithm for classifying character degree graphs using known results and constructions is outlined. This algorithm is applied to graphs of order eight to determine which graphs can occur as $\Delta(G)$ for a finite solvable group $G$.

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**Trivial-intersection transitivity in finite groups**

Tuval Foguel, Adelphi University

We study finite groups in which the trivial intersection (TI) property is transitive among subgroups, which we call TIT-groups (Trivial Intersection Transitive groups). Thus, whenever $H$ is a TI-subgroup of $G$ and $K$ is a TI-subgroup of $H$, the subgroup $K$ is also a TI-subgroup of $G$. We investigate structural properties of TIT-groups and determine the TIT-property for several families of finite groups, including dihedral and dicyclic groups, and identify families of finite simple groups that satisfy the TIT condition. These results clarify how the transitivity of the TI-property interacts with subgroup structure and provide new structural constraints for groups satisfying this condition.

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**Dominions and nonsurjective epimorphisms in varieties of groups**

Arturo Magidin, University of Louisiana at Lafayette

Dominions were introduced by Isbell to study epimorphisms (morphisms that are right-cancellable). Let $\mathcal{C}$ be a class of groups, $G \in \mathcal{C}$, and $H$ a subgroup of $G$. The *dominion of $H$ in $G$* (relative to $\mathcal{C}$), is the subgroup

$$\{x \in G \mid \text{for all } K \in \mathcal{C}, \text{ if } f, g\colon G \to K \text{ and } f|_H = g|_H, \text{ then } f(x) = g(x)\};$$

that is, the intersection of all equalizer subgroups of $G$ that contain $x$. A morphism $f\colon H \to G$ is an epimorphism in $\mathcal{C}$ if and only if the dominion of $f(H)$ in $G$ is all of $G$.

Some years ago I studied dominions and instances of nonsurjective epimorphisms in some varieties of groups (classes that are closed under homomorphic images, subgroups, and arbitrary products). As part of a project with a doctoral student, I am revisiting some of those results and looking for extensions. I will cover some of the results I obtained then, and discuss some of the questions we are hoping to be able to answer now.

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**The linear characters of basic characters**

Alexandre Turull, University of Florida

Let $G$ be a finite group, let $p$ be a prime, let $Q_p$ be the field of $p$-adic numbers, and let $\chi$ be an irreducible character of $G$ that takes its values in some finite extension $F$ of $\mathbf{Q}_p$. BAssociated with $\chi$ is an element $[\mathrm{End}_{FG}(M)]$ of $\mathrm{Br}(F)$, the Brauer group of $F$, and its Hasse invariant $inv_K(\chi) \in \mathbf{Q}/\mathbf{Z}$. I recently proved that if $\chi$ is in a $p$-block $B$ with cyclic defect group, then associated to $B$ are two linear characters $\alpha_B$ and $\mu_{B,K}$, and that $inv_K(\chi)$ is easily computed from them. More generally, I also proved, without the assumption of the existence of the block $B$, that $inv_K(\chi)$ can always be computed from the $inv_K(\chi')$ for various *basic* $\chi'$. We show that these basic $\chi'$ have associated with them two linear characters and that they can be easily computed from $\chi'$.

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**Group properties determined by 2-generator subgroups**

Thomas Wolf, Ohio University

John Thompson proved that a finite group $G$ is solvable if and only if every 2-generator subgroup of $G$ is solvable. We discuss what properties of a finite group are determined by the 2-generator subgroups of $G$ (or vice versa). In particular, we discuss properties related to the $\pi$-structure of a group.

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**Non-nilpotent solvable groups with four prime power character degrees and derived length four**

Nic Beike, Kent State University

It is conjectured that for finite solvable groups the inequality $\mathrm{dl}(G) \leq |\mathrm{cd}(G)|$ always holds. This has been shown to hold when $|\mathrm{cd}(G)| = 4$. We examine the case when we have the equality $4 = \mathrm{dl}(G) = |\mathrm{cd}(G)|$ where $G$ has character degrees that are all powers of a single prime and $G$ is not nilpotent.

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**The category of centralizer lattices**

Wil Cocke, U.S. Army and Carnegie Mellon University

We formalize the concept of a centralizer-respecting homomorphism, surjective homomorphisms which are equivariant with respect to taking the centralizer of a subgroup. There is a functor from the category of centralizer-respecting homomorphisms to the category of centralizer lattices. Finally, we conclude with some theorems about centralizer-respecting homomorphisms that show that the category of centralizer-respecting homomorphisms has many interesting maps.

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**The number of ordinary characters containing a Brauer character in a solvable group**

JP Cossey (University of Akron)

Let $G$ be solvable, and let $\varphi$ be a Brauer character of $G$. We define $\mathrm{Irr}(\varphi)$ to be the set of ordinary irreducible characters of $G$ that contains $\varphi$ in their decomposition. What can we say if $\mathrm{Irr}(\varphi)$ is "small"? If we similarly define $\mathrm{Irr}_p(\varphi)$ to be the characters in $\mathrm{Irr}(\varphi)$ that have degree divisible by $p$, then what can we say if $\mathrm{Irr}_p(\varphi)$ is small? In this talk we'll answer these questions, as well as natural analogs regarding heights of characters.

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**Finite groups with many elements of the same order**

Ryan McCulloch, Binghamton University

Deaconescu asked the following question: If at least half of the elements of a finite group are of the same order, $k$, does the group have to be solvable? The answer to the question is negative for some $k$. In this talk we let $k$ vary, and answer the question for some specific values of $k$, with a focus on the $k = 4$ case. This is a joint work with Lee Tae Young.

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**Groups with a fixed character degree**

Brandon Martin, Kent State

Previously, we've constructed an arithmetic characterization to the following question: for which positive integers $d$, $e$ with $\gcd(d, d+e) = 1$ and $d$ square-free, does there exist a solvable group $G$, or order $d(d+e)$, such that $d$ is an irreducible character degree of $G$? We now begin removing the condition that $d$ is square-free and obtain analogous results. This work is motivated by previous investigations into finite groups that feature an irreducible character of comparatively large degree.

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**A generalization of Camina pairs and orders of elements in cosets**

Thu Quan, Binghamton University

Let $G$ be a finite group with a nontrivial proper subgroup $H$. If $H$ is normal in $G$ and for every element $x \in G \setminus H$, $x$ is conjugate to $xh$ for all $h \in H$, then the pair $(G, H)$ is called a Camina pair. In 1992, Kuisch and van der Waall proved that $(G, H)$ is a Camina pair if and only if every nontrivial irreducible character of $H$ induces homogeneously to $G$. In this talk, we discuss the equivalence of these two conditions on the pair $(G, H)$ without assuming that $H$ is normal in $G$. In addition, we look at the structure of the pair $(G, H)$ under a more general assumption that, for every element $x \in G \setminus H$ of odd order, the coset $xH$ consists entirely of elements of odd order. This is joint work with Hung Tong-Viet.

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**Semi extra special groups of order $p^{12}$ and center $p^2$**

Samantha Wyler, Kent State

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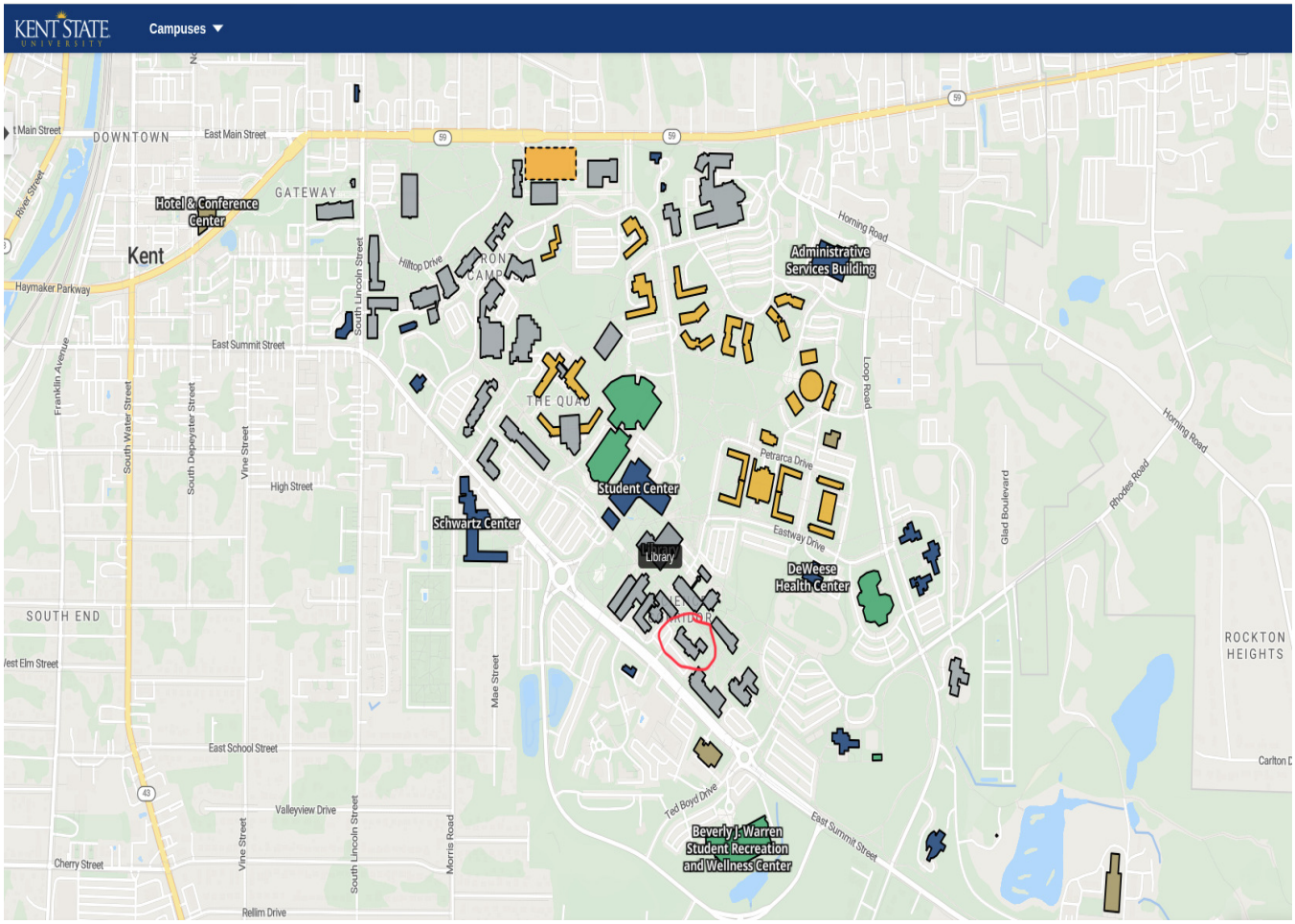
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High Street
South Lincoln Street
Hilltop Drive
THE QUAD
Schwartz Center
Student Center
Library
Petrarca Drive
Eastway Drive
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Administrative Services Building
Loop Road
Glad Boulevard
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West Elm Street
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Valleyview Drive
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ROCKTON HEIGHTS
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43
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## Notes

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