AMEP News

Applied Mathematics, Engineering, and Physics
Degree Program
University of Wisconsin - Madison

2024

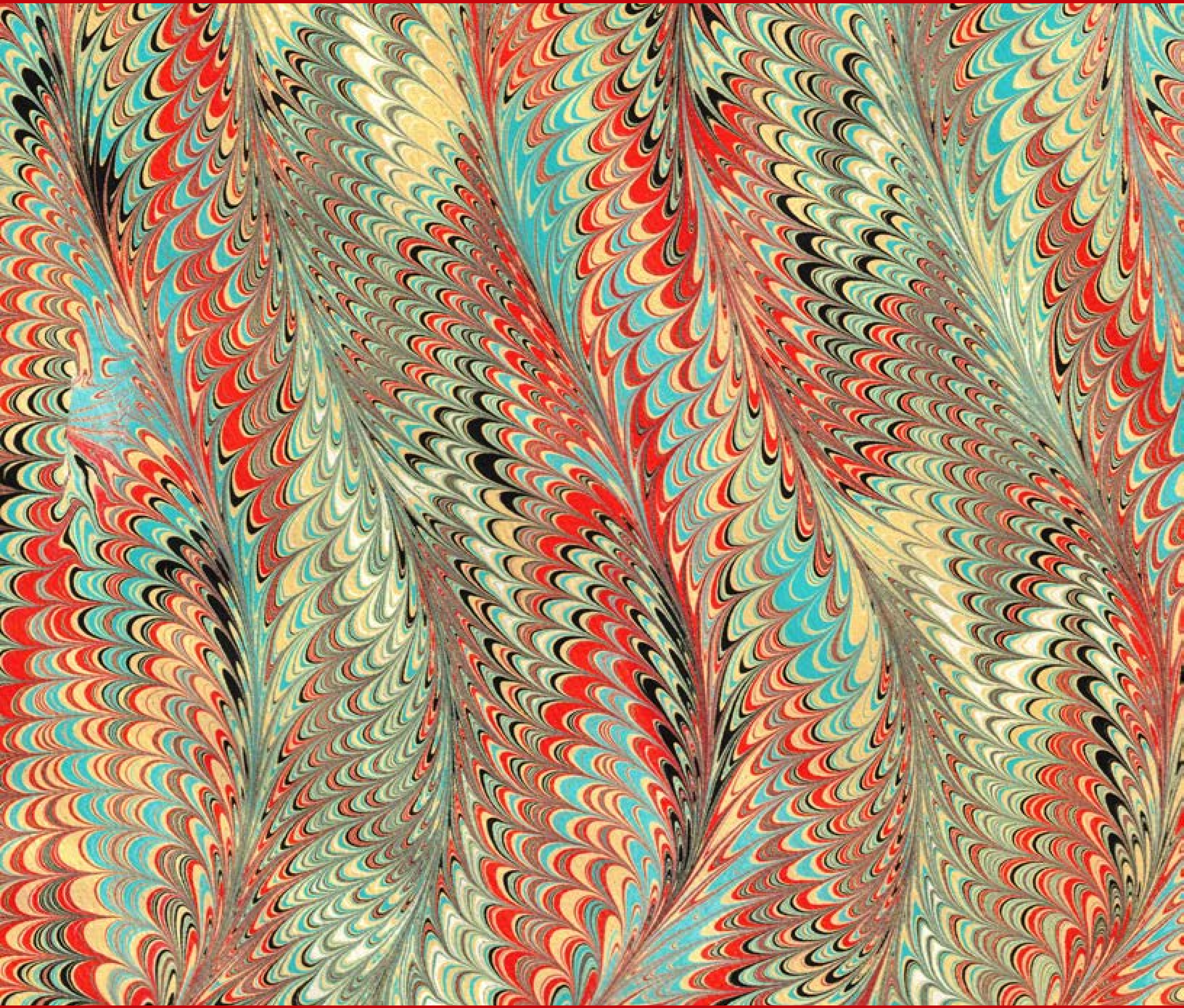

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Photo credit: Yue Sun, AMEP Lab

Letter from the Coordinators

Dear Friends of AMEP,

It has been too long since our last AMEP newsletter! This one is taking off thanks to Saverio Spagnolie and Morgan Adams. Morgan was hired in summer 2023 as a Mathematics department advisor with 20% duties allocated to the AMEP program. Morgan is assisting with student advising and recruiting, program management, and provides liaison with UW advising and career services. This is big news since, as you should know, AMEP is an interdisciplinary and cross-college degree program, previously managed by a small group of volunteer faculty. The Mathematics department has been the administrative home of the AMEP program since its inception, but AMEP did not have a dedicated budget or dedicated administrative staff until Morgan's hire last summer. Welcome, Morgan!

Alumni also play a critical role in our planning and operations, and your support plays an outsized effect on student experience! Dan Koellen, Craig Heberer, Lloyd Hackel, and Tom Dillinger, have been steadfast supporters and effectively formed an AMEP alumni Board of Visitors. Craig, Lloyd, and Tom have served on the Physics Department's Board of Visitors since it started about 10 years ago. Dan has been on the Astronomy Department's Board of Visitors since 2007. Dan Koellen also instituted the AMEP leadership prize awarded yearly for the past 20 years to one or more students who have "demonstrated leadership in AMEP, and possess a solid academic record." Dan, Craig, Lloyd, Tom, and many other alumni have donated to the AMEP support fund that supports the AMEP lab, directed by Prof. Saverio Spagnolie.

The AMEP lab has provided research opportunities for AMEP, Mathematics, and Physics undergraduates, as well as some Mathematics graduate students. Yue Sun, an applied math graduate student working with Math professor Chris Rycroft, won the Milton Van Dyke award in the Gallery of Fluid Motion at the American Physical Society (APS) Division of Fluid Dynamics (DFD) meeting this past November 2023 for her artistic work performed in the AMEP lab.

The AMEP support fund also enables us to have AMEP get-togethers every semester, purchase AMEP T-shirts, and provide other opportunities for undergraduates, such as travel to conferences or participation in the international COMAP contest in mathematical modeling, mentored by Saverio and assistant professor Amy Cochran.

The 2021 leadership prize recipient was Helena Van Hemmen who got involved with the UW Badgerloop project early in her UW-Madison studies. She earned a year-long internship at Tesla in the middle of the pandemic. She is now an engineer at Tesla in California.

Ayodeji Lawal was the 2023 leadership prize recipient. Ayo has an ebullient personality and energized our get-togethers and all the classes that he took. He is now a modeling, simulation, and analysis engineer at Raytheon in Arizona.

This year, we awarded two leadership prizes, and boosted the award to $1,500. One recipient was graduating senior Achintya Krishnan, who also earned an Astronomy-Physics major. He did a senior thesis with AMEP faculty advisor Sam Stechmann and Astronomy assistant professor Juliette Becker. Achintya also worked as a course assistant in the Mathematics Learning Center (MLC). He is moving to the University of Illinois at Urbana-Champaign to pursue a PhD in Astronomy.

Patrick Walsh was the second recipient of a leadership prize this year. Patrick is a junior who always participates in our AMEP get-togethers and mentors other AMEP students. He is interested in quantum computing and is working as an undergraduate researcher in Physics professor Mark Eriksson's group. He is vice-president of the Wisconsin Quantum Computing club.

Our next AMEP get-together is Wednesday September 18, 2024. Dan Koellen and Craig Heberer will be there. We'd love to see you there as well, or at one of the other get-togethers. Please keep in touch and let us know what you are up to.

Please also consider giving back to AMEP in the form of a gift or your time. Thank you for your support.

Best wishes,

Fabian Waleffe
Professor of Mathematics
Professor of Mechanical Engineering (formerly Engineering Physics)

Deniz Yavuz
Professor of Physics

Faculty Feature

Interview with AMEP Faculty

Professor Chris Rycroft, Mathematics

Tell me a bit about yourself.

My research interests are in computational mathematics and modeling, and I particularly enjoy collaborating with researchers in other fields, such as in physics, materials science, and biology.

Nowadays, mathematics and computation enter in to almost every area of science and engineering, which creates a large demand for applied mathematicians. I like building links with scientists in different disciplines, and helping them solve their problems. This often leads to the development of new mathematical and computational techniques.

What has it been like for you at UW-Madison?

I've been a professor since 2014, and I moved to UW–Madison in September 2022. I was attracted to UW–Madison by the large number of faculty in applied mathematics, with many strong links to related fields such as physics, engineering, and computer science. In the past several years, UW–Madison has grown to be one of the largest and most active communities in applied mathematics in the nation. We have deep expertise and critical mass in a range of topics across applied math, and it makes it an exciting place to work for students and faculty alike.

I love teaching at UW–Madison. I grew up in a small town in northern England, and I am the first person in my family to go to college. My education was a transformative experience, both in terms of personal development and the career paths that it opened up. It means a lot to me to work at a flagship public university, where I am able to teach and guide students with a wide range of backgrounds, from Wisconsin and beyond.

Madison is a great place to live. It's family-friendly with many amenities, and it's small enough to easily get around. I really enjoy the outdoors, and I like exploring the parks and woodlands near Lake Mendota, Monona, and Wingra.

What has your experience with AMEP been like?

My first experience with AMEP came before I arrived at UW–Madison! One of my former PhD students Nicholas Derr graduated from the AMEP program in 2015, and he completed his doctoral degree with me from 2016–2022. Throughout his time working with me, I was really impressed with Nick's wide-ranging technical skills, which he attributed to his AMEP education. Nick is currently an instructor in the MIT Mathematics Department.

At UW–Madison I frequently interact with AMEP students, particularly through teaching the course Math/CS 514 on numerical analysis. Some of my students work in the AMEP lab. In summer 2023, one of my Ph.D. students Yue Sun performed a sequence of experiments in the AMEP lab on the fluid mechanics of paper marbling, which formed the basis of an award-winning video at annual DFD Gallery of Fluid Motion competition [1]. The physics of paper marbling involves a complicated mix of surface tension, interfaces, and surfactants, and in the coming year we are planning to study these in more detail.

How did you first become interested in math?

I was always interested in math from an early age. When I was in elementary school, I had a knitted sweater with many rows of cats on it, and I used the cats to practice counting and solve arithmetic problems. Growing up in the eighties, I was also lucky to have one of the first personal computers, which were just starting to become widespread. I had a Sinclair Spectrum with 48 kilobytes of memory. Even though this would be a museum piece by today's standards, it was enough to spark my interest in computers and their power for solving math problems, which continued throughout my education.

What drew you to research in applied math?

I did my undergraduate degree at the University of Cambridge in the UK. It was a great learning environment and I took many pure and applied math courses. Toward the end of my time there, I became particularly interested in the mathematical side of astronomy and theoretical physics. This was partly through reading about scientists such as Einstein, Hubble, and Hawking, whose achievements permeate into the popular consciousness.

When I started my PhD at MIT in 2002, I initially wanted to work in theoretical physics, but I found that a lot of research in this area was highly abstract. I think this was particularly true in this period, when key experimental facilities such as Large Hadron Collider (LHC) were still under development and not producing data. Around this time, I took several courses in applied math, and I had an epiphany when I realized that there were so many practical questions around us that could be addressed using mathematics.

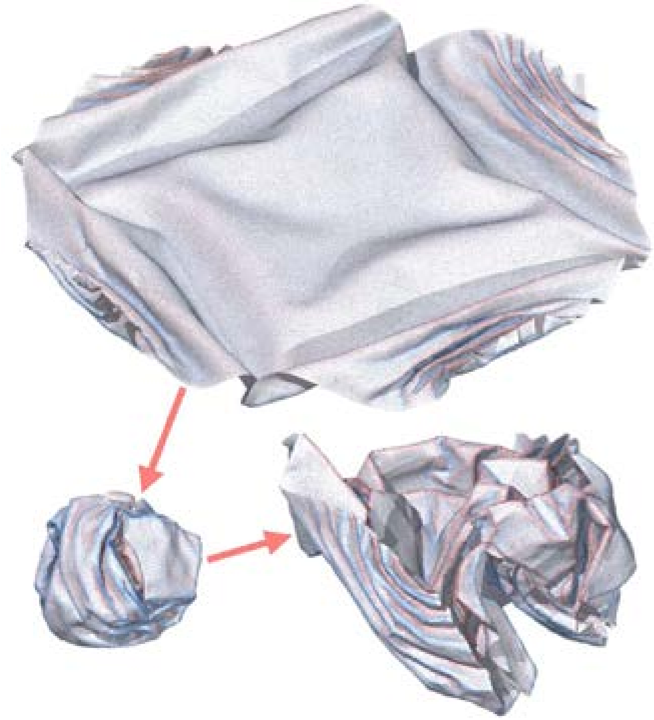
My PhD work focused on computational modeling of granular materials. There are many industrial and agricultural processes where it is necessary to manipulate granular materials (e.g. sand, salt, grain), yet the physics of how these materials flow is surprisingly complex. I built several models to address how grains will mix together during flow. After my Ph.D. was completed, one of these algorithms was later adopted by a coal-fired power plant to predict the mixing of different coal types in hoppers that were feeding the furnace.

Could you give me an example of working with scientists in other fields?

Several years ago, I started working with a group of physicists on studying the process of crumpling. If you crumple a sheet of paper and unfold it, then you will see a network of creases that have formed. If you measure the total length of creases, then it gives you an estimate of the damage that the sheet has sustained. Our physics collaborators performed experiments where they systematically crumpled a sheet multiple times, and they found that the total crease length grew logarithmically with number of crumples [2]. It was really surprising to see a simple mathematical form—a logarithm—emerge from such a random, disordered process as crumpling. At the time, no-one had any explanation for this.

Starting from a large database of crease patterns, we were able to develop a mathematical model of this process. The key idea was to switch the focus away from the creases themselves, and instead look at the facets delineated by the creases. When the sheet is crumpled, the facets break up into small facets, and we were able to build a model of this fragmentation process, to track the evolving distribution of facet areas. Once we knew how the facet areas evolved, we could also understand why the crease length grew logarithmically. This work was published in Nature Communications [3], and covered in several news outlets including the New York Times [4].

The project involved a range of math and computing techniques, including image analysis methods, machine learning methods for data analysis, and building a mechanical simulation of the crumpling process to supplement the experiments. While we focused on crumpling, many of the ideas have broader engineering relevance, to scenarios where structures experience damage and fatigue due to repeated loading.



Three snapshots of a mechanical simulation of a crumpled sheet, used to investigate how creases accumulate (J. Andrejevic and C. H. Rycroft).

What advice would you give to undergrads looking forward to a career with applied math?

Applied math is a great field—you should definitely get involved! One of the most exciting aspects of applied math is its versatility, where we can often use the same mathematical ideas to describe completely disparate phenomena. For example, we can use the concept of random walks to model how elementary particles will diffuse, but also how stock market prices will fluctuate. Applied math gives you the tools to translate any real-world problem into mathematical language so that you can study it. I think this is especially important in the twenty-first century, where many of the most pressing societal problems, such as tackling climate change, addressing the energy crisis, and stopping the next pandemic can initially seem insurmountable. But applied math gives us the tools to quantify them, to break them down into human-scale problems that we understand and address.

A degree focusing on applied math, particularly with programming experience, makes you highly employable. Many applied math graduates find jobs in the information technology sector, or in other areas such as aerospace, finance, and engineering. There are other excellent career opportunities for applied math in the US national laboratory system, which consists of a network of sites (e.g. Argonne National Laboratory, Lawrence Berkeley Laboratory) throughout the US that have extensive research programs in topics of national importance, such as energy, national security, and health.

What advice would you give to students wanting to get involved in applied math research?
If you are an undergraduate student, then getting involved in applied math research can be an eye-opening and useful experience. It is exciting to work on a new question that no one has looked at before. Doing research is very different from taking courses. In a typical course, the path is laid out for you, and you need to study, complete the homework assignments, and do the exams. Research is not like this! Things rarely work the first time, and you need to be self-motivated and proactive, address problems as they come up, and often change your approach. To quote Einstein, "if we knew what we were doing, it would not be called research".

In terms of practical advice, I think it is good to establish a solid foundation in coursework beforehand, such as by completing courses up to the 500 level in the UW course catalog. Gaining experience in a programming language, either through courses or independently, is also useful, because computation is near-ubiquitous in modern applied math research. There are a number of structured research opportunities that you can apply to, such as the Research Experiences for Undergraduates (REU) program organized by the National Science Foundation [5], and the Science Undergraduate Laboratory Internships (SULI) program organized by the US Department of Energy [6]. You can also sometimes arrange research projects individually with professors that you know, e.g. from taking a course with them. If you are contacting a professor, I would recommend doing some homework beforehand and making it clear why you want to work with them specifically.

Research can be done as an independent study course (often in lieu of a regular course) in the school year, or can be done over the summer. In my experience, students often find summer research experiences more fulfilling, as they can focus on the work, rather than having to juggle responsibilities from other courses. Research takes time and builds on itself, so working with a professor over a longer time period, can be particularly worthwhile.

How did you decide on academia as your career choice? Did industry ever appeal to you?
I have a number of friends and former students who work in industry, and there are many excellent opportunities available, but it has never appealed to me personally. A unique feature of an academic career is the ability to teach and mentor young people, and I find this an extremely rewarding aspect of the job. It is a real pleasure to be able to work with students over months or sometimes years, see them grow and develop as people, and then move on to do important things. Students bring an energy and dynamism to the university environment that is difficult to replicate elsewhere.

References:
[1] https://doi.org/10.1103/APS.DFD.2023.GFM.V0002
[2] https://doi.org/10.1038/s42005-018-0072-x
[3] https://doi.org/10.1038/s41467-021-21625-2
[4] https://www.nytimes.com/2021/03/08/science/math-crumple-fragmentation-andrejevic.html
[5] https://www.nsf.gov/crssprgm/reu/
[6] https://science.osti.gov/wdts/suli

Faculty Appreciation

We would like to thank the following faculty for their contributions to the AMEP program and congratulate them on their recent retirements:

Mikko Lipasti was a professor in the Department of Electrical and Computer Engineering and advised AMEP students interested in computer engineering for many years. He retired this year. Your contributions to AMEP are appreciated and we wish you the best in your retirement!

Susan Babcock was a professor in the Department of Materials Science and Engineering. She advised AMEP students for many years and served on the AMEP 10-year review committee in 2014. She retired in 2023. We appreciate your service and wish you all the best!

Student Stories

Modeling Lamprey Population Dynamics and Solar Cars

Harry Luo is starting his third year at UW-Madison. He's pursuing AMEP with an additional major in Mathematics and a certificate in Integrated Liberal Studies.

He participated in the 2024 Mathematical Contest in Modeling (MCM) hosted by the Consortium for Mathematics and its Applications (COMAP). His team was awarded "Successful Participants", placing them among the top 65% of contest participants, for their study of Lamprey population dynamics in Lake Michigan.

"Our submission was an elementary attempt to model the unique life cycle of Lampreys using a discrete-continuous approach. We employed a demographic matrix to update the Lamprey population annually and a 3-species generalized Lotka-Volterra (GLV) system to model the interactions among different species in Lake Michigan throughout the year. This combination allowed us to capture the Lamprey population dynamics and their ecological relationships within the lake ecosystem to an acceptable degree.

"I appreciate my teammates, Pramana Saldin and Minghao Yin, for about 40 hours of intense and quality teamwork, and ScienceDirect, for not giving up on recommending papers on Lampreys and the fish population in Lake Michigan to me to this day."

Harry is also active in the Badger Solar Racing Club. He worked with AMEP alum Jacob Petrie on a solar racing car that Jacob built in 2023.

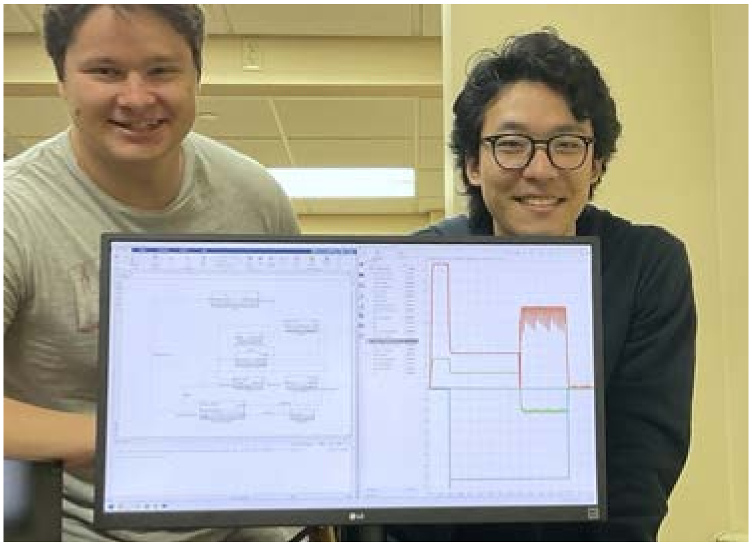
"Our club is dedicated to building a racing car powered purely by solar energy and putting the best possible car forward in the American Solar Challenge. My mission has been to help modify the car to faithfully reflect the mathematical mechanisms of each component.

"During my involvement, I added an overcharge protection feature to ensure that the battery in our model wouldn't charge beyond 100%. I also implemented an undercharge protection system that shuts down the car and initiates charging when the state of charge (SOC) falls below a critical level, such as 10%. Additionally, we improved the cruise control scheme by setting a constant power output goal instead of maintaining a constant speed. This change aligns with our ultimate goal of optimizing the allocation of SOC with respect to time.

"Thanks to our efforts, the modeled car is now complete. We can run simulations and observe the car climbing a hypothetical hill, running out of battery, rolling back downhill while charging, and continuing its climb once the SOC reaches the critical level. The collaboration between Jacob and me has been smooth, thanks to the spirit of teamwork and a shared enthusiasm for the project. However, due to our lack of background in data analysis, retrieving the aerodynamic constants from test run data has been a bit of a challenge.

"I am excited to share that starting next semester, I will be taking on the role of race strategy team lead in the Badger Solar Racing club. In this position, I hope to further enhance the model to better suit our ultimate mission: finding the optimal race strategy for the competition. This opportunity will allow me to apply my skills and knowledge to help the team achieve its goals.

"Working on this project has been an extremely rewarding experience. Having the opportunity to solve engineering problems with mathematical modeling is one of the reasons that drove me in declaring the AMEP degree. Taking a step back, I find it fascinating that we can mathematically describe most, if not all, aspects of the car."



AMEP student Harry Luo (right) and AMEP alum Jacob Petrie (left) showing off their Simulink model of a solar-powered car created for the Badger Solar Racing Club

AMEP Lab Goes to APS

This March, the AMEP lab sent students to participate in the annual March Meeting of the American Physical Society (APS). Over 10,000 mathematicians, physicists, chemists, biologists, and engineers convened in Minneapolis this year to share their latest results.

From left: Graduate students Carsen Grote and Hanzhang Mao, undergraduates Mark Han and Michael Zhao, postdoc Thomas Chandler, graduate student Jingyi Li, and Professor Saverio Spagnolie

Hanzhang Mao presents recent work in the AMEP lab on geometric dependence of curvature-induced rigidity in thin elastic sheets. The project has involved a ‘tetrahedron’ of a faculty member (Spagnolie), postdoc (Chandler), graduate student (Mao), and undergraduate student (Han), and blends experiments, theory, and numerical simulation

2023-2024 Graduates

Congrats to our new AMEP alumni!

Jiayi Liu
Peter Zlatev
Ziheng Feng
Achintya Krishnan
Ruhan Liao
Taylor Toth
Henry Windau
Ruitao Xie
Sabrina Zhu

Awards

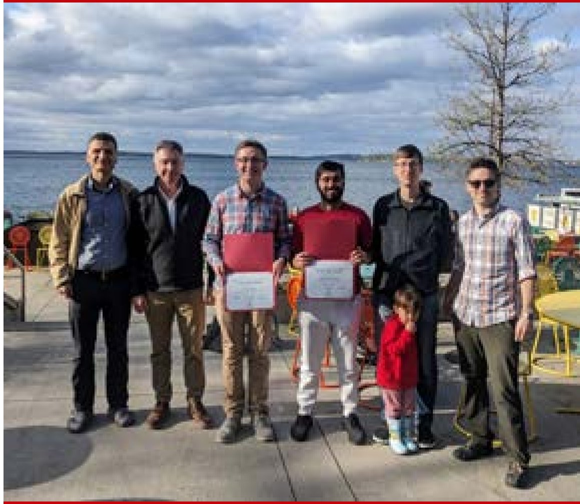
Congrats to all of our AMEP students who received awards this academic year!

AMEP Leadership Prize
Achintya Krishnan and Patrick Walsh

UW-Madison Undergraduate Scholarship for Summer Study
Harry Luo

Phi Beta Kappa (UW-Madison Chapter) Membership
Amitabha Shatdal

US Department of Defense SMART Scholarship
Mitchell Stachowiak



AMEP Leadership Prize recipients, Patrick Walsh and Achintya Krishnan, alongside Professors Deniz Yavuz, Fabian Waleffe, Sam Stechmann, and Saverio Spagnolie

Alumni Spotlight

Alumni Interviews

AMEP alum Craig Heberer, interviewed two recent AMEP graduates. Helena Van Hemmen graduated in 2022 and Bai Yang Wang graduated in 2016.

Helena Van Hemmen

Tell us a little about your academic and career path and what you're working on now.

I was in the AMEP program from 2017 to 2022, during which time I studied mechanical engineering and machine learning. I was involved in the SpaceX Hyperloop Competition from 2017 to 2019 as a mechanical design lead. In parallel, I used my engineering credits on the core mechanical engineering curriculum. My undergraduate research focused on applied deep learning and signals processing, leading me to pivot into the ECE department. I studied machine learning methods by taking a series of advanced courses that were cross listed with the CS and Math departments. My combined interests in hardware and software have led me to work as a computer systems engineer at Tesla. Specifically, I work on Dojo, which is a supercomputer for neural network training.

What drew you toward AMEP?

I heard about AMEP for the first time in the SOAR program. I had previously been considering a physics major, but I had reservations about being in such a theoretical space. The rigorous nature of physics is what first drew me in, but I found my intellectual interests lie at the intersection of applied math and cutting-edge engineering.

What were your favorite classes?

My favorite undergraduate classes were fluid mechanics and matrix methods for machine learning.

How did AMEP prepare you for what you're doing now?

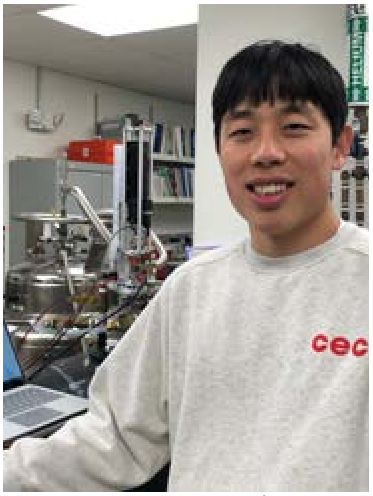
The AMEP program has equipped me with a broad perspective on how scientists and engineers are tackling the problems of the day. I left AMEP with an awareness of how theory, experimental research, and product development overlap. It also helped me build the confidence to take on cross-disciplinary and complex problems in my career.

What advice would you give to a person who is going into or is currently in the AMEP program?

My advice to any current AMEP students: treat AMEP like a tool. The value of the program is not in the rigor of the curriculum, but in the flexibility. Get involved with extra-curricular activities on campus in order to figure out what kind of scientist/engineer you want to become. Then build a curriculum with intention. (And if you aren't sure what you want to become yet… just get your chemistry requirements out of the way. You don't want to be the only senior in Chem 109!)

Bai Yang Wang

Tell us a little about your academic and career path.



I studied as an undergraduate in Applied Math, Engineering, and Physics in UW-Madison, with an emphasis on physics. There I was mentored by Professor Duncan Carlsmith under his Garage physics program, where we explored the possibility of using cosmic muons for archeology surveys. I then joined Professor Mark Eriksson's group as a research intern where I was trained on various aspects of low temperature experiments and gained valuable experience learning quantum computing based on hybrid qubits. In the summer of my junior year, I also did a summer research internship in Professor Filip Tuomisto's group at Aalto University in Finland where I learnt about positron annihilation spectroscopy. These experiences spurred my interests in condensed matter physics which I then pursued in Professor Harold Hwang's group at Stanford University for my Ph.D. degree. There I learnt the state-of-art techniques of material synthesis and became fascinated in designing quantum materials in novel forms and developing techniques to manipulate them either mechanically, chemically, or optically. This research interest motivated me to join Professor Zhi-Xun Shen's group as a postdoc in 2023 where I will be investigating the correlated physics hosted in quantum materials, using a combination of various material manipulation techniques and state-of-the-art optical tuning/characterization tools that Professor Shen's group excels at.

What are you doing/working on now?
At the moment, I'm developing a measurement setup that will allow me to tune the structural properties of quantum materials in-situ while performing spectroscopic measurements at the same time. The spectroscopic measurements that are enabled by powerful beamlines at the national laboratory give me exceptional access to examine the electronic structure of the material directly. Using this technique, I hope to investigate several potentially new electronic phases that I have discovered in materials under extreme strain tuning.

What attracted you to AMEP?
The most immediate attraction of AMEP program was the freedom of designing your course load to your career needs. I was always determined to pursue a physicist's career and my experiences during my three research internships have taught me that success in experimental physics would require more than fluency in textbook physics but also knowledge in subjects including electrical engineering, programming, math, and even public communication. AMEP offers exactly what is needed to prepare me for my goals.

Once I entered the program, I had the pleasure to be mentored by Professor Fabian Waleffe, as well as several Professors in Physics including Professor Duncan Carlsmith, Mark Eriksson, Michael Winokur, Thad Walker, and Susan Coppersmith. These professors offered me great opportunities to participate in actual research and a huge amount of guidance on the preparation for graduate school. I was quickly convinced that I'm in the right program.

How did you become aware of the AMEP program?
I learnt about AMEP through SOAR and reading through the Guide.

Did you look at other programs or majors before settling on AMEP?
I had many friends who double majored in Math and Physics. But I decided that I want a flavor of engineering in my education. So, I chose AMEP.

While in the program, did you have a favorite area or areas of study?
My favorite area was physics. I was particularly fascinated by how complex and beautiful phenomena can emerge from simple identical units following simple rules, once the number of these units reaches a large value. I felt that there should be some universal principles in governing this quantity induced change and this was a subject of study in physics.

Did you have a favorite class or classes? What were they?
I particularly enjoyed quantum mechanics classes taught by Professor Walker, and the statistical mechanics class taught by Professor Eriksson. Both classes were taught very clearly and were thought provoking. The computer science classes were also extremely useful in retrospect.

How did AMEP prepare you for what you're doing now?
Compared to my peers, when I entered graduate school, I was fluent in several programming languages already, had decent knowledge about electrical engineering and at the same time was not far behind in physics courses. This knowledge made my adjustment into the life of an experimental physics research very smooth. I was able to participate and contribute to lab equipment maintenance, writing up measurement codes, and designing and building new electronics right away. Moreover, thanks to the systematic courses that I took on these subjects, I know where to find resources when I encounter an engineering or computer science problem.

What's next for you?
I would like to pioneer techniques of tuning materials at temperatures much below their synthesis temperature (usually this is close to their melting temperature). By manipulating them into novel forms, I can study how the intricate correlated physics hosted in these materials evolve and gain insights into their underlying mechanism. In my current postdoc, I'm hoping to learn spectroscopic and scanning probe characterization techniques that are particularly compatible with such novel materials. Once I finish my current postdoc in 2-3 years, I will be looking to start my own lab.

What advice would you give to a person who is going into or is currently in the AMEP program?
I would recommend them to think early and deeply on what career they would like to pursue. Once they have a reasonably good picture, reach out to as many professors or mentors as you can to get a grasp of what is needed to be successful for that career. Then utilize the flexibility and the resources of the AMEP program to tailor your course load as well as your summers (in terms of research internships) towards the preparation for that career.

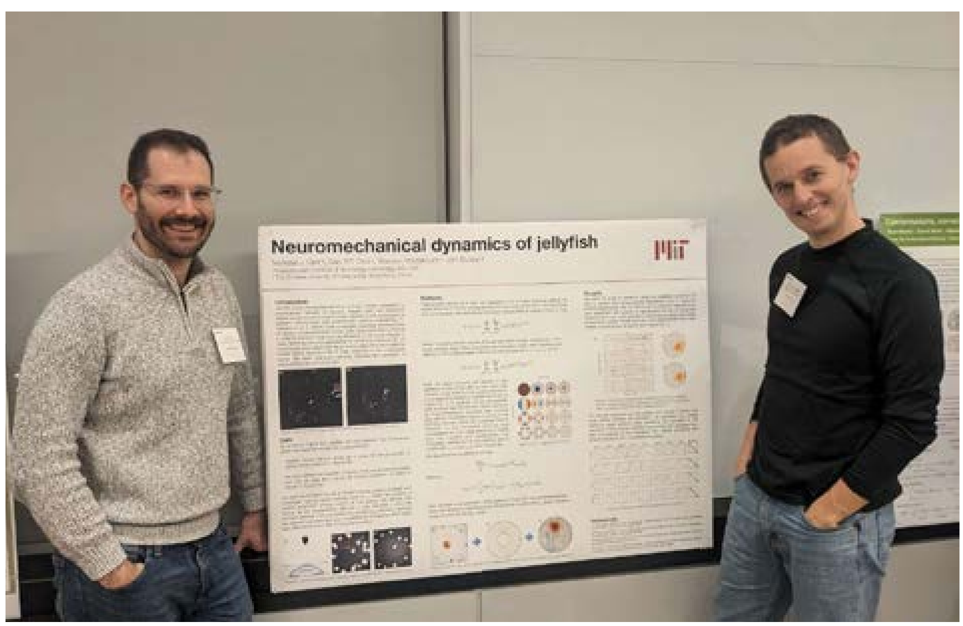
Advice for recent grads?
My only advice based on my experience is to try to regularly come back to your learnings in subjects that are less relevant to your current project. Using myself as an example, I would regularly use my physics education for my graduate study and tend to forget what I learnt in, for example, my computer algorithm class. In retrospect, I would try to do a rough review

and refresh my learnings. Every now and then, situations would pop up where a minimal understanding of algorithms would save a lot of time and open up many opportunities. So, in short, try to prevent your AMEP education from reducing to just Applied Math, or Engineering, or Physics.

Is there anything you'd like to pass onto AMEP students and fellow AMEP alumni?
I would just say good taste on choosing AMEP! I haven't achieved much, so it will have to wait before I can have anything to pass on!

Researching QCS at NASA

Collin Frink graduated in 2022 with AMEP and a major in Computer Science. He participated in the Space Communications and Navigation (SCaN) Internship Project at NASA's Goddard Space Flight Center for the second time in the summer of 2023. He implemented, tested, and benchmarked algorithms for quantum compressive sensing (QCS) on the quantum cloud service Amazon Braket. Compressive sensing is a signal processing protocol that optimizes large-signal reconstruction, or interpolation, via learned structures and the sparsity of the signal. He built upon his research from his first internship in utilizations of quantum algorithms to implement QCS protocols previously developed in Goddard's quantum communications lab. His work with QCS will support the lab's future development and implementation of more sophisticated algorithms and may prove beneficial to NASA's long-term efforts in quantum communication.



AMEP alum Nick Derr and former PhD advisor Professor Chris Rycroft reunite at Mechanics of Life - II, a workshop at the Flatiron Institute in New York

University Communications

Make a Gift

Our AMEP Support Fund supports activities designed to improve AMEP's ability to prepare students to successfully meet industry needs, to create a sense of community among students and faculty affiliated with AMEP, and enhance visibility of AMEP on campus and to external audiences.

To mail a donation, please visit supportuw.org/how-to-give/printable-forms for instructions.

To make a secure gift online, please visit supportuw.org/giveto/amep.

Applied Mathematics, Engineering, and Physics

DEPARTMENT OF MATHEMATICS

UNIVERSITY OF WISCONSIN–MADISON

Thank you for reading! We appreciate the support of our AMEP community and love sharing your news. Please reach out to amep@math.wisc.edu with anything you'd like us to feature in the next edition of this newsletter. On, Wisconsin!

Students Sam Christianson, Hongyi Huang, Hanzhang Mao, and Mark Han enjoying their work in the AMEP Lab housed in Sterling Hall