Abstracts and Descriptions
Fall 2016 Seaway Section Meeting

(Banquet Speaker)
Bruce Pitman, University of Buffalo

I Don't Know Where I'm a Gonna Go When the Volcano Blow

The prediction of many natural hazards, such as volcanic eruptions, earthquakes, and tsunamis can be estimated using field data and high performance computer simulations. However, the computational work involved in these simulations is very large, and the challenges of combining field data with simulations are significant. Important in predicting the hazard impact is an understanding of the uncertainty present in these models and their input parameters. In order to be effective in hazard warning, time to prediction is critical. This talk will address all these aspects of hazard prediction, within the context of volcanic eruptions.

Biography:

E. Bruce Pitman is a Professor in the Department of Materials Design and Innovation at the University at Buffalo. Pitman earned his Ph.D. from Duke in 1985, and was a post-doctoral fellow at the Courant Institute before joining UB’s Math Department in 1989. He has been Vice-Provost, Associate Dean, and just completed an appointment as Dean of the College of Arts and Sciences at Buffalo. He is the author of some 75 peer reviewed papers on topics ranging from the constitutive relations for granular materials to Hopf bifurcation in a model of blood flow in the kidney. For the past 15 years he has been studying volcanic eruptions, including airborne ash clouds and overland pyroclastic flows, and hazard predictions.
Mathematics for All

Mathematics education as a professional field started in the last part of the 19th century and since mathematicians and educators have worked together to support the improvement of students’ mathematical learning. But sadly, the widespread beliefs in our society that only few are “good” at math, that is ok not to excel in math, or that math is “natural” prevails. Segregation by achievement level in mathematic classrooms is common in almost every school, even in early grades, resulting in inequities in the experiences students have in the classroom. As a result, the number of students selecting mathematics or mathematics-related careers is low and, more alarming, the number of students of color and women in mathematics is even lower. What can we, as future mathematicians or as mathematics faculty, do to promote a more positive view of mathematics?

Biography:

Cristina Gomez earned her Ph.D. from the University of Wisconsin-Madison in 2000. She is the coordinator of the teaching option at the mathematics department at Ithaca College where she has taught since 2006. She has been working with mathematics teachers for over 30 years, teaching methods courses for elementary and secondary teachers and organizing professional development workshops for in-service teachers. She is interested in teachers’ pedagogical knowledge needed for teaching mathematics for understanding and has worked with faculty at mathematics departments to create content courses for elementary teachers. In New York State, she has participated in the Mathematics Masters Teachers Program and in the Common Core Test Standard Setting Panels. She has presented her work in regional, national and international conferences.
Numerical Ranges over Finite Fields: A Discrete Analogue of a Complex Problem

Mathematics includes the diverse areas of algebra, analysis, and geometry. Studying the interplay between these areas can lead to striking breakthroughs in our understanding of the deep structure of mathematics. Given a square matrix, we can calculate its determinant, trace, eigenvalues, and eigenvectors to deduce its core structural properties. A lesser known core invariant of the matrix is a set of complex numbers known as its numerical range. If A has complex entries, then the numerical range of A is a convex set of complex numbers which contains the eigenvalues of A. While these complex numerical ranges have been completely classified for n-by-n matrices with n<5, little is known in higher dimensions. When we consider these matrices over finite fields, new simplifications and complications arise. History tells us that the study of these analogous problems can provide new insight on the original problem. Here we will discuss the pioneering work on these finite field numerical ranges by undergraduates at SUNY Geneseo, as well as some new generalizations using the machinery of number theory. It is foreseeable that a complete classification of finite field numerical ranges could be accomplished in the coming decade, which could in turn shed light on what a classification for complex matrices would look like.

Biography:

Dr. Patrick X. Rault is an Associate Professor at the State University of New York College at Geneseo, currently on leave at the University of Arizona South. Patrick is a 2008 Project NExT Fellow of the MAA and recipient of the 2015 Henry L. Alder Award presented by the Mathematics Association of America. Patrick has done research in number theory and matrix analysis. In 2013, Patrick co-founded the Upstate New York Inquiry-Based Learning Consortium. For his work on bridging the gap between research and the classroom he was awarded with the Council on Undergraduate Research's inaugural Faculty Mentoring Award for Outstanding Mentoring of Undergraduate Students in Research. His textbook, A TeXas Style Introduction to Proof, will be published by the MAA this spring.
(Final Saturday Speaker)
Tim Chartier, Davidson College

Mime-matics

In Mime-matics, Tim Chartier explores mathematical ideas through the art of mime. Whether creating an illusion of an invisible wall, wearing a mask covered with geometric shapes or pulling on an invisible rope, Dr. Chartier delves into mathematical concepts such as estimation, tiling, and infinity. Through Mime-matics, audiences encounter math through the entertaining style of a performing artist who have performed at local, national and international settings.

Biography:

Dr. Tim Chartier specializes in data analytics. He frequently consults on sports analytics questions, including projects with ESPN Magazine, ESPN's Sport Science program, NASCAR teams, the NBA, and fantasy sports sites. Tim is 2nd Vice President of the MAA. In 2014, he was named the inaugural Math Ambassador for the MAA, which also recognized Dr. Chartier's ability to communicate math with a national teaching award. His research and scholarship were recognized with the prestigious Alfred P. Sloan Research Fellowship. He’s published *When Life is Linear: From Computer Graphics to Bracketology* (MAA) and *Math Bytes: Google Bombs, Chocolate-Covered Pi, and Other Cool Bits in Computing* (Princeton University Press). Through the Teaching Company, he taught a 24-lecture series entitled *Big Data: How Data Analytics Is Transforming the World*. In K-12 education, Tim has worked with Google and Pixar on their educational initiatives. Dr. Chartier has served as a resource for a variety of media inquiries, including appearances with Bloomberg TV, NPR, the CBS Evening News, USA Today, and The New York Times.
Micro-course, $15 fee, Friday, October 21, 2016, 2:30-5:30
Rob Rolleston, Paychex

R Markdown for beginners: Formatted documents that update through code

R Markdown is a file format for making dynamic documents with R. An R Markdown document is written in markdown (an easy-to-write plain text format) and contains chunks of embedded R code (http://rmarkdown.rstudio.com/articles_intro.html). Rather than just commenting your code, the paradigm is to create a live formatted document, with embedded code, that can be executed and updated as your data changes. In this tutorial we will introduce the concept of ‘Reproducible Research’, and how to achieve the goal of helping others understand the process and thoughts which lead to your conclusions. We will be working through several examples to create interactive HTML pages, and show how to produce PDF documents and presentations slide decks. Participants should have a working knowledge of R, and we will use the R-Studio IDE. Some cursory knowledge of HTML5 & CSS3 is helpful but not necessary. Participants should bring their own laptops and may want to pre-install the packages; "markdown", "DT", "leaflet", and optionally "ggplot2", "dplyr", and "tidyr".

Biography:

Rob Rolleston works at the intersection of Information Visualization and Data Science; Helping people turn data into knowledge, see the forest for the trees, and create order from chaos. Four distinct careers at Xerox included Image Processing and Color Management, Strategy and Planning, Area and Laboratory Manager, and Principal Scientist. His technical interests have always been related to how people see, perceive, and interact visually with the world around them; and, in turn, helping others understand these mechanisms. He received his B.S. in Computational Physics from Carnegie-Mellon University, his M.S. and Ph.D. in Optics from the University of Rochester, and his MPS in Information Visualization from MICA.

Rob rides his bicycle to work year around. In the summer of 1987, he rode his bike from the Pacific Coast of Oregon to Washington, D.C., and has tried to get his charming wife and lovely daughters to do some bicycle touring, but the trips along the Canal du Midi in France and The Erie Canal from Rochester to Albany along were enough for them. Instead, his wife has gotten him into yoga. Another passion has been becoming an ADK 46er a task for which his family is so relieved that he has found others with whom he can beat himself silly in the mud, rain, rocks and cold while completing this goal. He is now working on the winter 46… go figure… Learn more about Rob and see samples of his work at rob.rolleston.homewebsite.info.
Other Special Events

**Seaway Estimathon**  
Friday night after the banquet speaker, hosted by Blair Madore, SUNY Potsdam

Come one, come all to the first ever Seaway MAA ESTIMATHON! Teams will use their mathematical powers to estimate numerical constants reflecting "real life" values. The best estimators will receive prizes and most importantly the glory of the win. Faculty and students can participate. Each team must contain at most one faculty member and members from at least three different colleges.

**Panel on Careers Using Mathematics**  
Saturday 11:10 – 12:05, organized by Keiko Dow, D'Youville College

Representatives from business or industry will come together on a panel so that participants can ask them questions about their career path. Panelists include representatives from Xerox, Paychex, Apple, MedAmerica, and Nielsen. This session is designed for students! If your students struggle to see what their future beyond college might look like, listening to these panelists (and asking questions) may prove enlightening.

**Project NExT discussion, Re-Energizing Your Career at All Stages.**  
Saturday 11:10 – 12:05 organized by Nathan Reff, The College at Brockport, SUNY

The Seaway NExT discussion session is open to anyone who would like to join the conversation, share their experiences and learn something new. The purpose of the session is to provide a faculty development networking opportunity with a focused theme. This year, the topic is "Re-Energizing Your Career at All Stages," so it is safe to say everyone should have something interesting to share!

**Workshop on Leadership in the Mathematical Sciences**  
Saturday 2:05 – 3:00, hosted by Mihail Barbosu, Rochester Institute of Technology

Topics this semester will focus on the role of the Department Chair.
Invited Special Session on Inquiry-Based Learning (IBL)

Saturday 1:35 – 3:00, by Patrick X. Rault, University of Arizona South & SUNY Geneseo

1) Yousuf George, Nazareth College, 1:35-2pm

Title: A Departmental Transition to Inquiry-Based Learning

Abstract: Over the past three years the Mathematics Department at Nazareth College has transitioned to using Inquiry-Based Learning in virtually every class we teach. We will discuss how this transition began, what supports made it possible, as well as what teaching and learning looks like in the department today.

2) Perry Y.C. Lee, Kutztown University of Pennsylvania, 2:05-2:30pm

Title: Giving Students the Opportunity to Effectively Communicate Mathematical Ideas Through Active Learning

Abstract: Learning requires doing, and only through inquiry is learning achieved. We begin by discussing the use of active learning across mathematics curriculum. We submit that students understand by both asking and answering questions; by engaging; and, by explaining to one’s self and one’s peers’ concepts. Active learning creates a dynamic learning environment which enables students to understand mathematics. We continue by presenting both the successes and the failures in using active learning. We focus on how active learning, namely, inquiry-based learning (IBL), through speaking effectively forges students’ confidence, and motivates students to hone their precise use of language to communicate math. IBL encourages students to delve deeply into concepts rather than shallowly be trained to regurgitate information. We conclude with remarks about the results of an assessment study that the author and a colleague have been conducting in College Algebra for the past two years.

3) Ryan Gantner, St. John Fisher College, 2:35-3pm

Title: I can’t spell “Seaway” without “IBL”

Abstract: In the past few years there have been several sessions, workshops, guests, and activities at our Seaway meetings focused on Inquiry-Based Learning in mathematics (IBL). Much of this has been driven by the Upstate New York Inquiry-Based Learning Consortium (UNY IBL), a grant-funded program with a charge to develop and maintain a network of IBL practitioners across the region. As our grant period begins to draw to a close we must step back and assess what the impact has been and where we go from here. With input from you (the audience and members of the Seaway Section) we begin to draw up the next stages of this process so that we can maintain a purposeful presence at Seaway meetings into the future that is both useful and appealing.
Contributed Talks

1. Ephraim Agyingi, RIT

Simulation of biofilm formation on a cutaneous wound

Cutaneous wounds can be contaminated with bacteria that are able to grow into a colony and subsequently lead to an infection. A colony or group of colonies residing on the wound may in due process grow into a biofilm. The biofilm may be formed by a single bacteria species or a mixture consisting of many species of bacteria. We use the Eden model of a growing cluster to simulate biofilm formation from adjacent colonies when they exhibit a cooperative behavior towards each other on a wound surface.

2. Caitlyn Cunningham and Theresa White, Le Moyne College

The Role of Smell in Selecting a Mate: A Case Study of Statistical Collaboration

Effective statistical collaboration requires the extensive input of both the statistician and the originating scientist. In this talk, we will describe in detail the process of a statistical collaboration, from initial data analysis to eventual model building and publication. Data was collected on two separate surveys relating to smell awareness and romantic interest, and administered to the same set of subjects consisting of men and women, both heterosexual and homosexual. The eventual goal was to understand the way in which awareness of odors affects the value a person places on odor when selecting a mate, and the way sex and sexual orientation might influence this. The final analysis seeks to provide the clarity of interpretation necessary for the eventual audience of psychological and olfaction researchers, while accounting for the statistical complexity of the data, and involves one-way and two-way ANOVA, multinomial logistic regression and principal components analysis. This talk is suitable for undergraduates, and is intended to be understood by those without a statistical background.

3. Jonathan Hoyle, Apple

Forensic Mathematics and the World Trade Center Project

Fifteen years ago, 2,606 people were killed from the 9/11 attacks on the World Trade Center. The victim identification process was the largest and most complex forensic project in history. This presentation will describe the events of September 11th from a forensic perspective and detail the Mathematics of DNA victim identification. These include DNA Fingerprinting, Kinship Analysis and other genetic applications of Forensic Mathematics.
4. Katelynn Kochalski, University of Virginia

**Fluid Limit for a Batched Processor Sharing Queue**

We consider a sequence of single server queues operating under a service policy that incorporates batches into processor sharing. Assuming the limiting system is critical, we find a fluid limit for the measure-valued processes that describe each system in the sequence.

5. Katelynn Kochalski, University of Virginia

**Mathematicians in the Community: Enriching Middle School Mathematics Education**

The math topics we typically focus on in middle and high school classrooms aren't necessarily the ones that promote the most excitement or curiosity about mathematics. How can we get young students to recognize that math is much more than they learn in the K-12 education? The UVa Math Ambassadors, an outreach program at the University of Virginia, tries to do just that. By sending graduate students into local middle school classrooms to lead fun math-based activities that use higher level math concepts, we expose students to a range of new mathematics in an age-appropriate way. We'll discuss the program, its primary objectives, and some of our activities.

6. Nikolai Krylov, Siena College

**On the subgroup generated by solutions of Pell's equation and elements of order 2 in the corresponding quotient group**

Equivalence classes of solutions of the Diophantine equation $a^2 + mb^2 = c^2$ form an infinitely generated abelian group $G_m$ under the operation induced by complex multiplication, where $m$ is a fixed square-free positive integer. Solutions of Pell's equation $x^2 - my^2 = 1$ generate a subgroup $P_m$ of $G_m$. I will show how the sequence of decreasing convergents of the continued fraction expansion of $\sqrt{2}$ generates elements of order 2 in the quotient groups $\frac{G_m}{P_m}$ for certain $m$. To do that I will use a homomorphism $f_m : G_m \rightarrow Cl(Q[\sqrt{-m}])$ into the ideal class group of the imaginary quadratic field $Q[\sqrt{-m}]$, and show that $P_m \subseteq \ker(f_m)$, when the ring of integers of the real quadratic field $Q[\sqrt{m}]$ has units of norm -1.

7. Jonathan Lopez, Canisius College

**A classification of small operators using graph theory**

Given a real $n \times m$ matrix $X$, its operator norm is a measure of the way that $X$ lengthens vectors in the maximal case. We consider a matrix “small” if it has non-negative integer entries and its operator norm is less than 2. These matrices correspond to bipartite graphs with spectral radius less than 2, which can be classified as disjoint unions of Coxeter graphs. Our goal here is to see these known results as part of a general program of classification of “small” objects. This is joint work with Terrence Bisson.
8. Carl Lutzer, RIT

A Curious Feature of Best Fit

Least-squares regression is used to find the line of "best fit" for data that exhibit a linear relationship, as one might see in scientific experimental data. It's well known that repeating any one of the data points will make the line of best fit move toward the repeated point. In this talk we use linear algebra to explore the how and why of a less-well-known fact: the regression line not only moves, it pivots.

9. Peter Maceli, Canisius College

Coloring graphs and their complements

Nordhaus and Gaddum showed that for any graph the sum of its chromatic number together with the chromatic number of its complement is at most one more than the number of vertices in the graph. The class of graphs which satisfy this upper bound with equality have long been understood, however not much beyond this initial case is known in terms of characterizing graphs via this sum of complementary chromatic numbers. In this talk, we will discuss how adopting a more structural approach to this general problem leads to an interesting method of graph decomposition, which in turn allows one to generalize and extend several previous results.

10. James Marengo, RIT

Rao-Blackwell, Sufficiency, and the Taxicab Problem

Suppose that there an unknown number theta of taxicabs operating in the vicinity of a certain location, and that they are clearly numbered from one to theta. One observes the number on each of n taxicabs as they pass by this location, where n is a known positive integer. How can these observations be used to estimate theta? Sufficiency is a fundamentally important concept in mathematical statistics which has to do with summarizing data without losing information about the unknown parameter of interest. We will discuss this concept, along with the associated geometry in the Rao-Blackwell theorem to derive an estimator of theta which is optimal in the sense that it has minimum variance in the class of unbiased estimators of theta. The talk will be accessible to a student who has some background in statistical inference.

11. Antonio Mastroberardino, Penn State Erie

Tear Film Dynamics: Modeling the Glycocalyx as a Poroelastic Region.

The human tear film is a complex fluid structure composed of an aqueous layer, an outermost lipid layer, and the glycocalyx, a forest of large transmembrane mucins that provide stability to the ocular surface. We formulate a thin film model based on lubrication theory and mixture theory in order to understand the dynamics between the aqueous layer and the glycocalyx, which we treat as a poroelastic region.
12. Peter Mercer, Buffalo State College

*The Levin-Steckin and Clausing inequalities, united.*

We show how to obtain two inequalities about convex functions, due to V.I. Levin & S.B. Steckin (1960) and A. Clausing (1980), by a single argument. The idea is to optimize a suitable linear function on a certain compact set in an infinite dimensional space. The approach will be gentle, making the general ideas accessible to most undergraduate mathematics students.

13. Darren Narayan, RIT

*The STEM Real World Applications of Mathematics Project*

Traditional undergraduate curricula seldom offer students concrete real-world applications of mathematics. As a result, students graduate asking themselves the question, "What else can I do with a mathematics degree besides teach?" One of the goals of the STEM Real World Applications of Mathematics Project is to create a library of modules where students connect classroom concepts with real world applications. A series of examples will be presented including how discrete mathematics can be used to analyze the Atlanta metro system, and how graph theory can be used to gauge functional connectivity of the human brain.

14. Olympia Nicodemi, SUNY Geneseo

*The Science that’s in the Music*

I will share some thoughts about a course that I am developing in conjunction with an NEH grant application focused on Humanities Connections to the STEM disciplines. My contribution will focus on Science and Music. After looking at the broader outlines of the project and the course, I will focus on one topic, namely the musician who was Galileo’s father.

15. Samuel Northshield, SUNY Plattsburgh

*Functions of matrices and Sylvester’s formula*

As an undergraduate, I was struck by the fact that matrices act like numbers and, in particular, many functions extend naturally to matrices. Sylvester’s formula expresses a function of a matrix in terms of how that function acts on the eigenvalues of the matrix. We give a short proof of this result and a novel application or two. Note: This talk is accessible for undergraduates.

16. David Perkins, Hamilton College

*From an Euler expansion to the Cantor Set*

While poking around Euler's expansion of $P(x) = (1 + x)(1 + x)^2(1 + x)^3(1 + x)^4 ...$ and its connection to binary numbers, I wondered if it could be tweaked to say something about ternary numbers. I discovered that it could, and further, that I could link the result to the Cantor set. I will show what I discovered, and we can decide if it's interesting. The only prerequisite is algebra, so the content is absolutely accessible to an undergraduate audience.
17. Gabriel Prajitura, SUNY Brockport

The perils and paradoxes of addition

We will discuss several paradoxical and dangerous addition properties like commutativity and associativity.

18. Paul Seeburger, Monroe Community College

Playing with Multivariable Calculus Concepts Wearing 3D Glasses.

A tour of an NSF-funded project that seeks to develop geometric intuition in students of multivariable calculus. CalcPlot3D, an online exploration environment, allows students (and instructors) to create and freely rotate the graphs of functions of two variables, contour plots, vectors, plane and space curves, vector fields, parametric surfaces, implicit surfaces, etc. 3D glasses can be used for a real 3D perspective! Come get a pair and try it out! This JavaScript web app works on smart phones, tablets, and regular computers. A series of concept explorations is also being created, including topics in multivariable calculus, differential equations, and linear algebra. Each allows students to "play" with the concepts visually to develop their geometric understanding. http://web.monroecc.edu/calcNSF/.

19. Stephen Viggiano, RIT

Properties of First-Order Rational Generators of Archimedean Copulas

Copulas characterize the dependence structure between two or more random variables; a joint distribution function (DF) may be written in terms of the copula and the marginal DFs. Archimedean copulas are an interesting sub-class of copulas that originally came from study of probabilistic metric spaces, and now find wide application in many fields. Archimedean copulas possessing first-order rational generating functions will be discussed in this presentation. These form a simple single-parameter family, and generate bivariate copulas ranging from the Frechet lower bound to a copula with modest positive association (tau = 1/3). Level sets, scatter plots, code for simulation, and strategies for fitting the copula to bivariate empirical data will be discussed.

20. Kazuo Yamazaki, University of Rochester

Ergodicity of equations in fluid mechanics with noise

In the theory of turbulence, ergodicity, namely the energy transfer through nonlinearity to the small scales and the existence of a unique statistical steady state, is often assumed. However, due to the work of various mathematicians in the last two decades, the analysis through rigorous proofs on ergodicity has seen remarkable progress. In this talk we review recent results on the ergodicity of nonlinear partial differential equations in fluid mechanics with noise, such as the stochastic Navier-Stokes equations.