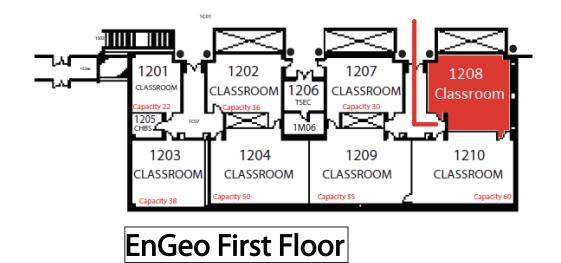
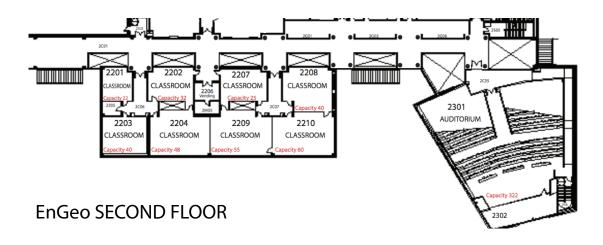
SUMS 2025 TENTATIVE TIMETABLE

When	What & Where					
9:00-10:00	Registration & Breakfast					
	EnGeo Building, 2nd floor hallway					
10:00 - 10:10	Welcome					
	Dr. Sam Prins (JMU, CSM Dean)					
	2301					
10:10 - 11:00	Opening Talk Dr. Wirsk only Sallows (NCSH)					
10:10 - 11:00	Dr. Kimberly Sellers (NCSU) 2301					
	Talk Session I					
11:15 - 11:30	C. Phillips	D. Laddha	Tain Sobbi	R. Nomikos	L. Pelham	
	2209	2210		1209	1210	
	Talk Session II					
11:35 - 11:50	K. Gill	M. Ryan	M. Grove	J. Layne	Z. Harrington	
	2209	2210	1208	1209	1210	
	Talk Session III					
11:55 - 12:10	C. Don Juan	T. Gafurov	D. Heath	M. Cooper	L. Paredes Idiaquez	
	2209	2210	1208	1209	1210	
	Panel Session I					
12:15 - 12:30			Career/Industry	Graduate School	REU	
			Lunch and Post	1209	1210	
12:30-1:45						
	Hallway					
1:50 - 2:05	Panel Session II					
			Career/Industry		REU	
			1208	1209	1210	
2:10-2:25	Talk Session IV A. Callahan B. Droubay M. Marfo A. Yu					
	2209	2210		1209	1210	
	Talk Session V					
2:30-2:45	S. Weimar	T. Porter	Tolli Sobbic	T. Tarter	J. Ungerleider	
	2209	2210		1209	1210	
	Afternoon Coffee & Tea					
2:45-3:00	Hallway					
	Closing Talk					
3:10 - 4:00	Dr. Neal Bushaw (VCU)					
	2301					
4:10-4:20	Prize session					
			2301			
4:20	Conference Closing					
	2301					

All events are on the first and second floors of the JMU EnGeo building.





Wireless Network: Log onto "JMU-Visitors"

Username: sums@jmu.edu

Password: 878085

The username and password are case specific.

If you registered online, you should pick up your name tag at the registration table. If you still need to register, please do so at the same table.

Poster presenters should take their posters to room EnGeo 2202 for check in.

Be sure to come to the Prize Session at the end of the day!

10:00 - 10:10 Opening Remarks

auditorium 2301

Join Dr. Samantha Prins, Dean of the College of Science and Mathematics, as we welcome you to SUMS 2025.

10:10 - 11:00 Opening Address

auditorium 2301



Dispersed Methods for Handling Dispersed Count Data

Dr. Kimberly Sellers North Carolina State University

While the Poisson distribution is a classical statistical model for count data, it hinges on the constraining equidispersion property (i.e. that the mean and variance equal). This assumption, however, does not usually hold

for real count data; over-dispersion (i.e. when the variance is greater than the mean) is a more common phenomenon for count data, however data under-dispersion has also been prevalent in various settings. It would be more convenient to work with a distribution that can effectively model data (over- or under-) dispersion because it can offer more flexibility (and, thus, more appropriate inference) in the statistical methodology. This talk introduces the Conway-Maxwell-Poisson distribution along with several associated statistical methods motivated by this model to better analyze count data under various scenarios (e.g. distributional theory, generalized linear modeling, control chart theory, and count processes). As time permits, this talk will likewise acquaint the audience with available associated tools for statistical computing. Interested persons can learn more about this distribution via the reference, The Conway-Maxwell-Poisson Distribution (Cambridge University Press, 2023).

2209 On the Existence of Locally Linear Strongly Regular Graphs

Connor Phillips, James Madison University

If graph Γ is an $srg(n, k, 1, \mu)$, it has the property that each edge lies in a unique triangle, and so we construct a new graph with vertices as the triangles of Γ . We derive the spectrum of this new graph, and use its spectral properties to find strong necessary conditions on the existence of the original graph Γ .

2210 Modeling of AI's Data Center, Emission, and Workforce Impact

Divya Laddha, Freedom High School

We model generative AI's impacts on data centers, emissions, resources, and workforce via coupled ODEs and a labor compartment model (At Risk, Unemployed, Reskilled). Numerical simulations test adoption rate (r) and policy pushback, tracking energy, emissions, water, and jobs.

1209 Parallel Postulate Without SAS: Equivalents and Independence Romeo Nomikos, James Madison University

In classical Hilbertian geometry, Euclid's parallel postulate has many equivalents. It has been shown previously that the equivalence between the parallel postulate and Playfair's axiom no longer holds in the absense of SAS triangle congruence. We investigate which other equivalences will fail in a non-SAS geometry.

1210 Rocket Launch Acoustic Flame Trench Analysis

Lydia Pelham, Adam Short, James Madison University

The aim of this project is to gain a greater understanding of flame trenches and how they affect rocket launches. This research investigates how modifications of the flame trench's physical configuration can mitigate the noise directed at the rocket to reduce structural damage to the rocket and its payload.

2209 Approaches to the L'vov-Kaplansky Conjecture

Kylie Gill, Longwood University

The L'vov-Kaplansky Conjecture is an open question in the field of Algebra, which asks if the image of a multilinear polynomial acting on the space of $n \times n$ matrices is a subspace. We consider new approaches to the conjecture, including using an analytic version: the Density Dimension-Free L'vov-Kaplansky Conjecture.

2210 Geometry of Solutions to PDE's via Laplace Invariants Matthew Ryan, Virginia Tech

Equivalence of projective surface immersions with linear PDE systems is of perennial interest in geometry and integrable systems. We study the latter using the sequence of Laplace invariants of a planar linear scalar hyperbolic PDE in a novel way and discuss applications in Appell's hypergeometric functions.

1208 TetraStix + HexaStix = TetraHexaStix

Marija Grove, Bethany Droubay, Maxwell Cooper, JMU

Inspired by George Hart's "72 Pencils" and based on Matt Parker's pencil sculpture videos, we have constructed a TetraHexaStix and its accompanying TetraStix and Hexastix. The TetraHexaStix is the union of the TetraStix and HexaStix, visual representations of the orthogonal and tetrahedral axes, respectively.

1209 An Upper Bound on Higher Moments of Newform Dedekind Sums

John Layne, University of Virginia

The classical Dedekind sum arises in the automorphy factor of the Dedekind eta function, and its value distribution has been studied extensively. We study the value distribution of a variant of the Dedekind sum associated with two primitive Dirichlet characters, known as a newform Dedekind sum.

1210 Record Linkage Techniques: A Comparative Study

Zach Harrington, James Madison University

An introduction and discussion of record linkage and various linkage methods are presented. Specifically, the Fellegi-Sunter Method, Expectation-Maximization Method, and the EpiLink Algorithm will be discussed. Afterwards, we dive into an application of these methods on simulated health datasets (Parrish, 2024).

2209 Equivalence of incidence matrices and its applications

Cole Don Juan, University of Montevallo

We study equivalence of various incidence matrices of graphs and signed graphs. This produces a condition for a graph to be bipartite. Also, we look into the equivalence of a net incidence matrix of a signed graph and the incidence matrix of the underlying undirected grap. This aids in finding the Moore-Penrose.

2210 Using ODEs and Control Theory to Optimize Mentorship Costs

Timofey Gafurov, Lake Braddock High School

The compartments of a Susceptible-Exposed-Infected-Recovered model are modified to describe the positive propagation of knowledge. Optimizing the percentage of mentors for a student body attempts to maximize the informed population. Results of linear and non-linear control are then compared to a constant control model.

1208 Time-Scale Model for Glucose Tolerance Tests

Dane Heath, West Virginia Wesleyan College

Glucose tolerance tests are defined, time scales are introduced, and a time-scale model is developed for a pre-existing differential equation to model glucose levels in the bloodstream.

1209 Trimming Tests for Divisibility

Maxwell Cooper, James Madison University

Divisibility tests have been used since the year 500. In this talk, we take a deep dive into a special type of divisibility tests called trimming tests. We will build and use different types of trimming tests and show the connections between them. We also look at divisibility in other bases and preserving remainders.

1210 Mapping Boundaries of Coanda Jets

Leon Paredes Idiaquez, Gregory Granahan, James Madison University

Rocket launches generate extreme acoustic waves that travel along flame trenches and threaten sensitive payloads. This talk models Shock Associated Noise from Coanda wall jets using a Coanda flare framework, with improved Schlieren imaging to refine jet boundaries and predict and reduce acoustic loads.

1208 Career Panel

Will Clewett, Software Engineer Grant Wagner, Naval Surface Warfare Center-Dahlgren Division Ask questions and learn about careers involving mathematics and statistics.

1209 Graduate Panel

Rao Chaganty, Old Dominion University
Christine Demars, James Madison University
Andre Mas, NC State University
Learn about what life is like as a graduate student in mathematics or statistics.

1210 REU Panel

Alex Capaldi, James Madison University
Cole Don Juan, University of Montevallo
John Layne, University of Virginia
Taylor Murrell, Virginia Tech
Learn all about the process of applying for, and participating in, an REU program.

12:30 - 1:45 Lunch

hallway

LUNCH: If you are hungry and have a circle on your badge, please pick up a boxed lunch near the registration table at 12:30. (If you do not have a circle, it means that you registered after our catering order deadline. But you still might get a free lunch. Please wait until 12:45 to check for unclaimed lunches).

12:30 - 1:45 Poster Session

hallway

POSTER SESSION: Students will be near their posters during lunch. Please stop by to see their excellent work! Poster judging will start by 12:45.

Overcoming Noise in Spatial Data Using Algebraic Topology Alethea Callahan, The College of William & Mary

Partial Covering of the Sphere with N=5 Caps Ryan Childress, Longwood University

Seed Dispersal Strategies: Evaluating Spatial Patterns

Anaiel Jibrelle Dayrit, The College of William & Mary

Using Compartmental Systems of Ordinary Differential Equations

Timofey Gafurov, Lake Braddock High School

Partial Sphere Covering

Emma Heisig, Longwood University

Modeling AI's Data Center, Emissions, and Workforce Impact Divya Laddha, Freedom High School

Ergodic Proof of Szemerdi's Theorem & Green-Tao Theorem John Layne, University of Virginia

Modeling Synaptic Dysfunction as Neural Contagion Michelle Marfo, Osbourn Park High School

Reconstructing Chaotic Dynamics with Delay Embedding and GPR Joev Park, Thomas Jefferson High School for Science and Technology

Convex Geometry and Frame Theory

Kevin Rivera-Ayala, Longwood University

1:50 - 2:05 Panel Session II

1208 Career Panel

Will Clewett, Software Engineer Grant Wagner, Naval Surface Warfare Center-Dahlgren Division Ask questions and learn about careers involving mathematics and statistics.

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Learn about what life is like as a graduate student in mathematics or statistics.

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Alex Capaldi, James Madison University Cole Don Juan, University of Montevallo John Layne, University of Virginia Taylor Murrell, Virginia Tech

Learn all about the process of applying for, and participating in, an REU program.

2209 Overcoming Noise in Spatial Data Using Algebraic Topology

Alethea Callahan, William & Mary

This project utilizes morphological image processing and persistent homology to extract population patterns from noisy population data. We compare clean, noisy, and smoothed images. Results show that smoothing removes fine detail but preserves key topological features, supporting this method for pattern analysis.

2210 Modeling probiotic control of white-nose syndrome in bats Bethany Droubay, James Madison University

Caused by an invasive fungus, white-nose syndrome (WNS) has spread across North America and devastated many bat species. We built a differential and difference equation model of a probiotic control to combat WNS. We find that the control is potentially effective in mitigating WNS and restoring bat populations.

1209 Graph-Based SEDR Model of Neural Signal Dysfunction Michelle Marfo, Osbourn Park High School

This study models synaptopathies, disorders from failed synaptic transmission, with a graph-based SEDR framework. Neurons move through Susceptible, Exposed, Dysfunctional, and Recovered states; ODEs with β , σ , and γ drive spread. Simulations across network topologies reveal how connectivity and weights drive propagation.

1210 Viscous film in tube: PDE simulation and probability Aya Yu, Virginia Commonwealth University

With viscous films moving in a thin tube, waves form and could form plugs. This is significant in patients with bronchitis, where their airway could be blocked. There has been less work on the transient conditions where plugs could form probabilistically. We look at that transient region through PDE simulations.

2209 Exploring the Mandelbrot Set in Abstract Algebras Shane Weimar, Liberty University

The Mandelbrot set is a well-known topic in complex analysis. Less discussed is the Mandelbrot set in hypercomplex algebras. This talk will discuss the characterization and attributes of the Mandelbrot set in an abstract two dimensional real algebra.

2210 Self-Sorting in a Continuous Opinion Dynamics Model Timothy Porter, Virginia Commonwealth University

A continuous model of opinion dynamics based on one by Baron (2021), is developed. The model by Baron is first recreated, and then extended to introduce a representation of self-sorting. The changes this extension makes to the transitions between different macroscopic states and the behavior of the model as a whole is then studied.

1209 A Faster Attack on LFSR Recurrences

Timothy Tarter, Garret Priebracha, Arsenii Herasymov, James Madison University

LFSR sequences are used to generate pseudo random numbers and encode binary plaintext. Cryptographers utilize minimal recurrences to reverse engineer the original sequence. Our algorithm offers an alternative to the current industry standard for finding the minimal recurrence of a complete binary string.

1210 Predicting Acoustic Loads on Rockets at Launch

Joseph Ungerleider, James Madison University

Predicting acoustic loading on rockets is vital in minimizing damage during liftoff. The NASA SP-8072 is an outdated prediction model developed in 1971. Despite being over 50 years old, it is still the best model available today. This paper will discuss and compare possible improvements upon the NASA SP-8072 model.

Please join us for tea and coffee in the EnGeo foyer. This is your last chance to enter the candy contest!

3:10 - 4:00 Closing Address

auditorium 2301



I heard there was a secret chord ...

Dr. Neal Bushaw Virginia Commonwealth University

What is a musical chord, to a discrete mathematician? What about a scale, or a rhythm? In this talk, we explore these (and other) mathematical versions of musical notions, with a focus on problems that seem like combinatorics. How many scales or chords are there with some specified property? How can we measure a scale, chord, or rhythm? Can we enumerate all chords (and thus find Cohen's Secret Chord along the way)? Can we use any of this to make

drum machines? We'll see surprising connections between these musical notions, and glimpse the tip of a mathematical iceberg which began with the study of wealth inequality by Muirhead and Lorenz in the early twentieth century, and which was later expanded by mathematical titans Schur, Littlewood, Hardy, and Polyá. This talk is intended for a general audience – no background in either music theory or combinatorics is expected! This talk includes joint work with Viktoriya Bardenova, Brent Cody, Paul Fay, Luke Freeman, Chris Leffler, Maya Tennant, and Toby Whitaker.

4:10 - 4:20 Prize Session

auditorium 2301

Please join us for the prize session in the auditorium. Poster competition winners and the candy contest winner will be announced!

4:20 Conference Closing

auditorium 2301



Jellybean Competition

Rules: Each person may enter only once. Your guess must consist of a connected interval of real numbers. The winning entry will be the smallest interval containing the actual number of jellybeans, with any ties broken using the distance from the center of your interval to the actual number. The winner will be announced at the prize session at the end of the day.



Thank you to all of the volunteers who make this conference possible. We are grateful for support from JMU's College of Science and Mathematics, and the General Education Program.

Join us next year for SUMS 2026! www.jmu.edu/mathstat/sums