89th Annual Meeting

of the

Mathematical Association of America

Wisconsin Section

March 31-April 2, 2022

Online Via ZOOM

Meet Our Invited Speakers

Sarah J. Greenwald, PHD
MAA PÓLYA Lecturer

Sarah J. Greenwald is a professor in the Department of Mathematical Sciences and a faculty affiliate of Gender, Women's and Sexuality Studies in the Department of Interdisciplinary Studies at Appalachian State University. Greenwald earned a PhD in Riemannian geometry from the University of Pennsylvania and a BS in mathematics from Union College.

Interdisciplinary scholarship in mathematics and gender studies as well as the scholarship of teaching and learning have inspired a broad variety of published articles, books, plenary addresses, special issues of *PRIMUS* and more, for example, the educational website SimpsonsMath.com created with Andrew Nestler. *Library Journal* named the three-volume *Encyclopedia of Mathematics & Society* co-edited with Jill Thomley a “Best Reference 2011.” Plenary addresses have wide-ranging topics including π-day with *The Simpsons* and *Futurama*, the geometry of the earth and universe, how and why the Association for Women in Mathematics (AWM) was founded and is still needed today, mathematical identities: representing the underrepresented, mathematical morsels from *The Simpsons* and *Futurama*, popular culture and mathematics: gender, race and more, and Rubik's cube games on spheres.

Investigating connections between mathematics and society, Greenwald has won awards for teaching, scholarship and service. These include an MAA Henry L. Alder Award for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member, an AWM Service Award, and College of Arts and Sciences Outstanding Teacher of the Year. As an AWM Fellow, Greenwald was cited for “creative and effective efforts to spark interest in mathematics among young people, especially girls… extensive contributions to advancing women in mathematics through writing, lectures and working with professional societies… and mentorship of students.” Greenwald’s Erdős-Bacon number is six, seven or infinity, depending on what and how we count. For instance, the interactive mathematics lecture “Bite My Shiny Metal X” has been distributed on approximately one million DVDs worldwide as a 25-minute extra for the *Futurama* movie *Bender's Big Score* and is listed as “Mind-bending.” Greenwald has spoken about the impacts of scientific popular culture representations on NPR's *Science Friday* and all over the country.

Tim Chartier

MAA chair of the Congress

Dr. Tim Chartier is a professor of mathematics and computer science at Davidson College and specializes in sports analytics. He is also Chair of the MAA Congress and member of the Executive Board. Tim consults with ESPN, the New York Times, the US Olympic Committee and teams in the NBA, NFL and NASCAR. He oversees close to 100 student researchers who supply analytics to Davidson College sports teams, which includes basketball, football, soccer, volleyball, baseball and swimming. Tim has also worked with Google and Pixar on their educational initiatives. He has received the Alder award from the MAA for his teaching. His research and scholarship were recognized with an Alfred P. Sloan Research Fellowship. Through the Teaching Company, Tim completed a 24-lecture series entitled *Big Data: How Data Analytics Is Transforming the World*. Tim authored the book When *Life is Linear: From Computer Graphics to Bracketology* which won the MAA's Beckenbach Book Prize. He wrote *Math Bytes: Google Bombs, Chocolate-Covered Pi, and Other Cool Bits in Computing* which won the Euler Book Prize. Tim also coauthored the textbook *Numerical Methods: Design, Analysis, and Computer Implementation of Algorithms*. The MAA recognized the impact of Tim's writing on undergraduate mathematics education with the Daniel Solow Author's award.

Holly Attenborough, PHD

University of Wisconsin-Platteville

Dr. Holly Attenborough earned her PhD in math from Indiana University and has been a faculty member at UW-Platteville since 2013. She has a wide variety of interests, having taught 17 different courses during her time at UW-Platteville. She has been awarded with the 2018 UW-Platteville Early Career Faculty Award for Teaching Excellence, 2020-2021 MAA-WI Section Distinguished Teaching Award and 2021 Alliant Energy Underkofler Excellence in Teaching Award. Dr. Attenborough was a 2017-2018 Wisconsin Teaching Fellow; her project involved measuring the effects that UW-Platteville's Mathematical Explorations course has on growth mindset and self-efficacy. You may think from the title of her talk that she is a math historian, but she doesn't want to mislead you – her Ph.D. dissertation was in noncommutative algebra, and she is a math history enthusiast!

Conference Schedule

Thursday, March 31st

2:30 – 2:55	**Mu-Ling Chang (University of Wisconsin-Platteville)**
	A "Universal" Divisibility Test
Most people probably know how to determine whether a positive integer is divisible by 2, 3, 4, 5, 6, 8, 9, 10, or 11. Have you ever heard of the divisibility rule for 7? In this talk, I will provide and prove a "universal" divisibility test that shows why the divisibility rule for 7 works.	
3:00 – 3:25	**Scott Lawton and Erin Coonen (University of Wisconsin-Eau Claire students sponsored by Chris Ahrendt)**
	Analyzing Turning Points of the Airy Dynamic Equation Via the Time Scale Calculus
The purpose of this study is to identify and analyze behavior of turning points of the Airy Dynamic Equation, a discrete generalization of the classic Airy Differential Equation. Throughout the process, we appeal to the Time Scale Calculus, which allows for the unification of differential and difference equations. As a result, we are able to analyze the parameterization space and also describe the periodicity as well as other behaviors associated with various parameters in the discretization of the Airy equation. In this work, a brief introduction to the Time Scale Calculus and discretization methods will be provided.	
3:30 – 3:55	**Thomas Drucker (University of Wisconsin-Whitewater)**
	What's the Mathematics in Philosophy of Mathematics?
The history of mathematics can pursue any branch of mathematics at any period of time. It is less obvious what sort of mathematics is looked at when doing the philosophy of mathematics instead. This talk will examine which aspects of mathematics have proved to be of the most philosophical interest and how changes in mathematics provide the occasion for asking different sorts of philosophical questions. No background in philosophy will be assumed.	
4:00 – 4:25	**Min Shu (University of Wisconsin-Stout)**
Member of WI-NExT	Detecting the Bitcoin Bubbles and Crashes
We employed the Log-Periodic Power Law Singularity (LPPLS) model for real-time identification and monitoring of Bitcoin bubbles and crashes in 2021. We also proposed the modified Lagrange regularization method to alleviate the impact of potential LPPLS model over-fitting to better estimate bubble start time and market regime change. The analysis has disclosed that the financial bubble peaking in early January 2021 had sprouted from as early as September 2019. We also found that the Bitcoin boom from November 2020 to mid-January 2021 is an endogenous bubble, stemming from the self-reinforcement of cooperative herding and imitative behaviors of market players, while the price spike from mid-January 2021 to mid-April 2021 is likely an exogenous bubble driven by extrinsic events including a series of large-scale acquisitions and adoptions by well-known institutions. The utilities of multi-resolution LPPLS analysis in revealing both short-term changes and long-term states have also been demonstrated in this study.	
4:30 – 4:55	**Benjamin Leisher (Milwaukee School of Engineering)**
	Pokemon as a Gateway to Supervised Machine Learning and Predictive Analytics
This talk explores the utilization of linear regressions, decision tree models, random forests, support vector machines, and K-nearest neighbors algorithms to classify a pokemon's competitive viability in single battle video game modes. In doing so, it serves as an entry-level introduction to such topics.	

Thursday, March 31st

5:00 – 5:25	
6:30 – 7:00	**Social Event (Bring your own beverage!)**
This event includes the teaching award.	
7:00 – 8:00	**Sarah J. Greenwald (Appalachian State University)**
Pólya Lecturer	Popular Culture and Mathematics: Gender, Race, and Broader Implications
Mathematics and statistics are pervasive in modern society, but have you ever known anyone who asserted that they do not have the "math gene" or mistrusts science, statistics, or mathematics? Popular culture can reveal, reflect, and even shape how society views mathematics and mathematicians. We'll analyze examples from a variety of shows and films and consider the intersections of gender, race, class, ability, and more. We'll also discuss ways to counter stereotypes and contribute to research in this area. At the same time we'll reflect more broadly on what mathematics has to offer, and the diverse ways that people can succeed in making an impact, including you!	

Friday, April 1st

1:00 – 1:50	**Tammy Moynihan (WMC President) and Erick Hofacker (University of Wisconsin-River Falls)**
	Developing Synergies & Partnerships across Wisconsin in Mathematics Education

This session will discuss how Wisconsin MAA, Wisconsin Mathematics Council (WMC), and other organizations within the state, can work together on initiatives to promote mathematics teaching and learning across grades PK-16.

We will share some of the current activities being done, such as: release of the revised K-12 WI Mathematics Standards, recruitment, retention and preparation of K-12 math teachers, book studies and webinars, and the infusion of mathematical modeling and data science into the PK-16 curriculum.

There will be time for full group discussion on how future synergies can be created and developed to further the promotion of this work.

2:00 – 2:25	**Margaret Adams (South Georgia State College)**
	Benefits of High-Impact, Active-Learning, Embedded Error Tasks

Critical thinking is necessary to learn mathematics, as one must ask whether problems and solutions make logical sense. After solving a problem, students don't often go backwards to determine if their solutions and steps are correct and make sense in various real-world application contexts. Knowing that students benefit from significant, impactful learning experiences, college algebra and pre-calculus classes were assigned embedded mistake tasks on paper and on short videos the instructor made on an iPad. In class, students had to find the mistake then rework the problems, and with online classes, they did the same but uploaded their findings into a discussion post. A few weeks later, students created their own embedded mistake tasks and had to share them with the class either in person or in another discussion post. Examples included order of operations, factoring, long division, fractional exponents, graphs and asymptotes, linear equations and analytic trigonometry. Students also video-recorded themselves solving a problem containing authentically created mistakes, then either uploaded a movie file or converted the video into a YouTube link to share on the discussion board. Student learning outcomes were significant as they critically analyzed problems rather than just passively absorbed math content in a classroom or online platform. Positive, engaging peer feedback and written reflections followed these active learning assignments. Most students did not like hearing their own and procrastinated starting but were enthusiastic about the experience itself. Embedded mistake tasks offer opportunities for critical analysis and reflection, fostering course engagement and more successful learning outcomes.

2:30 – 2:55	**Tyler Skorczewski* and Justin Nicholes (University of Wisconsin-Stout)**
***Member of WI-NExT**	Using writing to engage students in a multivariable calculus course

Many non-math major students view mathematics courses as a hoop that must be jumped through or a box that must be checked and not as a genuine learning opportunity in their chosen major. This attitude affects classroom engagement and may lead to poor learning outcomes. This project investigates how writing projects in a multivariable calculus course taken primarily by non-math majors may lead to more positive student attitudes about mathematics, mathematics courses and writing in general. Pre and post course student surveys show student preferences for technical and transactional writing over other forms, positive movement away from rigid thinking about mathematics, and improved views of themselves as writers and how the course connects to their future careers.

Friday, April 1st

3:00 – 3:25	**Ben Stucky (Beloit College)**
Member of WI-NExT	A live ranking system for games of social deduction using PageRank
PageRank is an algorithm developed by Google founders Larry Page and Sergey Brin, who sought to conceptualize the relative importance of web pages in order to create a better search engine. The guiding philosophy is that a page should receive a greater share of importance if it has lots of incoming links to it from other important pages. Surprisingly, this seemingly paradoxical conceptualization of importance may be realized as follows: Consider an internet user who surfs the web for a very long time by 1) choosing a starting page at random, 2) randomly clicking a link on that page, and 3) repeating this process at each subsequent page. The importance of a given page is defined as the fraction of total visits that page receives during this process, i.e., the probability of arriving at that page after a large number of clicks. In this talk, we will discuss the linear algebra and graph theory necessary to understand the PageRank algorithm and explore some technicalities that arise in its implementation. I will then explain how I modified and implemented the algorithm to create a live public ranking system for an online version of the social deduction game, "Mafia," which may be described as a text-based version of the popular video game "Among Us." This talk will be accessible to undergraduates who have had linear algebra.		
3:30 – 3:55	**Lydia Rehder, Elizabeth (Izzy) Rahmel, and Jordan Ball (Carthage College students sponsored by Diana Thomson)**
	Investigating Diversity, Equity, and Inclusion in Statistics and Data Science Courses.
In August 2020, the Kenosha community, home of Carthage College, was devastated after the shooting of Jacob Blake and the ensuing protests. Issues of inequality and racism have been at the forefront nationally in recent years and data is one of the most useful tools to quantify inequity and injustice. We developed a plan to incorporate such data into statistics and data science classrooms. We began by curating and cleaning real-world data sets related to diversity, equity, and inclusion. Querying the Census API allowed us to gather specific demographic data and match it with other available datasets, creating one particular dataset for a single topic. Then we evaluated and analyzed these data sets as students would in Carthage's Elementary Statistics class. Examples of data sets include Wisconsin Covid-19 vaccination data by racial demographic and county and data on fatal police shootings in the U.S. from 2015-2021. We developed lesson plans and researched best pedagogical practices for presenting these topics. Finally, we developed a likert-scale survey to compare control and experimental groups. This social-justice oriented curriculum is being implemented in a new course, Statistics for Social Justice, during the Spring 2022 semester. Exposing students to concrete examples of social justice issues may have many benefits, including making class content more relatable, improving students' technical skills, and showcasing the power of quantitative literacy and analysis, all while emphasizing the need for change in our society.		

Friday, April 1st

4:00 – 4:50	**Bala Pandiyan (University of Wisconsin-Whitewater)**
	This social event will include discussion of this year's student Quiz Contest led by Dr. Bala Pandiyan of UW-Whitewater.
5:00 – 5:25	**Chris Ahrendt (University of Wisconsin-Eau Claire)**
	Exploration of Solutions to a Discrete Analog of Clairaut's Equation on Time Scales

Using the framework of the time scale calculus, we focus on a discrete analog of the classic Clairaut differential equation. We briefly describe the derivation of the discrete equation. We then explore a specific example of the Clairaut equation to compare and contrast with the well known behavior of the solutions of the classic Clairaut differential equation. In particular, we examine the general solution and a singular solution using phase portraits and a strategic substitution.

The time scale calculus generalizes and unifies differential and difference equations, but also is a source of many interesting results that do not have a direct analog to these classic cases. A brief introduction to the key results of the time scale calculus that are used in this work will be provided.

5:30 – 5:55	**Nathan Tennies (University of Wisconsin-Milwaukee Student sponsored by Filipe Alberto)**
	Giant KelpeR: A Webapp for Exploratory Analysis of Macrocystis pyrifera Population Change in Southern-Central California

On the North American West Coast, giant kelp (Macrocystis pyrifera) population declines have been prevalent with increasing extreme heat waves in sea surface temperature (SST). Individuals typically persist below 22° C and past this quickly die off. Giant kelp is the foundational species of the California coast kelp forest ecosystem. The value of this ecosystem's services has led to several kelp cover monitoring programs, most using remote imagery. Input data and output products are mostly formatted for academic use despite stakeholder value. To tackle this, we are developing an RShiny webapp to visualize time series of kelp biomass in Southern-Central California with SST changes and derived statistics (number of consecutive days with SST above 22° C and SST anomalies). Rshiny is a package for webapp development in the R language. RShiny users can program a webapp in R ran with HTML and CSS. In our webapp, users click a location on a map of kelp biomass and choose a radius around the selection. In this radius, the previous statistics are calculated from average kelp biomass and SST. Our webapp will help stakeholders and non-specialists explore kelp and SST time series data. Eventually we plan to add spatially explicit kelp genetic monitoring records from projects by our team censusing genetic diversity changes in California kelp beds. Currently we are deploying our webapp online and after will incorporate OpenStreetMap software to improve our map interface and interactivity.

Friday, April 1st

6:30 – 7:00	**Social Event (Bring your own beverage!)**
This event recognizes those who have been MAA members for 25 years and 50 years.	
7:00 – 8:00	**Tim Chartier (Davidson College)**
MAA Visitor	Get in the Game: Math and Sports Analytics
Sports analytics has gathered tremendous momentum as one of the most dynamic fields. Diving deep into the numbers of sports can be game changing or simply a fun exercise for fans. How do you get inthe game with numbers? What questions can be explored? What actionable insights can be gleaned? From March Madness to national media broadcasts, analytics are becoming increasingly indispensable. Dr. Tim Chartier will discuss outlooks that help with successful analytics, and the variety of questions that can be tackled. He will also share how he leads students to dig into sports using math and computer science, and their great success across the NBA, NFL, NASCAR, ESPN and his own college teams. Learn how to get in the game — as a sports analyst!	

Saturday, April 2nd

8:00 – 9:00	**MAA Wisconsin Section Business Meeting**
An agenda for this meeting will be made available on the Wisconsin MAA web site.	
9:00 – 9:25	**Robert Calcaterra (University of Wisconsin-Platteville)**
	Finding a C.D.F. Using an O.D.E.
Mathematics Magazine posed Problem 2098 asking to find the distribution of a particular random variable. This talk will use a recursion relationship to reduce this problem to solving a particular differential equation and then solving the differential equation.	
9:30 – 9:55	**Whitney George (University of Wisconsin-La Crosse) and Haley Yaple (Carthage College)**
	Math for the People: A textbook for teaching quantitative reasoning through social justice
Math for the People is a new project which seeks to create a collaboratively-written, open educational resource designed to replace a classic textbook for a first-year quantitative reasoning course. The text encourages students to explore how mathematics can be used to understand social justice concepts like generational wealth inequity, climate change, and racially-biased policing from a solutions-oriented perspective. Rather than learning a series of mathematical concepts, followed by applications of those concepts, Math for the People seeks to invert that structure, beginning with a problem that students are interested in and discovering the mathematics which can help to understand and even solve that problem In this presentation, we will discuss the value of incorporating social justice topics into a quantitative reasoning course, the current state of the project, opportunities for collaboration across the community, and our experiences with the creation of the text.	

Saturday, April 2nd

10:00 – 10:25	Kevin Schoenecker (University of Wisconsin-Stevens Point)
Member of WI-NExT	A Calculus Proof of the Fundamental Theorem of Algebra

The fundamental theorem of algebra states that any polynomial with complex coefficients of degree at least 1 has a root in the complex numbers. Another way to state it is to say the any polynomial of even degree with real coefficients factors into quadratics factors with real coefficients. This talk will explore ways to prove the fundamental theorem of algebra with basic multivariable calculus before ever taking a complex analyis class. Also it generalizes to the complex case and so can be used in a complex analyis class as an alternate proof.

10:30 – 10:55	Wonchul Song (Milwaukee School of Engineering)
Member of WI-NExT	Nonparametric Group Screening procedure

Feature screening is crucial in the analysis of ultrahigh dimensional data, where the number of variables (features) is in an exponential order of the number of observations. In various ultrahigh dimensional data, variables are naturally grouped, giving us a good rationale to develop a screening method using joint effect of multiple variables. I propose a nonparametric group screening procedure which is a direct extension of the original sure independence screening procedure, when the group information is known, for example, from prior knowledge. Under regularity conditions, the proposed group screening procedure possesses the sure screening property that selects all effective groups with a probability approaching one at an exponential rate. We use simulations to demonstrate the advantages of the proposed method compared to other procedures.

11:00 – 11:25	Jonathan Cox (Milwaukee School of Engineering)
	A Geometry Adventure in the Spirit of Euclid

A proof-based geometry course provides a superb opportunity for students to build intellectual independence, confidence, and mathematical maturity by developing their own mathematical system. In an inquiry-based learning (IBL) geometry course, the instructor helps guide student progress in productive directions, in part by providing course notes containing definitions, problems, and other background information. We will examine the set of Geometry IBL course notes that I authored. I'll describe the process of writing and revising the course notes, what it's like to teach geometry using them, and my quest to publish A Geometry Adventure in the Spirit of Euclid in the Journal of Inquiry-Based Learning in Mathematics. There's an opportunity here! Might you be interested in teaching (or taking) a course using this open source, extensive, and thoroughly refined set of course notes, complemented with auxiliary materials? The adventure needs more live classroom testing! The adventure awaits!

Saturday, April 2nd

11:30 – 11:55	**Theodore Reimer** (**Carthage College student sponsored by Diana Thomson**)
	Coincidence Isometries of 3D Lattices
Crystal structures are important to the material and geographic sciences, so it is reasonable to desire a mathematical model for their study. We do this using lattices: these are integer linear combinations of a set of basis vectors which we will represent as a single matrix. Rotating, shifting, and otherwise altering these lattices can help us represent crystal defects, which occur where two different crystals meet. In this work we review coincidence site lattices, that is, new lattices made of points where a lattice and the image of its transformation intersect. Our primary concern is determining when a rotation actually results in a coincidence site lattice. We cover the matrices for three dimensional crystals with two complex eigenvalues and one real eigenvalue, and we prove that we can consider this case as a rotation of lattices with a real diagonal basis matrix, which would allow us to shrink the total number of possible cases for three, and possibly higher, dimensions.	
1:00 – 1:25	**Nathan Warnberg (University of Wisconsin-La Crosse)**
	Helping Students Persist
Helping students build persistence in the face of mathematical (and other) setbacks is an objective for all of my courses. I will share some ways that I think help build persistence in my students. For example, I have students articulate how they FEEL when they make mathematical mistakes and reflect on if the way they handled that FEELING was productive or unproductive. Anecdotal evidence indicates that engaging in this type of metacognition helps students normalize making mistakes and helps them deal with those mistakes in healthier, more productive ways.	
1:30 – 1:55	
2:00 – 2:25	**Durga Kutal (University of Wisconsin-Whitewater)**
Member of WI-NExT	Parameter Estimation of Cure Models using both Maximum Likelihood and Bayesian Approaches for Survival Data
This project considers mixture and a non-mixture cure models for time to event data. The maximum likelihood method and Bayesian method used to estimate model parameters in the mixture and non-mixture cure models with modified Gompertz distribution. The simulation study is based on non-mixture cure model with modified Gompertz susceptible distribution to evaluate the performance of the method. We applied both approach to estimate the parameters of a proposed model to real data set on allogeneic marrow HLA-matched donors and ECOG phase III clinical trial e1684.	

Saturday, April 2nd

2:30 – 2:45	**Social Event (Bring your own beverage!)**
This event will include recognition of student award winners for the Quiz Contest.	
2:45 – 3:45	**Holly Attenborough (University of Wisconsin-Platteville)**
Invited	In Favor of History Tidbits in Class and the Ideal Result of Fermat's Last Theorem
In this talk I will discuss a bit of my journey from hate to love of history: how it has fueled a deeper appreciation of mathematics, bringing more context to my students and to me. The talk will finish with one of my favorite stories from the history of mathematics and how to use this story as a powerful educational device. To tell these tales, we will discuss some historical context of calculus and how false proofs of Fermat's Last Theorem led to the development of a very important modern tool in abstract algebra.	

Candidate for MAA – WI Section Chair-Elect

Petre Nelu Ghenciu, University of Wisconsin–Stout

Petre Nelu Ghenciu received his Ph.D. degree in Mathematics from the University of North Texas. He joined University of Wisconsin-Stout as an Assistant Professor in the Mathematics, Statistics, and Computer Science Department in 2004. He has been promoted to Professor of Mathematics in 2014 and elected in 2017 as the MSCS Department Chair. He won the UW-Stout Outstanding Teacher Award 2009-2010 and most recently served as the UW-Stout Team Leader for the UW-System Mathematics Initiative, a 3-year long project. He has published in peer reviewed national and international journals and attended numerous regional, national, and international conferences. Dr. Ghenciu strongly believes in the principle of shared governance; he served as UW-Stout Faculty Senate Chair from 2013 to 2019 and is serving a 2 -year term from 2021 to 2023.

Dr. Ghenciu is a member of MAA and has been active in the activities of MAA sections both at MAA Texas Section in the past and MAA Wisconsin Section currently. He periodically gives talks at the Section Meetings. He is willing and fully ready to serve the Wisconsin Section through the Chair-Elect role.