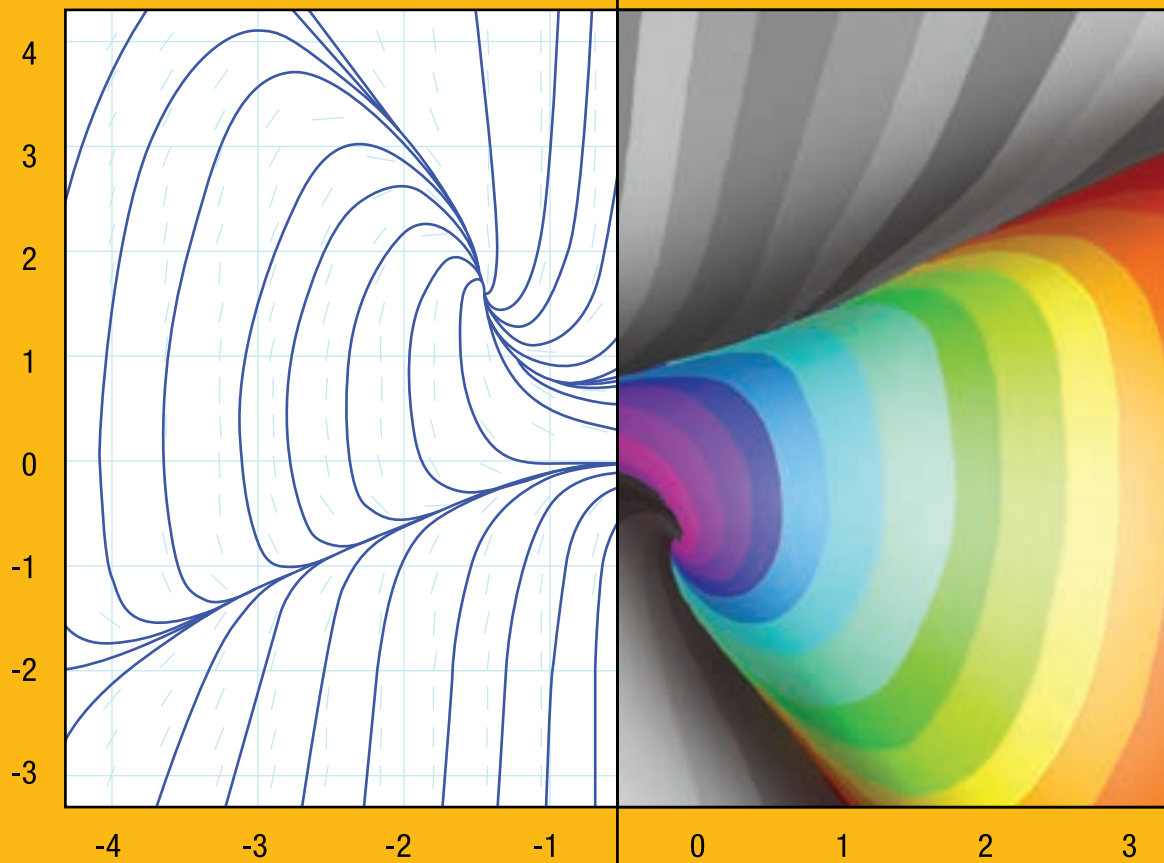


MUDDMATH



VOLUME 15 = 2021

**HARVEY
MUDD
COLLEGE**

Letter From the Chair

Dear Math Alumni, Families and Friends,

The Fall 2021 semester is well underway. Students are back on campus, our classrooms are once again active learning spaces, and everyone is tired. It's hard to articulate the campus zeitgeist, which is a mix of anxiety, excitement, exhaustion and gratitude. After teaching remotely for a year, our new faculty members finally get to teach on campus, interact in-person with colleagues and use their offices! Sophomores are in a similar state, arriving on campus for the first time even after completing their first year at Mudd. Indeed, according to the principle of "conservation of frosh" the current juniors were relieved once the sophomores finally signed the Honor Code in August, releasing the juniors from "frosh" status. Masks are everywhere and regular testing is in place, with convenient test sites on campus. These safety measures and our high vaccination rates appear to be working. We continue with cautious optimism.

Despite the unique challenges of last year, the department has many exciting news items to share with you in this issue of *MuddMath*. Our math majors are flourishing, with 64 graduates in Spring 2021, 17 math, 38 joint CS-math, five math-comp-bio and four joint math-physics. Zoë Bell '21, John Lentfer '21 and Aria Beaupre '21 received NSF Graduate Fellowships to support their PhD studies (page 11), and mathematical and computational biology major Abel Saperstein '21 received a Watson Fellowship (page 10). Our graduates who seek PhD programs continue to matriculate to many excellent schools including the University of Washington (5), UC Berkeley (3), Rutgers, University of Texas at Austin, UC Irvine, University of Illinois Urbana-Champaign, University of Pennsylvania, Stanford, University of Wisconsin, Johns Hopkins, University of Colorado Boulder, Cambridge (Part III), ETH Zurich and the University of Wyoming.

Graduates seeking industry jobs also found exciting opportunities with companies such as Laserfiche, Microsoft, Citadel, Renewable Energy Group, Susquehanna Investment Group, Lyft, Epic Systems, Datadog, Deloitte & Touche, Gusto, Databricks, Optimus Ride, Veeva Systems, Sandia National Labs, Vobile Group, Estée Lauder, Goldman Sachs, Akuna Capital and Zillow. The remarkable range of opportunities our graduates receive, no doubt due to their hard work and efforts, reinforces our belief in our math program and department goals to prepare our students for a wide range of post-Mudd opportunities.

In the following pages, you'll read about our colleagues being recognized for their teaching, scholarship and professional activities through richly deserved honors and awards. Jamie Haddock, Haydee Lindo, Darryl Yong '96, and Heather Zinn Brooks each received NSF funding to support their research. Susan Martonosi received the

INFORMS Teaching Prize, and Lisette de Pillis received an IBA Distinguished Senior Fellowship Award. A global online conference was held in honor of Alfonso Castro in recognition of his substantial contributions to mathematics and the profession. We also celebrate the promotion of Dagan Karp to full professor and Darryl Yong's recognition as one of 2021's HMC Outstanding Alumni.

This year marks the official retirement of now Professor of Mathematics Emeritus Nick Pippenger. Nick spent 15 years in the department without taking a sabbatical and taught an incredible range of courses including Core, Intermediate, Numerical, and Advanced Linear Algebra; Discrete Mathematics, Intermediate Differential Equations, Intermediate Probability, Putnam Seminar, Combinatorics, Numerical Analysis, Algorithms, Complexity Theory, Topology, Real Analysis II, Stochastic Processes, Number Theory, Special Topics courses in Graph Theory and Asymptotics, Writ 1, along with advising a Clinic project, 24 senior thesis students, and offering many independent studies. He has been a wonderful, active, and engaged member of the department, and we wish him well in his retirement and continuing mathematical endeavors.

It remains humbling and thrilling to work in a department with such amazing students and colleagues. As chair, my goal is to support our students, staff and faculty to attain excellence in their teaching, learning and scholarship. Thanks to your generosity, including two new gifts to support summer research and community building, I am now able to say "yes!" to more of these requests, and for that I am very grateful. With such talented students and faculty, we have many great ideas and opportunities to consider, especially as we transition back to in-person life, and we appreciate your continued interest and support.



Jon Jacobsen

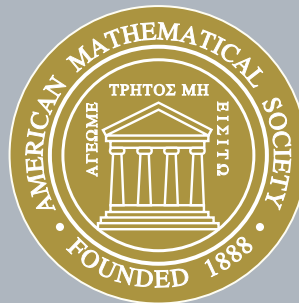
Kenneth and Diana Jonsson Professor
of Mathematics and Department Chair

Contents

- 02** DEPARTMENT NEWS
- 04** FACULTY NEWS
- 09** STUDENT NEWS
- 14** ALUMNI NEWS
- 17** A VISIT FROM ST. CORONA

MuddMath is published by the Harvey Mudd College Department of Mathematics, 301 Platt Boulevard, Claremont, CA 91711.
math.hmc.edu

Jon Jacobsen and Francis Su, co-editors. Produced in cooperation with the Office of Communications and Marketing. Inquiries, suggestions, comments and updates are welcome and can be emailed to jacobsen@g.hmc.edu.



In 2006, the HMC Department of Mathematics received the very first Award for Exemplary Program by the American Mathematical Society.

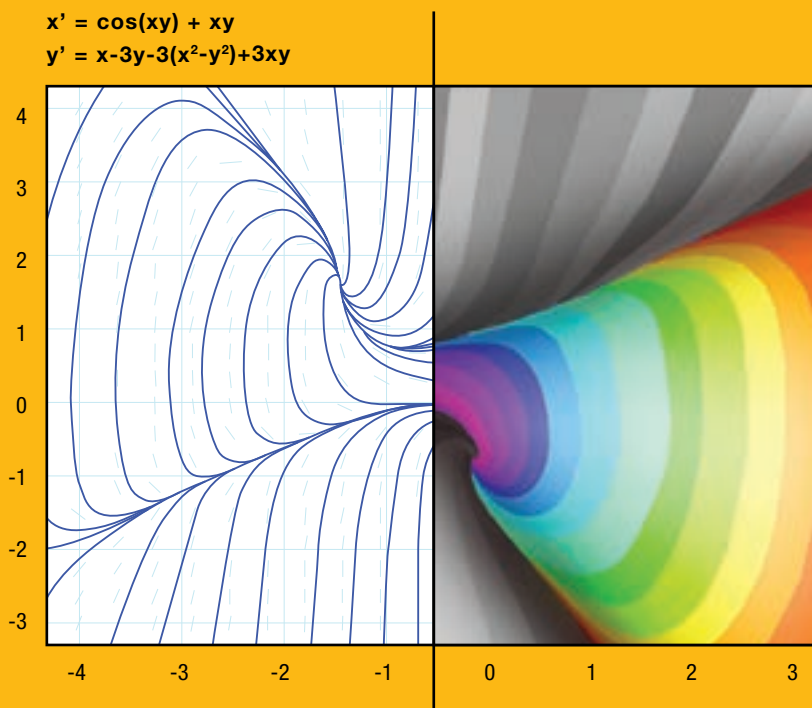
Harvey Mudd College is a co-educational liberal arts college of engineering, science and mathematics that also places strong emphasis on humanities and the social sciences. The College's aim is to graduate engineers, scientists and mathematicians sensitive to the impact of their work on society.

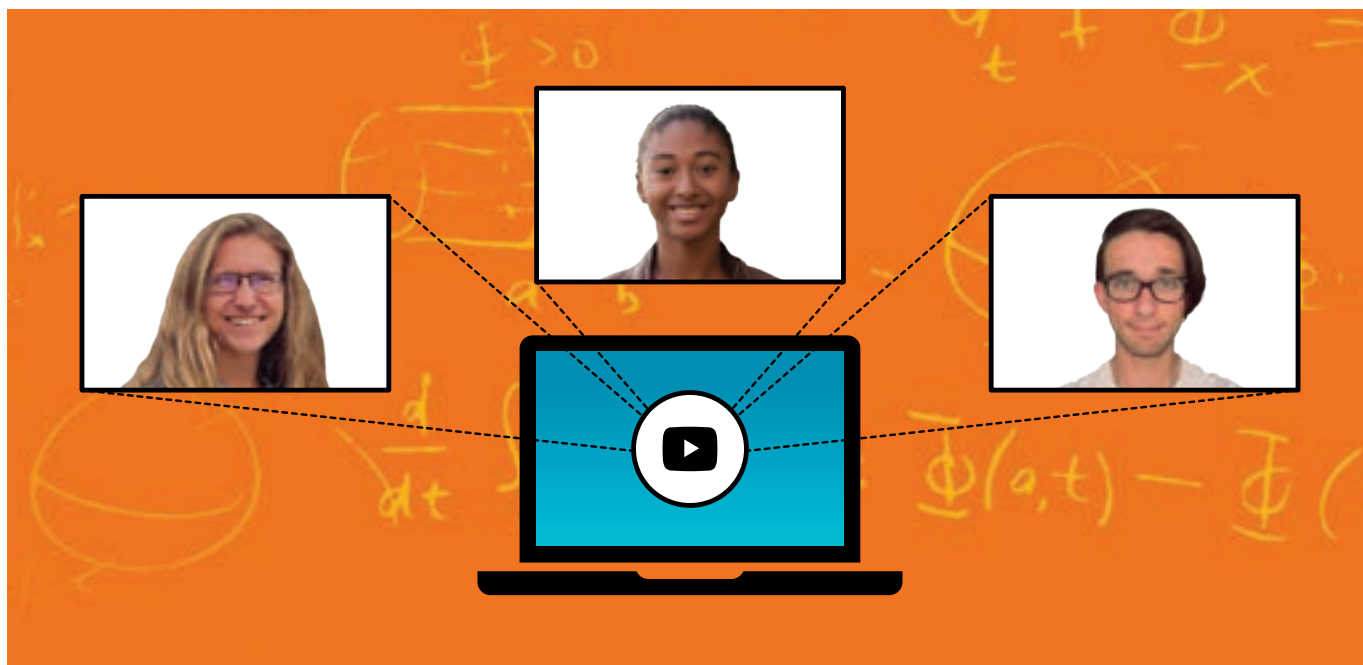
© Harvey Mudd College Department of Mathematics, all rights reserved. Harvey Mudd College does not discriminate on the basis of race, color, sex, sexual orientation, age, gender identity or expression, marital status, religion, disability, national origin, ethnic origin or prior military service in any of its policies, procedures and practices.

About the Cover

Systems of DEs: An Artistic Interpretation

Submitted by Phia Ribeiro '24 and Toby Anderson '24 for Homework Omega in Math 82 (Differential Equations) taught by Darryl Yong '96 and Jon Jacobsen. Homework Omega, the last Core Math homework assignment, is an open-ended creative project related to Math 82 or Core Math as a whole.





Math Forum Forges Forward Online

First-year students who are considering a math major at Harvey Mudd College will eventually take the Department of Mathematics' class in public speaking, Math 198: Forum. The class serves as a chance for students to hone their skills in communicating mathematical ideas to both general and technical audiences. With their classmates as the audience, students present a series of talks that range from personal stories of "aha" moments to technical explorations outside their mathematical comfort zone.

During the pandemic, fall semester Forum looked a little different than usual. Zoom presentations took the place of

in-person talks. "We practically became YouTubers as well as mathematicians," says Jasper Weinburd, visiting assistant professor of mathematics and a National Science Foundation postdoctoral fellow.

Despite the frustrations that come with trying to provide constructive and authentic feedback to peers while the internet connection is lagging, students built a Forum where they shared knowledge and reflections on mathematics through their presentations, several of which can be viewed here <https://bit.ly/3DKDinw>.

Outstanding Alumnus, Beloved Faculty Member



As part of its annual awards, the HMC Alumni Association Board of Governors presented Darryl Yong '96 with a 2021 Outstanding Alumni Award, recognizing his impact on Harvey Mudd College as well as his service to society. Given from alumni to alumni, the award recognizes individuals who have made a sustained

and effective commitment to improving society and who best exemplify the mission of Harvey Mudd College.

Yong (mathematics and music), professor of mathematics at the College, is making significant contributions to society through his mathematics instruction and his work to improve the quality of math education throughout the Los Angeles region. He began as a visiting professor at Harvey Mudd (2000–2001)

while teaching at Caltech, then joined the HMC faculty full-time in 2003. His primary research area is in mathematics education, specifically in the recruitment, training and professional development of highly skilled secondary school mathematics teachers through the Math for America Los Angeles program, which Yong co-founded.

An accomplished author (six books) and mathematician, his other research interests include asymptotic analysis, numerical analysis and applied mathematics. Yong served as the College's associate dean for diversity and was the inaugural interim director of The Claremont Colleges' Center for Teaching and Learning. He's received several awards for community service and teaching, including the 2020 American Mathematical Society Award for Impact on the Teaching and Learning of Mathematics.

Math Alumni Share Research in Moody Lecture, Mudd Talk and Summer Seminar

Michael E. Moody Lecture



Nadia N. Abuelezam '09 (mathematical biology), an epidemiologist and assistant professor at the Connell School of Nursing, presented the 18th Michael E. Moody Lecture, "Injustice, Inequity and Inequality," in October 2020.

The COVID-19 pandemic exposed existing health inequities for communities of color in the United States. Racism is a known structural cause of these health inequities. Counterfactuals are essential to our understanding of causal relationships in epidemiology, but how do you formulate a counterfactual for racism? Abuelezam explored the basis for counterfactual thinking in epidemiology and the ways

in which we need to "reimagine" counterfactuals to address society's longstanding racism issues.

Abuelezam was trained in infectious disease epidemiology at the Harvard T.H. Chan School of Public Health. She has expertise in mathematical modeling and data analytic approaches in public health and in mitigating health inequities for vulnerable populations. Her current research focuses on understanding health risks in hard-to-reach populations, including immigrants. The goals of her program of research are to use quantitative methods and novel data streams to better understand inequities in health outcomes and healthcare access in resource-poor settings and vulnerable populations. View the lecture on YouTube: <https://bit.ly/3A6Mr81>.

Mudd Talk



Tom Konrad '87 participated in the College's popular Mudd Talks speaker series, delivering his talk "How to Divest from Fossil Fuels and Invest in Clean Energy" in October 2020. Konrad discussed how individual investors can ensure that their money is not invested in fossil fuel companies as well as how to

target investments in clean energy. He covered the basics of selecting mutual funds, investment advisors or individual stocks, and the types of investors who should consider each of these strategies.

A financial analyst, portfolio manager and freelance writer specializing in renewable energy and energy efficiency investing, Konrad writes articles about investing in clean energy for AltEnergyStocks.com and freelances for GreenTech Media, The Guardian and Forbes. He manages a private, income-oriented portfolio of clean energy stocks for a family office and serves as a research analyst for Registered Investment Advisor JPS Global Investments. Watch Konrad's Mudd Talk as well as others from the series on HMC's YouTube channel.

Summer Seminar



In June 2021, Xanda Schofield '13 (computer science and mathematics) presented the Summer Seminar "Text Analysis Isn't a Piece of Cake."

In recent years, experts across a variety of social science and humanistic disciplines have adopted natural language processing technologies to help assist their analyses

of large text collections. However, these new projects in computational text analysis are often stymied by obstacles in the critical human work of applying these models: obtaining access to data in a useful format, implementing a processing workflow that attends to things the expert cares about,

and analyzing the limited information that a model of text can reflect. Schofield discussed how it can be hard for text analysis novices to navigate the underspecified "recipes" of the text analysis process, focusing specifically on LDA topic models. She discussed research she's done with students in understanding how text analysis practitioners make meaning from LDA models and how to build software to better support their work. Expect many baking analogies.

Schofield is an assistant professor of computer science at HMC. She completed her PhD in computer science at Cornell University in 2019. Her work focuses on practical applications of unsupervised models of text, particularly topic models, to research in the humanities and social sciences.

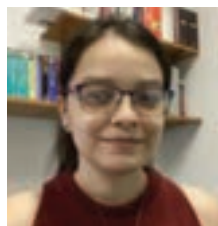
Art Benjamin continued working with students on developing a mathematical model for determining probabilities for the endgame in backgammon. His research may have paid off when he won the Online American Backgammon Tour for 2020. His oldest daughter just graduated college and his youngest one is just getting started.

Lisette de Pillis very much enjoyed being on sabbatical in 2020–2021, during which her mathematics graduate student completed her PhD, an adorable second grandchild was born and she took up water coloring as a new hobby.



Jamie Haddock received a grant from the National Science Foundation funding her research on supervised and hierarchical models for multi-modal tensor data and an exciting collaboration with Harbor-UCLA cardiologists applying these techniques to echocardiograms (DMS-2111440, May 2021 to June 2024). She and her

partner adopted a two-year-old golden retriever mix who they named Muncy (after her favorite Dodger)!



Melissa Hernandez-Alvarez joined the math department as the new IT Analyst in July. This past year, she graduated from California State University, Long Beach, with her master's of science in applied mathematics. She loves to read, complete 1,000-piece puzzles, crochet scarves and play video games.

Dagan Karp chaired the SoCal-NV Section of the MAA and had his first book, *A Conversation on Professional Norms* (with Emily Riehl, et al), accepted for publication by the American Mathematical Society. He continued to teach remotely during fall semester.

Haydee Lindo received a grant from the National Science Foundation to continue commutative algebra research developing the theory of trace modules. She will have a thesis student and a research student this academic year. Haydee is excited to start exploring Los Angeles County and taking long-distance bike trips.

Susan Martonosi was on sabbatical for the 2020–2021 academic year. She had a productive year publishing a few papers and helping her kids with distance learning. A highlight of the year was a two-week family road trip to Yellowstone, Grand Teton, Flaming Gorge and Bryce Canyon.



Mohamed Omar was inducted into the inaugural class of Karen EDGE fellows and launched a Great Course on the Mathematics of Everyday Life through the Teaching Company. He has become very enthralled by interior design.



Michael Orrison recently joined the editorial board of *Mathematics Magazine*, and he was a guest instructor at the summer 2021 Canada/USA Mathcamp. He continues to enjoy thinking about harmonic analysis on finite groups and voting theory, and he is excited to be back on the field this year as a youth soccer coach and referee.

Nick Pippenger retired! But he'll still be around for at least the next two years.

Francis Su co-chaired a task force for the American Mathematical Society examining its historical role in racial discrimination. They produced a public report titled "Towards a Fully Inclusive Mathematics Profession." The pandemic disrupted his teaching, but a positive consequence was being present for all the milestones of his baby's first year.



Jasper Weinburd took a silver lining from virtual teaching and flipped his classes, so that in-class time was completely devoted to homework in small groups. The department helped the effort by sending personal-sized whiteboards to each student, and they all had a blast writing equations and drawing graphs for each other across the internet.

Along with Ilana Horn (Vanderbilt University), Brette Garner (University of Denver) and Ben Rydal Shapero (Georgia State University), **Darryl Yong '96** received a grant from the National Science Foundation to study middle and high school teachers' teaching practices (DUE-2100784, August 2021 to July 2025). He also started a new research collaboration with Doris Santoro (Bowdoin College) to understand the reasons why teachers of color leave or stay in the teaching profession.



Heather Zinn Brooks received a grant from the National Science Foundation to undertake a three-year project to advance the theory and application of mathematical models of opinion dynamics on networks. She especially enjoyed mentoring four amazing research students this summer. She's been doing a lot

of crossword puzzles during the pandemic, and she even competed in a few virtual crossword tournaments for the first time.

Lindo Promotes Math Excellence as NAM Board Member



Haydee Lindo, assistant professor of mathematics, sees her teaching as a vehicle for mentorship and science communication. Having recently been appointed to the National Association of Mathematicians (NAM) board as editor in chief and chair of the Publications and Publicity Committee, Lindo is in position

to influence a wider audience of mathematicians.

"I'm trying really hard to design my courses to extend my mentorship and look out for students when they look like me and also when they don't," says Lindo, who joined the Department of Mathematics in 2020. She's a commutative algebraist with research interests in homological algebra and representation theory. "Hopefully, I'll find more ways to do that and become more effective over time."

NAM is a nonprofit professional organization in the mathematical sciences that promotes excellence in the mathematical sciences and the mathematical development of underrepresented minorities.

"Now is a very exciting time for NAM," says Lindo. "Dr. Omayra Ortega just became president, and with any change in leadership comes new energy, new ideas, new directions. I think NAM will always pay respects to its roots, but it is also in the process of reimagining itself and how best to serve its members, to expand the membership and to build its place as one of the major mathematical professional societies."

Lindo became affiliated with the organization in 2018 after being invited to give a presentation in NAM's Haynes-Granville-Brown Session of Presentations by Recent Doctoral Recipients at Joint Mathematics Meetings. "After that, I ran into NAM folks at various conferences," she says. "They embraced me. Eventually Dr. Ortega recruited me to join the editorial board of the MAA-NAM Math Values Blog." During that time Lindo she wrote the article "Black and Excellent in Math." Lindo now serves on the editorial board of the parent MAA Math Values Blog.

Jon Jacobsen, mathematics department chair and Kenneth and Diana Jonsson Professor of Mathematics, says, "These roles demonstrate Haydee's sustained commitment to issues of equity and diversity in the mathematical sciences and her visible leadership to the advancement of equitable practices in the profession, especially for all who experience underrepresentation in their mathematical journeys."

Interested in the growing field of science communication, Lindo credits her background in mathematics and political science (she holds undergraduate degrees in both) for strengthening her communication and writing skills as well as her interest in teaching.

"As the chair of publications and publicity," Lindo says, "I get to be a part of shaping NAM's voice. I'm excited about that, and I'm eager to make sure that people find out about NAM much earlier in their careers."

NSF Support for Math Faculty

Awards from the National Science Foundation were granted to three mathematics faculty members. The grants will allow them to further research ranging from studying networks using mathematical models to determining best practices for in-class group work monitoring in K-12 education.



Heather Zinn Brooks, assistant professor of mathematics

"Advances in bounded-confidence models on networks," was funded by an NSF RUI grant, which is intended to facilitate research at primarily undergraduate institutions. Her three-year project focuses on the analysis of mathematical models for opinion dynamics on social networks. This work will provide a framework to connect the theoretical study of these mathematical models with real data from online social networks.

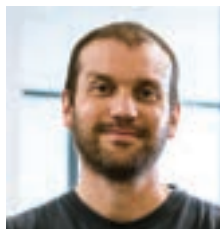
Darryl Yong '96, professor of mathematics

"Teaching Amidst Uncertainty: Developing Mathematics Teachers' & Groupwork Monitoring Practices," is a \$2.6 million, four-year award funded by the NSF Division of Research on Learning in Formal and Informal Settings. This project (building upon previous work by Yong and fellow researchers) is focused on trying to ascertain best practices for in-class group work monitoring in K-12 education (e.g., how do teachers promote productive mathematical talk in groups, how do they ensure equitable participation of group members?).

Jamie Haddock, assistant professor of mathematics

Haddock joined the Harvey Mudd faculty in July 2021 after serving as a computational and applied mathematics assistant professor (postdoc) in the UCLA Mathematics Department, where she received a three-year NSF grant for computational mathematics. The award supports the project "Tensor Models, Methods, and Medicine," which could lead to tools for tensor topic modeling that treat large-scale, complex, multi-modal data in its natural form and may advance the theoretical understanding of these models, their training methods and the complex tensor data to which they are applied. Haddock and fellow researchers will partner with collaborators in the Harbor-UCLA Medical Center Department of Cardiology to apply their findings to case study cardiac imaging data and will fund summer undergraduate research student support and a summer workshop connecting application domain experts with mathematical experts and summer undergraduate students.

Faculty Promotion



Promotions and tenure appointments for Harvey Mudd College faculty were approved by the board of trustees at its May 2021 meeting. Mathematics professor Dagan Karp received promotion to full professor. His research focus is algebraic geometry and Gromov-Witten theory, an interdisciplinary subject,

intersecting algebraic geometry, theoretical physics and string theory. He has supervised students in this area as well as tropical geometry, classical algebraic geometry, commutative algebra and representation theory.

International Conference Held to Honor Professor Alfonso Castro



A global online conference organized by the mathematics community was held in honor of Alfonso Castro, McAlister Professor of Mathematics.

On Oct. 23, 2020, the Universidad Nacional de Colombia, in collaboration with the Colombian Mathematical Society and the Colombian Academy of Science,

hosted the conference to celebrate Castro's 70th birthday, gather mathematical friends and colleagues from around the world and honor his many contributions to mathematics and the profession. Participants included many of Castro's collaborators, PhD students, friends and family. There were lectures and presentations from all over the world, including Colombia, Italy, Spain, Argentina, Brazil, Mexico, the UK and the U.S.

"What a wonderful testament to Alfonso's significant contributions to mathematics and his tenacious efforts to support and inspire mathematicians across the globe in the joy and wonder of differential equations and nonlinear functional analysis," said Jon Jacobsen, chair of the HMC Department of Mathematics and Kenneth and Diana Jonsson Professor of Mathematics.

Castro joined the Harvey Mudd faculty in 2003 and chaired the Department of Mathematics from 2004 to 2008. During his tenure as chair, the department was distinguished with the inaugural American Mathematical Society award for an Exemplary Program or Achievement in a Mathematics Department. Castro specializes in applied mathematics, differential equations and nonlinear functional analysis. His research areas include partial differential equations (including semilinear equations with discrete spectrum), variational methods, inverse-function theorems and water waves (solitons).

De Pillis Honored for Research, Teaching, Mentoring



Lisette de Pillis, Norman F. Sprague Jr. Professor of Life Sciences and professor of mathematics, is the co-recipient of the Intercollegiate Biomathematics Alliance (IBA) 2020 Distinguished Senior Fellowship Award.

The award is for established scholars "who have made outstanding scientific achievements, demonstrated a record of exceptional scientific contributions and active leadership in mathematical biology both as researchers and educators." Recipients "exemplify not only an outstanding level of scientific endeavor but also of mentoring and leadership which helped create scientific opportunities for the future scholars of the field."

"This recognition is well-deserved for Lisette's exceptional contributions to mathematical biology and equally steadfast efforts to support and inspire mathematicians and scientists internationally in the power and beauty of mathematical biology," said Jon Jacobsen, chair of the Department of Mathematics and Kenneth and Diana Jonsson Professor of Mathematics.

De Pillis works with other mathematicians, biologists and oncologists to search for new ways to treat diseases that interact with the immune system, in particular cancer, HIV and Type I diabetes. She received the IBA Fellowship Award jointly with Ami Radunskaya, professor of mathematics at Pomona College and a longtime collaborator in the area of modeling cancer growth and treatment. In 2005, de Pillis published the article "A Validated Mathematical Model of Cell-Mediated Immune Response to Tumor Growth" (with Radunskaya and Dr. Charles Wiseman from St. Vincent Medical Center) in *Cancer Research*, one of the most widely read medical journals. Recent work with international colleagues in mathematics and in experimental biology culminated in the publication of "Mesenchymal stem cells (MSCs) used as carrier cells of oncolytic adenovirus results in enhanced oncolytic virotherapy" in *Nature*. For the *Bulletin of Mathematical Biology* (May 2021), she collaborated on the paper, "Natural Killer Cells Recruitment in Oncolytic Virotherapy: A Mathematical Model," with researchers from the National University of Lesotho, the University of Pretoria and The College of Saint Rose.

Harvey Mudd students assist de Pillis with her research and share co-authorship.



Martonosi Receives INFORMS Teaching Prize

Professor Susan Martonosi has received the Institute for Operations Research and the Management Sciences (INFORMS) Prize for the Teaching of Operations Research and Management Science Practice. The prize is awarded annually to a university or college teacher for their excellence in teaching the practice of operations research and the management sciences (OR/MS).

The INFORMS committee cited Martonosi's outstanding breadth, innovations and hands-on approach to teaching/mentoring students and transforming them into passionate and competent users of OR/MS and analytics in their careers.

Martonosi focuses her research on the application of operations research and analytics methodology to problems in the public sector, including homeland security, humanitarian logistics and

public policy. Her work has included probabilistic models to guide aviation security policy related to passenger and cargo screening and shipping container screening policy; game theory, social networks analysis and graph theory to solve problems in resource allocation and terrorist network disruption; epidemiological techniques coupled with optimization models for the efficient allocation of interventions against malaria; and game theory models for negotiating pediatric vaccine prices in the public sector.

Martonosi says, "I am thankful for my HMC students past and present who continue to bring me such great joy. I am thrilled that so many of them have come to love the field of OR as much as I do. This award is as much a testament to their outstanding achievements as it is to mine."

Su and Contributor Jackson Share Euler Book Prize



The Mathematical Association of America awarded the 2021 Euler Book Prize to Francis Su, Benediktsson-Karwa Professor of Mathematics, and contributor Christopher Jackson for their book *Mathematics for Human Flourishing*. The two collaborators and friends share the \$2,000 prize.

The Euler Book Prize recognizes authors of outstanding books about mathematics that have a positive impact on the public's view of the field. The prize honors Leonhard Euler, an 18th-century mathematician, as well as Virginia and Paul Halmos for establishing the award.

In *Mathematics for Human Flourishing* (Yale University Press), Su describes how mathematics meets basic human desires and

cultivates virtues essential for human flourishing. "The book is a broad explanation for the general public about what math is, who it's for and why anyone should learn it," says Su, whose personal narrative, scholarly perspectives and mathematical problems in the book are enhanced by the writings of Jackson, whose own journey led him to discover the transformative power of mathematics from behind prison walls. Jackson credits the study of mathematics, politics and philosophy, among other subjects, with improving his life. He has worked his way from algebra texts to calculus to linear algebra to topology and his favorite area of math—analysis. He works in the education department at the Coleman federal prison in Florida and has helped over 50 inmates so far learn math to get their GEDs.



Benjamin is Backgammon Champ

Mathematics professor Art Benjamin won the inaugural 2020 American Backgammon Tour Online (ABTO) with the best overall performance in a series of 17 national tournaments. Benjamin garnered a 72–37 win-loss record by finishing first in three ABTO tournaments (Buffalo, Ohio, and Summer Finale), second in one event (Spring Fling), and finishing in the top 20 percent in six others (Michigan, Minnesota, Sunny Florida, St. Louis, California, and Chicago Classic). All tournaments were played online. He also won several events organized by the U. S. Backgammon Federation (USBGF), including the 2020 Tournament of Champions. Last year, Benjamin was part of a six-player team that represented the United States in the World Internet Team Championship. With 31 countries competing, the USA took first place, with Benjamin winning seven of his 10 matches.

A member of the USBGF board of directors since 2011, Benjamin is a supporter of the foundation's backgammon

educational activities, including stimulating interest in the game and educating young people and adults. He initiated Backgammon Night, a social event he created for MAA MathFest 2011, the annual summer meeting of the Mathematical Association of America. His love of the game also includes research.

"I'm grateful for funding that I received from HMC and the Department of Mathematics, which allowed me to hire students for the past two summers," says Benjamin. "Stephen Gross '22, Jackson Bibbens '22, Cedar Turek '23 and Mathus Leungpathomaram '23 did really interesting research with me on racing and the doubling cube, which we plan to publish soon. I'd like to think that some of that research also helped my game this year, too."

Benjamin believes that backgammon is the best game for the mathematically inclined. It can also be a great tool for learning mathematics.

Two Mathematics Majors are Goldwater Scholars

Tonatiuh Gonzalez '22 (mathematics and computational biology) and Anna Soper '22 (mathematics and physics) were awarded the Barry Goldwater Scholarship, the most prestigious national award for undergraduate STEM researchers. The scholarship covers the cost of tuition, fees, books, and room and board up to \$7,500 per year.



Gonzalez is doing research with biology professor Eliot Bush, who studies microbial genome evolution. "Our research is about reconstructing the evolutionary history of bacteria and identifying events that may have given bacteria environmental or antibacterial resistance or increased

virulence," says Gonzalez, who intends to pursue either an M.D. or PhD in computational biology and conduct research in disease genomics. His career interests include cancer research and practicing medicine. In 2020, Gonzalez was named an HMC Outstanding Emerging Leader for demonstrating collaboration, integrity, respect and support.



Soper, a member of engineering professor Lori Bassman's research team, is studying metal alloys and working on computationally simulating their compositions and structures. "My current research is in the field of computational materials science, where I am investigating the chemical and structural mechanisms

by which the brittle sigma phase in a novel stainless steel substitute is destabilized by the addition of aluminum, producing a useful,

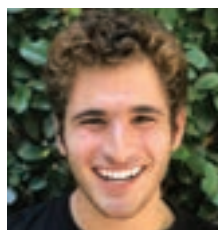
ductile alloy," Soper says. In collaboration with Bassman, physics professor Nicholas Breznay and Jonas Kaufman '17, she has developed a model of the complex sigma phase that predicts the lattice sites that different atomic species preferentially occupy, allowing researchers to study local changes in bond lengths and charge distributions that may contribute to the destabilization of the sigma phase. Over the summer, Soper performed research in nonlinear photonics and optical computing at Caltech before applying to graduate school, where she'll pursue a PhD in experimental atomic, molecular and optical physics.

CRA Recognizes Student Researchers

Joint computer science and mathematics major Lindsay Popowski '21 is a recipient of the Computing Research Association's 2021 Outstanding Undergraduate Researcher Award. The CRA also recognized joint computer science and mathematics major Abtin Molavi '21 as a finalist.



Popowski's CRA award recognizes several research projects she's worked on throughout her undergraduate career, including her participation in a National Science Foundation Research Experience for Undergraduates at Carnegie Mellon University's Institute for Software Research. Popowski plans to pursue a PhD in human-computer interaction.



Molavi's nomination for the award was based on a 2019 summer research project in program verification, a subfield of computer science that seeks to ensure that code written today and in the future is as secure, efficient and correct as possible. Molavi plans to pursue a PhD in computer science.

Sapirstein Wins Watson Fellowship

A prestigious 2021 Thomas J. Watson Fellowship was awarded to mathematics and computational biology major Abel Sapirstein '21, who will study alternate perspectives in healthcare equity while traveling to Bhutan, Chile and Japan. He plans to defer his Watson Fellowship for one year to enter a PhD program at Georgia Tech, where he will continue his studies in operations research.

For the fellowship, "I will be shadowing community physicians and interviewing community members to gain insight into how different nations have generated novel solutions to healthcare inequity," says Sapirstein, whose winning project is titled, "Past, Present and Future Alternatives in Health Equity." He has strategically selected locations where he can observe healthcare systems, culture and politics to gain insight that may lead to solutions related to healthcare equity.

Growing up in Baltimore, Maryland, Sapirstein witnessed inequality and systemic racism and how this plays a role in life expectancy, job opportunities and health in the U.S. It inspired him to study inequity in healthcare on a global scale. He says data-driven policy and resource allocation could unlock solutions to healthcare inequity, especially in countries where fewer financial resources are available.



Student's Research Accepted to PLATEAU2020

A paper co-authored by a joint computer science and mathematics major Ishaan Gandhi '21 and his sister, Anshula Gandhi (MIT), was accepted to PLATEAU2020, the 11th annual workshop on the intersection of human computer interaction and programming languages.

Terminal emulators, or simply terminals, are used ubiquitously by developers. While many have proposed alternatives, their paper "Lightening the Cognitive Load of Shell Programming" examines the fundamental reasons why shell programming, especially when using a terminal as a programming environment, can be difficult, as understood through the cognitive dimensions framework.

"The paper is about shell programming, a way of instructing computers, and terminal, an application used to write shell programs," says Ishaan. "We discussed



what parts of terminal make the experience of writing shell programs easier and less cognitively demanding and what parts make it harder and more cognitively demanding."

He continues, "A lot of developers and researchers proposed alternatives

to shell programming with terminal, but we wanted to take a step back and ask what shortcomings of shell programming with terminal any alternative might hope to address."

Mudd Mathematicians Awarded 2021 NSF GRFs

Harvey Mudd College mathematics majors Aria Beaupre, Zoë Bell, John Lentfer and Hunter Whaples were granted 2021 National Science Foundation Graduate Research Fellowships (NSF GRF).

The NSF GRF program recognizes and supports outstanding graduate students in NSF-supported science, technology, engineering and mathematics disciplines who are pursuing research-based master's and doctoral degrees at accredited United States institutions. Program participants are expected to become experts who contribute significantly to research, education and innovation in the STEM fields.



Aria Beaupre '21 is attending Cornell University and conducting research in algebra, number theory and combinatorics. A 2020 Goldwater Scholar, Beaupre is a prolific researcher, author and mentor. With HMC mathematics faculty, she has worked on integrating mathematical modeling into elementary

school mathematics curriculum and has studied voting theory. As part of a Research Experience for Undergraduates (REU) at the University of Texas at Tyler, she studied the inverse hull of shifts of finite type and continued this work into her senior thesis. She has served as a math tutor in the College's Academic Excellence Program and a grader and tutor for Abstract Algebra. In addition to coauthoring a book on math modeling for principals, she's been honored by the Department of Mathematics with the Alvin White Prize, for contributions to the humanistic side of the mathematics community, and with the Giovanni Borrelli Mathematics Prize.



Zoë Bell '21 is attending UC Berkeley and studies the theoretical foundations of computer science as part of her PhD program in computer science with an emphasis in science and technology studies. Last summer, she studied propositional proof complexity at the University of Washington. She intends

to continue studying computational complexity as well as how CS theory can be leveraged to understand the societal connections

of computer science in areas like algorithmic fairness. She's been honored by the Department of Mathematics with the Giovanni Borrelli Mathematics Prize and the Robert James Prize.



John Lentfer '21 is pursuing a PhD in mathematics (combinatorics, number theory and algebra) at UC Berkeley. He has participated in several NSF REU programs. During the HMC Summer Research Program, he studied "Density Functional Theory Studies on Ketal Claisen

Rearrangements" with chemistry professors

William Daub and Robert Cave. At UCLA, he investigated "Radially Balanced Growth in *Neurospora crassa*" with Marcus Roper, professor of mathematics, and at Williams College, his primary project was "Completeness of Positive Linear Recurrence Sequences" with Steven J. Miller, professor of mathematics. Lentfer has published three papers, two based on the work done at Williams, and one based on work done with HMC mathematics professor Arthur Benjamin and Thomas Martinez '21 as part of an independent study in combinatorics. "I also am working on my senior thesis called 'Tiling Representations of Zeckendorf Decompositions' with Professor Benjamin, which is expanding on some of the work I did at the Williams REU, but from a more combinatorial perspective," says Lentfer. After graduate school, Lentfer says he'd like to be a professor and make math more fun and accessible to everyone.



Math Clinic Team Analyzes Air Quality

As part of its Clinic Program, the College commits to at least two social justice projects every year. During the 2020–2021 academic year, the Department of Mathematics partnered with the city of South Gate’s Community Environmental Health Action Team (CEHAT) to provide data analysis and education about air quality and the impact on the health of its residents, who reside 12 miles south of downtown Los Angeles. South Gate’s industrial history has an ongoing

impact on the area, which is home to three Superfund sites and two oil wells, and which—like all of Greater L.A.—experiences poor air quality due to traffic, industry, fires and other factors.

Working with CEHAT, a unique collaboration of community residents, the city of South Gate, the L.A. County Department of Public Health, L.A. County Department of Mental Health, U.S. Environmental Protection Agency and California Department of Public Health,

the Clinic team worked to provide the community with useful air quality data and analysis and to create a website that would make that data accessible to citizens. In fall 2020, the Clinic team, supervised by Associate Professor of Computer Science Julie Medero, analyzed air quality in South Gate and determined how to best gather more data. In the spring, they focused on building a website that community members can access in both English and Spanish.

Math Majors Perform Piano Recitals

Matthew LeMay ’21 and Kewei Zhou ’21 performed solo piano works recorded at home as part of their senior year studies for HMC, performing works by Sergei Rachmaninoff, Franz Liszt, Claude Debussy and Frédéric Chopin, among others.

LeMay, a mathematics major and East Dorm president, has been taking piano lessons since his sophomore year and, before that, between the ages of 3 and 12. He is interested in music for its capabilities of expression and story-telling and likes

pieces that evoke particular moods or have interesting internal narratives. This fall, he began a PhD program in theoretical computer science at the University of Texas, Austin.

Zhou is a physics-mathematics major with a concentration in music. She had some experience playing the piano at a young age and, from her sophomore year, continued studying piano with Scripps College music professor Gayle Blankenburg. She is also a mezzo-soprano singer.



Departmental Recognition

2020–2021 Giovanni Borrelli Mathematics Prize Arie Beaupre, Zoë Bell, Natasha Crepeau

2020–2021 Stavros Busenberg Prize Ellie Byrnes

Henry A. Krieger Prize Bhavana Bheem, Daniela Elizondo, Deyana Marsh

Courtney S. Coleman Prize Amit Harlev, David Webber

Robert James Prize Kausik Das, Ian Shors, Zoe Tokheim

Leadership Award

Ignacio Lista Rosales '22, **IMPACT Leadership Program**

Mathematics Senior Theses

Zoë R. Bell: **Going Meta on the Minimum Circuit Size Problem: How Hard is it to Show How Hard Showing Hardness is?**
Advisor: Nicholas Pippenger, professor of mathematics

Matthew LeMay: **The Complexity of Symmetry**
Advisors: Mohamed Omar, associate professor of mathematics; Nick Pippenger, professor of mathematics

Fiona M. Callahan: **Evolutionary Patterns in the PEVK Region of Titin in Marine and Subterranean Mammals**
Advisor: Findley Finseth, assistant professor of biology, WM Keck Science Department

Aria E. Beaupre: **On the Inverse Hull of a One-sided Shift of Finite Type**
Advisors: Mohamed Omar, associate professor of mathematics; David Milan, professor of mathematics, University of Texas at Tyler

Ellie D. Byrnes: **Fractals, Fractional Derivatives, and Newton-like Methods**
Advisors: Jon Jacobsen, Kenneth and Diana Jonsson Professor of Mathematics and department chair; Jasper Weinburd, NSF postdoctoral fellow

Max Chao-Haft: **Discrete Vector Fields on Polytopal Complexes**
Advisors: Francis Su, Benediktsson-Karwa Professor of Mathematics; Dagan Karp, associate professor of mathematics

Natasha Z. Crepeau: **On the Tropicalization of Lines onto Tropical Quadrics**
Advisors: Dagan Karp, associate professor of mathematics; Jeremy Usatine, Tamarkin Assistant Professor of Mathematics, Brown University

Daniela Elizondo: **Counting on the Hosoya Triangle**
Advisor: Arthur Benjamin, Smallwood Family Professor of Mathematics and associate department chair

John Lentfer: **Tiling Representations of Zeckendorf Decompositions**
Advisor: Arthur Benjamin, Smallwood Family Professor of Mathematics and associate department chair

Feiyang Lin: **On Rank-Two and Affine Cluster Algebras**
Advisors: Dagan Karp, associate professor of mathematics; Gregg Musiker, professor of mathematics, University of Minnesota, Twin Cities

Kailee Lin: **Exploring Winning Strategies for the Game of Cycles**
Advisor: Francis Su, Benediktsson-Karwa Professor of Mathematics

Thomas C. Martinez: **The Slice Rank Polynomial Method**
Advisors: Mohamed Omar, associate professor of mathematics; Arthur Benjamin, Smallwood Family Professor of Mathematics and associate department chair

Miguel Velez: **Modeling the transition from homogeneous to columnar states in locust hopper bands**
Advisors: Andrew Bernoff, professor of mathematics; Jasper Weinburd, NSF postdoctoral fellow

William D. Warfield: **Emergent geometry through quantum entanglement in Matrix theory**
Advisor: Vatche Sahakian, professor of physics

Kewei Zhou: **Evidence for strong spin-orbit coupled Mott insulating ground state in Li2IrO3 from X-ray Absorption Spectroscopy**
Advisor: Nicholas Breznay '06, assistant professor of physics

Mathematics Clinic Projects

MATHEMATICS CLINIC

Agora Data: Mobile Data Analysis Tool for Automotive Dealers

Liaisons: Chad Stilwell, Kyle Flanagan, Steve Burke, Chris Hawke
Advisor: Zach Dodds
Students: Emily Howard (PM-S), Chris Thompson (PM-F), Nam Tran, Jenny Zhen, Nick Shepherd
Agora wants to offer “buy here, pay here” car dealers a mobile app that will help them evaluate vehicles being considered for purchase at auctions and originate loans on those vehicles at optimal terms. The team has designed and deployed an app, using statistical learning and computer vision, to help dealers optimize the overall health of their loan portfolio and engage in ethical lending practices.

Desmos: Helping Teachers Author Interactive Online Classroom Activities

Liaisons: Denis Lantsman '10, Cori McElwain '13
Advisor: Ben Wiedermann
Students: Harris McCullers (PM-F), Sarah Grade (PM-S), Leo Lindo, Laina Sanders
Desmos creates free, online learning tools for math classrooms. The goal of this project is to make it easier for teachers to use the Desmos Activity Builder to customize activities for their own classrooms. To accomplish this, the team added features to Computation Layer, a programming language that teachers can use to control Activity Builder. These features make it easier for teachers to understand potential errors in their programs so that they can create new activities faster and easier.

Los Angeles Unified School District: Improving Equity and Efficiency in Career Technical Education Funding Decisions

Liaisons: Esther Soliman, Seema Puri, Laura Hayes, Michael Flores, Andrew Ekchian
Advisor: Darryl Yong '96
Students: Sean Pine, Trevor Nogues, Fiona Plunkett, Bhavana Bheem, Justin Grant
Career technical education (CTE) programs in the Los Angeles Unified School District (LAUSD) are career-centered, sequenced courses in fields like engineering, arts, media and medicine. There are two inefficiencies in LAUSD's current funding allocation process for CTE programs: (1) it can distribute funding inequitably, and (2) its application review process is overly time-consuming. The team aimed to address these problems by revising the current funding application and introducing a data-driven process for determining how funding is allocated.

South Gate CEHAT: Community Air Quality Monitoring and Analysis

Liaisons: Samir Patel, Liz Ruiz, Victor Ferrer
Advisor: Julie Medero
Students: Hillary Rodriguez, Carson Herness, Lotenna Nwobbi, Amber Kampen, Adam Grobman
The team collaborated with the Community Environmental Health Action Team (CEHAT) of South Gate, California, to create an air quality website and to analyze air quality data. The website will be accessible to non-technical audiences in both English and Spanish. Their work will be used to inform the CEHAT, regulators and South Gate residents about local air quality.

MATHEMATICS/PHYSICS CLINIC:

HMC Achieving Net-Zero Emissions Through Infrastructure Decision-Making

Liaisons: Annika Eberle '09, Colleen Coxé (HMC)
Advisor: Peter Saeta
Students: Mary Anderson, Hannah Devalos (PM-S), Chai Karamchedu, Sam Ness (PM-F), Eric Thompson-Martin Jr.
To help HMC become a leader in sustainability and fulfill its environmental commitments, the team catalogued sources of greenhouse gas emissions arising from on-campus consumption of electricity and natural gas. While considering the financial needs of the College, they developed a time-sensitive and environmentally impactful plan to facilitate a transition to renewable energy. They identified strategies for developing off-site projects in Southern California and locations for on-campus renewable energy generation to swiftly bring HMC to net-zero emissions.

Fred Hollinger '65: Retired from the Air Force (colonel), 1994. Currently working in IT as a business analyst for Truist Bank. Living in Stone Mountain, Georgia.

Bud Simrin '67: I'm long retired, so I just do math for fun. I developed a pretty extensive user-oriented Clifford Algebra (aka geometric algebra) package in Mathematica. It is on my Github website for download in case anyone has an interest in such a thing. All the source code plus a tutorial with numerous examples is provided. <https://github.com/matrixbud?tab=repositories>



▶ **Frank Greitzer '68:** Frank is editor-in-chief of a new, online, unclassified, peer-reviewed journal *Counter-Insider Threat Research and Practice* (CITRAP), which is being launched by the Defense Personnel and Security Research Center through the Threat Lab, and in cooperation with the National Insider Threat Task Force and DOD's Counter-Insider Threat Program. Insider threats refer to the potential for individuals who have had authorized access to an organization's assets to use their access, and who act—either maliciously or unintentionally—in a way that could negatively affect the organization. The CITRAP journal will champion the relevance and importance of multi-disciplinary social and behavioral science (SBS) research to counter insider threats, communicate both theoretical and practical advances in the counter-insider threat mission space, and improve the translation of SBS counter-insider threat research into evidence-based practice. As a leading researcher on insider threats over the last two decades—initially through his research as a chief scientist at the DOE's Pacific Northwest National Laboratory and currently through his consulting company, PsyberAnalytix—Frank has served on journal editorial boards and as an associate editor, but this will be the first time he takes on the role of editor-in-chief. The first issue of the CITRAP journal is set to be published in late spring/early summer 2022.

David Wilbur '68: We (Linda and Dave Wilbur) started a nonprofit in 2013 providing education and mentoring to low-income, underserved families in East Los Angeles. Our main program is a free parenting and toddler program called Baby College (lindave.org). Baby College has had quite a 2020-2021. First, we lost our lease for Baby College in January 2020, but luckily found a new place at a church in the Hermon part of Los Angeles. Just as we had moved in but before we could open, the pandemic hit. We transitioned to a more remote mode, providing families with Covid-safe, curbside pickup of weekly art/science bags with online meetings with their teachers for the kids as well as online meetings with the parents providing our Parenting Without Violence program. When food insecurity hit, we arranged to deliver food boxes. So far, we have delivered over 2,500 art/science bags and 3,000 food boxes. With the improved vaccination rates and lowered infection rates, we finally opened with in-person classes in mid-June 2021. Over 100 families have attended.

Henry E. Brady '69: After 12 years as dean of the Goldman School of Public Policy (GSPP) at UC Berkeley, I stepped down June 30, 2021, to return to teaching and research. GSPP is the top-ranked public policy school in America according to *U.S. News and World Report's* rankings, and it was recently featured in an article in *The American Prospect* that called it the center of a new movement in economics to study inequality in America. After being dean through the Great Recession, state funding cuts and the last year and half of COVID, I am very happy to return to being a faculty member, especially since GSPP has managed to remain financially strong with no layoffs. Among other things, I will be leading the research component of Cal 100, a project looking at the future of California across a broad range of policy areas. I will also be continuing my research on declining trust in American institutions, and I will be finishing a book on the collapse of the Soviet Union. Patty and I will have more time to spend with our children, Julia, a high school teacher in the Bay Area; and Daniel, a pediatrician in Westchester County, New York.

Jack Cuzick '70: Received the Queen Mary Engagement Voyager Award for "impact with the best scope and geographical reach." The award was made for a body of research that was instrumental in worldwide decisions to replace cytological screening for cervical cancer with more effective primary HPV screening. HPV primary screening is now implemented in the UK and Australia, and recommended by the European Commission, the U.S. Preventive Services Task Force and American Cancer Society.



▶ **Robert L. Jardine '71:** Up to not much. Lots of reading, lots of listening to music. I just finished reading all of the *Callahan* books by Spider Robinson. Highly recommended. Big news is that I now have two granddaughters, 3.5 years and 1 year old. Recent favorite quote: "... a nuclear fission plant works because the gods breathe upon its mojo in such a way as to cause it to be far out."—Spider Robinson in the novel *Variable Star*. [Attached picture is the older granddaughter at about 6 months old.]

James Bean '77: Mid-pandemic, we retired from positions in Boston and moved back to Portland, Oregon. Our two children (Meghan and James) and two granddaughters (Lillian and Rosie) had settled there. We recently welcomed a third granddaughter (Zoe). I remain a senior advisor to the president at Northeastern University in addition to chairing the Harvey Mudd College Board of Trustees.

David Gurney '78: I am an assistant professor of mathematics at Southeastern Louisiana University in Hammond, Louisiana. I spend most of my time teaching elementary statistics courses. For a few years, I tried getting my papers published in mathematics journals but did not have much success. Now I just investigate math and stat topics that interest me, and if the investigation is fruitful enough, I will give a talk about it at the annual Louisiana/Mississippi MAA Meeting. My wife, Melissa, is a manager at a nearby Home Depot, and we have two cats, Melvin and Penny. I like to travel to my hometown, Mount Vernon, Washington, when I have the chance and hike some of the trails in and around the Skagit River valley. Of course, last year we couldn't travel, and traveling this year seems like an iffy proposition, but I hope to be hiking in Washington State again at about this time next year.



▲ **Louis Rossi '88:** After finishing a five-year term as chair of mathematical sciences at the University of Delaware in August of 2021, I failed Sabbatical 101 yet again. This time, the university searched for the inaugural dean of its new graduate college and chose me. It's been a very exciting experience being a pandemic dean. I get to work with a very talented team along with faculty and students who are all committed to creating outstanding graduate and postdoctoral experiences on campus. Tammy is still teaching mathematics at UD as well and has been promoted to senior instructor. It's great to see everything opening up on campus and in the community after working so long and hard in isolation from one another. Tammy and I just returned from a great trip to Seattle, Washington, where we hiked, sailed and explored with daughter Cassie (HMC math '20) and son Noah.

Angie (Kurle) Luengen '01: For the past 18 months, I've been working at a tiny education technology startup, Corsava. As is often the case with startups, I wear a lot of hats. Rarely does a day go exactly as planned, but I love my team, and it's fun to be tackling the "college fit" problem; working to connect the next generation of college students with a college campus and experience that will allow them to thrive. I'm learning a ton, too, which makes it even better. Outside of work, Ross and I continue to enjoy hiking, backpacking and kayaking in the Pacific Northwest. Our two dogs are frequently along for the adventures. My most frequent trail buddy is our three-and-a-half-year-old pup, Strider. We're racking up miles training to earn his working pack dog title.

Karl Mahlburg '01: It has been my great pleasure to work alongside Andy Bernoff on the problem-solving committee for the Putnam Competition.

Bryan Tysinger '01: I am currently a research assistant professor at the Price School of Public Policy at USC. I direct the health policy microsimulation team at the Schaeffer Center for Health Policy and Economics. My work focuses on life-course modeling for health and health-related economic outcomes. Jillian Wallis and I live in Los Angeles, where we are bossed around by our cat. I still spend as much time as I can making music.

Eric Harley '04: Last fall, we left Baltimore, for South Kingstown, Rhode Island, to be closer to family. I had been living in Baltimore, since starting grad school in 2004 at Johns Hopkins, so it was the end of an era, but 2020 was especially rough on the kids (9 and 5), and we didn't feel like we had another choice. Professionally, over the last year and a half, I led the development and implementation of a new sampling method for the USDA's Food Safety agency leveraging big data, machine learning and good ol' fashioned statistics. I can say unequivocally that America's supply of chicken nuggets has never been safer.



▲ **Holly Johnsen '07 and George Tucker '08:** We worked (Holly as a data scientist at Facebook, George as a research scientist at Google Brain) from our home in Sunnyvale, California, this year and enjoyed getting the extra time with our 2-year-old son. A baby brother is expected any day now. We are celebrating five years of marriage in July.



▲ **Maureen Saint Georges '07:** I live in Los Angeles and work as a pediatric emergency physician at the Children's Hospital of Orange County. My husband and I welcomed our second daughter, Zoe, at the end of 2020. We wish everyone at Mudd a healthy 2021.

Parousia Rockstroh '08: I was awarded a RAND Presidential Medal for the design and analysis of graph theoretic algorithms for national defense. This is the highest honor at our institution.

Joshua Swanson '10: Finished my postdoc at University of California San Diego, starting a second and final one at USC this Fall.

Katarina Hoeger '13: This past year was my second year studying in the intermedia department at University of Maine. I have created audio and visual artworks, in the media of VR, sound, visuals, webpages and booklets. A few of the pieces required mathematics and algorithms (efficient sorting, efficiently choosing a spot to place the next virtual object, etc.). One specifically was a partial exploration of wallpaper groups. As the year progresses, I will continue to figure out what topics my art seems to examine at the moment, and what I wish to work on for my thesis.

Kyle Shan '15: Last year, I finished a master's and moved to Boise, Idaho, where I'm a data scientist at Micron. **Kristina Ming '15** and I got engaged last year, and we are getting married in July.



◀ **Alec Dunton '16:** Just defended my PhD thesis at University of Colorado, Boulder, moving to the Bay Area to start a postdoc in scientific machine learning at Lawrence Livermore National Laboratory this Fall.

Maddie Weinstein '16: I graduated from UC Berkeley with my PhD (math) in May. In the fall, I will start a postdoc at Stanford. I am an AAAS IF/THEN Ambassador, a position in which I serve as a STEM role model for girls. My dog Pumpkin Pi and I were featured in a video on the GoldieBlox YouTube channel about debunking stereotypes about mathematicians.

Joyce Yang '16: I have been living near my family in Rockville, Maryland, since graduating. I worked in several roles over the past five years including software development (where matrix decomposition made an appearance), teaching for a programming boot camp and event planning for the MAA and was also active as a volunteer for the Democratic party throughout the recent election cycle. I enjoyed the opportunity to host a roundtable discussion about automation, AI and autonomous robotics last year. I'm interested in helping make math competitions more inclusive and would love to discuss this topic with other Mudders.

Lakshay Akula '17: Nothing too exciting at work, but I did make this math visualization of Penrose tilings in my free time that I think other math lovers might enjoy. Visit penrosemoire.com to view it.



▲ **Max Hlavacek '17:** I am in the process of getting a PhD in math at UC Berkeley, studying combinatorial questions about polytopes. I haven't been on campus in the past two years though, since I was visiting my advisor in Berlin for a year and then COVID happened. Now I am happily resettled in Berkeley with my partner and recently adopted a 20-pound cat named Squid.



◀ **Kira Wyld '17:** Since graduating from Mudd, I have earned a master's (library science) and been hired at the University of Washington to be the library's liaison to the mathematics, applied mathematics, statistics and computer science departments. More importantly, I also adopted a dog named Uhura, a black lab/shepherd mix who is now about 10 years old and a very good girl.

Daniel Johnson '18: After spending a year at the self-driving car company Cruise, I moved to Montreal, for a year-and-a-half position as an AI resident at Google Brain. At Google, I've been working on applying neural networks to discrete objects like graphs and trees and using that to build machine learning systems that make predictions about computer programs. This fall, I'll be moving to Toronto and starting a PhD at the University of Toronto and the Vector Institute.

A Visit From St. Corona



Written by Jon Jacobsen
(with apologies to Clement Clarke Moore)

Mathematician Sophia Kovalevskaya famously said "It is impossible to be a mathematician without being a poet in soul." It is in this spirit and in honor of our 2021 graduates that we offer this poem and reflection on the year that was.

'Twas the night before graduation,
when all through the Shan,
Not a senior was stirring, away we all ran;
Corona had sprung, and it brought such a scare,
Go home say we must, and masks must we wear;

Online went our classes, a Zoom matrix of heads,
And with video off, we can attend in our beds;
Profs learned how to teach online in a snap,
Though breakout rooms could feel like a trap;

As senior year approached, there arose such a matter,
To stay or to go? our class it did scatter;
Away to their pods friends flew like a flash,
Fall classes resume, if computers don't crash;

When Clinic and thesis online did we go,
Sharing our screens was the new status quo;
Then, what to our screen-tired eyes should appear,
But a Math Forum waiver, for our entire class year!

To return one last spring, each day we did pray,
Until spring went online, said an email from Klawe;
How could this be, a year of such angst,
No parties, no room-draw, no in-person pranks;

On sabbatical were profs Martonosi, dePillis and Gu,
Which meant no Topology course with Prof Su;
But a new course appeared, like a star through the window,
It's commutative algebra, with our new Prof. Lindo!

And Zinn Brooks it seems, there is one or two,
Stellar teachers they are, for being brand new;
Bernoff and Weinburd, a great team they make,
They flipped all their classes, for our learning's sake;

Prof Yong taught us SciComp with such tact and flair,
For our health and well-being, so much he did care;
When Castro and Williams, from leave did return,
Analysis and Time Series, math students could learn;

Karp was so groovy in one seventy-six,
Even without his chalkboard, our minds were transfixed;
Prof. Omar taught graph theory, so fun and so cool,
Why isn't he teaching everything at this school!

Orrison went async, slick videos he made,
But his orange shirts were missed, we wish they had stayed;
Prof. Benjamin took time to reflect and examine,
and now he's the champ of online backgammon!

Though retiring this year, Prof. Pippenger would,
For his last year of teaching, give all that he could;
We uploaded our finals to Gradescope with care,
In hopes that new degrees soon would be there;

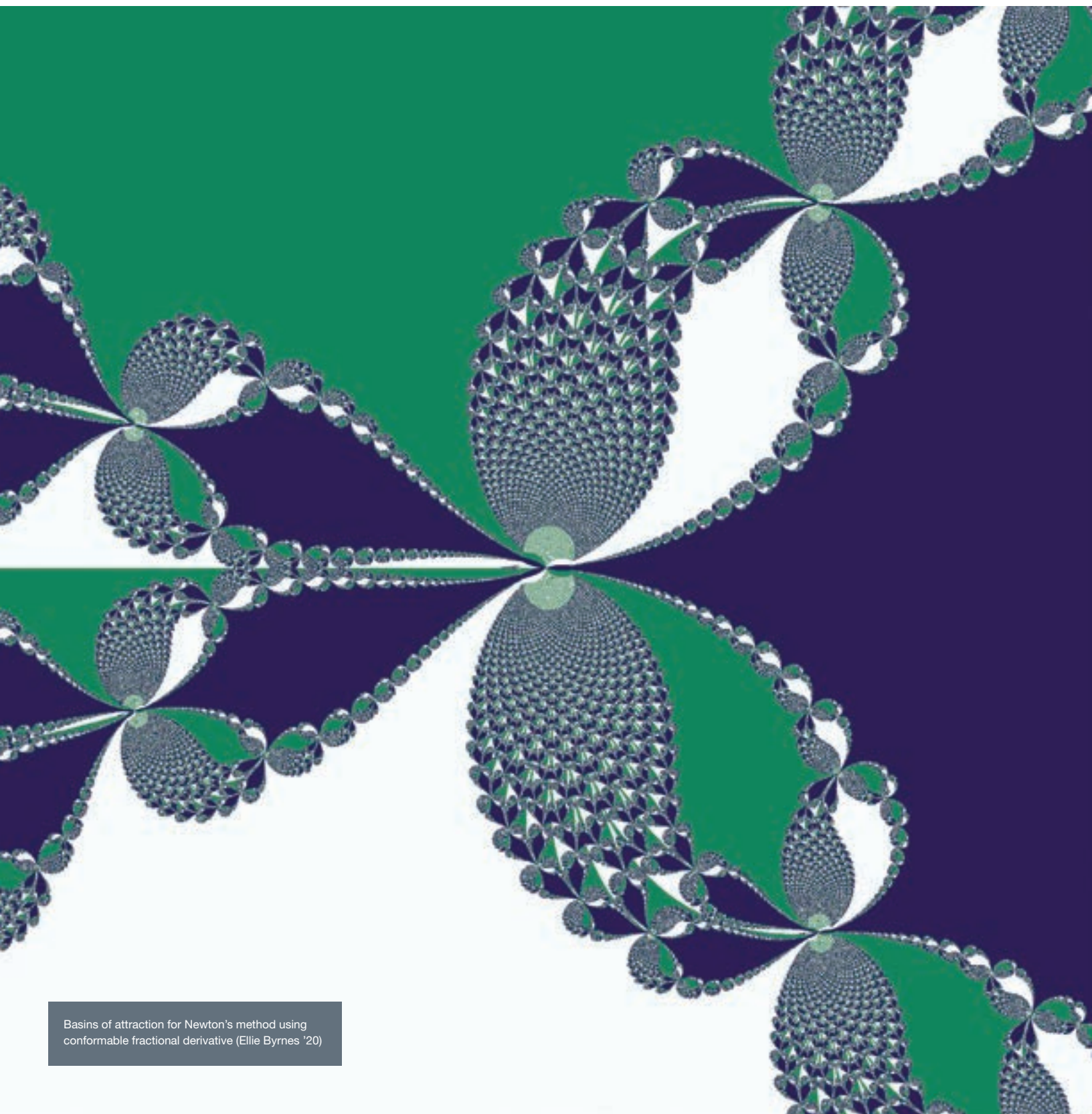
We turned in our theses and Clinic reports, too,
Hard to believe it, but naught more is due;
We earned our degrees, a bachelor's of science,
And with alumni we feel, a brand new alliance;

Now the math department fades from our lives, so it seems,
But one day we'll visit, thanks to vaccines;
Our profs, so supportive, our friends they become,
And make us more proud to be an alum;

Thus we end here today, and it brings us some sorrow,
But hope we must keep, for a new day tomorrow;
And I heard Prof. Jakes exclaim, with his Zoom screen so bright,
Happy graduation to all, and to all a good night!

Harvey Mudd College
Department of Mathematics
301 Platt Boulevard | Claremont, CA 91711
math.hmc.edu

Nonprofit Org.
U.S. Postage
PAID
Claremont, CA
Permit No. 35



Basins of attraction for Newton's method using
conformable fractional derivative (Ellie Byrnes '20)