

Fall 2026 MD-DC-VA Section Meeting Abstracts

Abstracts are in chronological order. All talks are Saturday, except the workshop and banquet talk.

Workshop

Explore Teaching with AI through Roundtable Discussions

Mindy Capaldi , James Madison University

4:00-6:00, Copley Science Center, Room 100

Have you checked your assignments for AI vulnerabilities or are looking to AI-proof your course? Or considered using AI for alternative assessments, tutoring, or lesson development? This workshop, sponsored by the MAA Committee for Professional Development, centers around sharing ideas and questions about teaching with AI as well as trying out some prompts with AI. Small groups will experiment with AI and, based on given questions, discuss potential benefits and concerns around various uses of AI in teaching and learning mathematics.

Banquet Talk

Double Take: Geometry, Perspective, and Optical Illusions

Annalisa Crannell , Franklin & Marshall College / Interim Editor of the *American Mathematical Monthly*

8:00-9:00, Birdsong Pavilion, 2nd Floor

Perspective geometry, so it's said, is the geometry of art that makes paintings seem realistic and true to life. Yet the same artistic techniques—and by extension, the same geometry—can create images that astound and confound us. We explore the geometry behind a carnival of such illusions, from images that seem to change shape as we move, to the impossible worlds of Escher and del Prete.

Unraveling Topological Crochet

Eve Torrence, Randolph-Macon College

8:45-9:05, Copley 100

I spent the last three years learning about low dimensional topology by crocheting models of surfaces. This study led to my recently published book, "Unraveling Topological Crochet" (CRC Press 2026), co-authored with Shiyong Dong. I will show many models made from patterns in the book and discuss the many advantages of learning about topology through crochet. With this method, the structure of many abstract structures becomes very clear.

Spanning Tree Modulus Algorithm (Cancelled)

Kottegoda Kottegoda, Norfolk State University

8:45-9:05, Copley 101

Spanning tree modulus is a generalization of effective resistance closely connected to graph strength and fractional arboricity. The optimal edge density associated with the spanning tree modulus induces two hierarchical decompositions of arbitrary graphs: one based on strength and the other on arboricity. We introduce an exact-arithmetic algorithm for computing the spanning tree modulus and the strength-based decomposition using Cunningham's algorithm for graph vulnerability. The method leverages a connection between spanning tree modulus and critical edge sets in the vulnerability problem.

The 2D MHD equations with fractional magnetic diffusion on the periodic domain T^2

Lakjayani Hewawasan Puwakpitiyage, Stevenson University
8:45-9:05, Copley 132

This talk concerns the two-dimensional magnetohydrodynamic (MHD) equations on the torus with fractional magnetic dissipation given by the operator $(-\Delta)^\beta$, $\beta \in (\frac{1}{2}, 1]$, and no velocity dissipation. We study whether small initial data $(u_0, b_0) \in H^s(T^2)$, $s > 2$, give rise to a unique global solution for every β in this range. Our result extends the global small-data theory of Wei and Zhang for the Laplacian case $\beta = 1$ to the fractional range $\beta \in (\frac{1}{2}, 1]$. The proof combines Besov-space techniques and Littlewood–Paley estimates with a bootstrapping argument and energy methods; a key ingredient is the exponential decay of the magnetic field, which is used to control the growth of the vorticity.

Which Roads Matter? A Graph-Theoretic Approach to Food Accessibility During Hurricane Helene

Alexandra Veremeychik, University of Maryland — MathArtPlay
9:15-9:35, Copley 100
(student talk)

How much can the loss of a single road segment change a community's access to essential resources? Motivated by the disruptions caused by Hurricane Helene, this study examines food accessibility through the lens of graph theory and transportation network analysis. We represent road networks as weighted graphs and apply shortest-path algorithms to estimate travel distances between residential areas and food retailers. By systematically removing road segments and recalculating optimal routes, we investigate how localized disruptions affect travel distances, destination choices, and network connectivity.

Symmetry in Polyomino Window Puzzles

Bruce Torrence, Randolph-Macon College
9:15-9:35, Copley 101

Imagine a simple puzzle in which the pieces are polyominoes: simply connected assemblages of unit squares joined edge-to-edge. The pieces are to fit into a game board, itself a connected region in a grid of unit squares, so that the pieces align with the underlying grid and do not overlap. If in total the puzzle pieces comprise n unit squares and the game board comprises $n + k$ squares where $k \geq 0$, then we have a polyomino window puzzle with k windows. That is, when all pieces are placed on the board, there are k grid squares left uncovered. We will introduce a notion of equivalence among the solutions for such a puzzle, and show how this simple idea leads to a new mode of interacting with such puzzles. We will showcase a 7-piece, 2-window puzzle with over 130,000 solutions, such that it is possible to navigate from one solution to almost any other by means of a simple symmetry operation.

On the Expected Position of the First Collision

Randall Helmstutler, University of Mary Washington

9:15-9:35, Copley 132

It is a general theme in cryptography that a collision between lists taken from n objects has a decent chance of occurring with only about $\sqrt{n}$ evaluations. We show how this can be modeled through the backwards differences in birthday probabilities as in the Birthday Paradox. Precisely, we will show that these backwards differences form a probability distribution themselves, giving the density for the random variable that measures the first instance of a collision in sequences with terms taken from n items. We will see that asymptotic estimates for the expected value of this random variable give the common $\sqrt{n}$ estimate.

Invited Address

Data With Purpose: How Modern Statistics Drives Solutions to Society's Greatest Challenges

Kimberly Sellers, North Carolina State University

10:00-10:55, Copley Science Center, Room 100

In an era dominated by massive datasets and rapid technological change, the bridge between mathematical and statistical methodologies and meaningful real-world impact is more critical than ever. Statistical science provides the foundational framework required to navigate uncertainty that can surface in myriad societal challenges such as validating life-saving medical treatments and guiding equitable public policy decisions. This talk offers a forward-looking perspective on how the evolution of statistical methods directly shapes modern healthcare and society. By exploring key intersections where mathematical rigor meets real-world application, we will examine how modern statisticians act as key architects of evidence-based progress.

An Introductory Guide to the Method of Regularized Stokeslets

Eva Strawbridge, James Madison University

1:00-1:20, Copley 100

There are many biologically relevant situations which involve long slender bodies (e.g. worms, flagella, bacterial bodies, etc.) where it is important to understand the dynamic interactions of the body and the low Reynolds number fluid in which it moves. In this talk, we will be discussing the design and organization of an introductory guide to the practical implementation of the method of regularized stokeslets with special attention to mentoring new undergraduate research students. The proposed guide is appropriate for most undergraduate audiences who have seen linear algebra and vector calculus (but can be adapted to even more novice audiences) with the goal of incorporating high impact research experiences as independent studies, class projects or as a minicourse in preparation for participation in novel research.

Coupled Enzyme Kinetics and the Renormalization Group Method

Ming Fang, Norfolk State University

1:00-1:20, Copley 101

Coupled enzyme assays use an indicator enzyme to monitor reactions whose substrates or products cannot be detected directly. We apply the renormalization group (RG) method of Chen, Goldenfeld, etc. to a coupled enzyme system where a substrate is converted to a product through an intermediate by two Michaelis-Menten enzymes.

Sangaku meets Geogebra: a cultural preservation project

David Clark, Randolph-Macon College

1:00-1:20, Copley 132

Thousands of sangaku tablets, inscribed with colorful geometry problems, were posted in shrines and temples across the Japanese archipelago starting in the Edo period (1603–1868), representing an intersection of artistic, religious, and mathematical traditions. The Sangaku Archive is an attempt to carefully document these objects using the latest digital tools, including Geogebra, and to tell an unusual and compelling story about mathematics — one that enriches computations and proofs with historical context and cultural appreciation.

Matrix Binomial Theorems

Dan Kalman (Special fill-in speaker Annalisa Crannell,

1:30-1:50, Copley 100

For square matrices A and B , if $AB = BA$ then $(A + B)^n$ is given by the binomial expansion for all positive integers n . What about a converse? We discuss a few partial converses, such as: If $(A+B)$ is invertible, and if $(A + B)^n$ is given by its binomial expansion for three consecutive positive integers n , then $AB = BA$. Note: AI played a significant role in discovering the results discussed in this talk.

Parity obstructions and additive orthogonal decompositions over the rings Z_2

Kubilay Dagtoros, Norfolk State University

Dr. Md Mashud Parvez, Dhaka Univ. of Engineering and Technology

Dr. Md. Ibrahim Kholil, Norfolk State University

Dr. Kapila Kottegoda, Norfolk State University

Dr. Sujan Pant, Norfolk State University

1:30-1:50, Copley 101

We study additive decompositions of matrices over the rings Z_{2^r} into sums of orthogonal matrices. Unlike the odd-modulus case, where orthogonal matrices generate the full matrix ring, the even-modulus case exhibits parity obstructions due to the non-invertibility of 2. We establish necessary conditions based on reduction modulo 2, trace parity, and row/column balance. In low dimensions, we recover known obstructions and provide explicit constructions when these conditions are satisfied. We further propose a classification framework based on finitely many Z_{2^r} -valued invariants and state related conjectures and open problems. .lin

Progress on Formalizing a Real Analysis Course

Brian Sutton, Randolph-Macon College

1:30-1:50, Copley 132

Can I learn Lean before I'm scheduled to teach it? Let's find out!

Please Touch the Math: Turning Math Class into a Museum with TouchDesigner

Rebin Muhammad, Montgomery College | MathArtPlay

Alexandra Veremeychik, University of Maryland | MathArtPlay

2:00-2:20, Copley 100

Museums such as MoMath show that people engage deeply with mathematics when they can touch, manipulate, and experiment with it. Few of our students will visit such a museum, but many of the same experiences can be brought into the classroom. In this talk, I will describe how I use TouchDesigner, a free node-based visual programming environment designed for real-time interactive installations, to build hands-on mathematical exhibits for my courses. Examples include slope fields in Calculus 2, where students modify a differential equation from a tablet and observe solution curves respond in real time; the Lights Out puzzle in Linear Algebra, which leads to solving linear systems over the integers mod 2; a k-nearest neighbors classification game in Data Science. I will discuss student responses and practical considerations for classroom use. .1in

Consecutive Repetitions in Euclidean Division-Count Cycles

Chirashree Bhattacharya, Randolph-Macon College

2:00-2:20, Copley 101

The number of steps (division-count) in the Euclidean Algorithm has been well-studied. This talk considers repeated blocks in division-count cycles and describes a lifting construction to prove their existence.

Recovering Bistability from Noisy Time Series Data

Raina Robeva, Randolph-Macon College

2:00-2:20, Copley 132

Bistability plays a central role in cell differentiation, fate decisions, and phenotypic switching. Yet to determine if and where a gene regulatory network is bistable using noisy experimental observations remains challenging. Machine learning offers powerful tools for inferring regulatory dynamics, but their success depends on the information available in the data. We investigate how noise, incomplete observations, and experimental sampling affect the recoverability of bistability. Using a two-gene toggle switch as a test case, we show that simple linear surrogates can detect and help reconstruct bistability in nonlinear systems subject to heavy-tailed Lévy noise. By separating the effects of noise and sampling limitations, we identify what information can be reliably recovered and what may remain inaccessible, regardless of the method.

Invited Address

Seeing the Beauty of Mathematics

Debra Hydorn, University of Mary Washington

3:00-3:55, Copley Science Center, Room 100

In this talk I will briefly describe the First Year Seminar I have taught on the *Art of Mathematics* (originally titled *Escher Math: The Mathematics of Pattern and Design*) and how that course led me to using Geometer's Sketchpad to create art as examples for student assignments. I will share some of my art work along with the work of other artists that have inspired me. Some of my artworks are tessellations of the plane created using corner- or edge-matching puzzles or are puzzles I have created based on an individual's favorite geometric shapes and colors. I also create art based on patterns that I have observed in mathematics applications. I will also share some of my activities to develop an interest in mathematical art in my students, family, and friends.