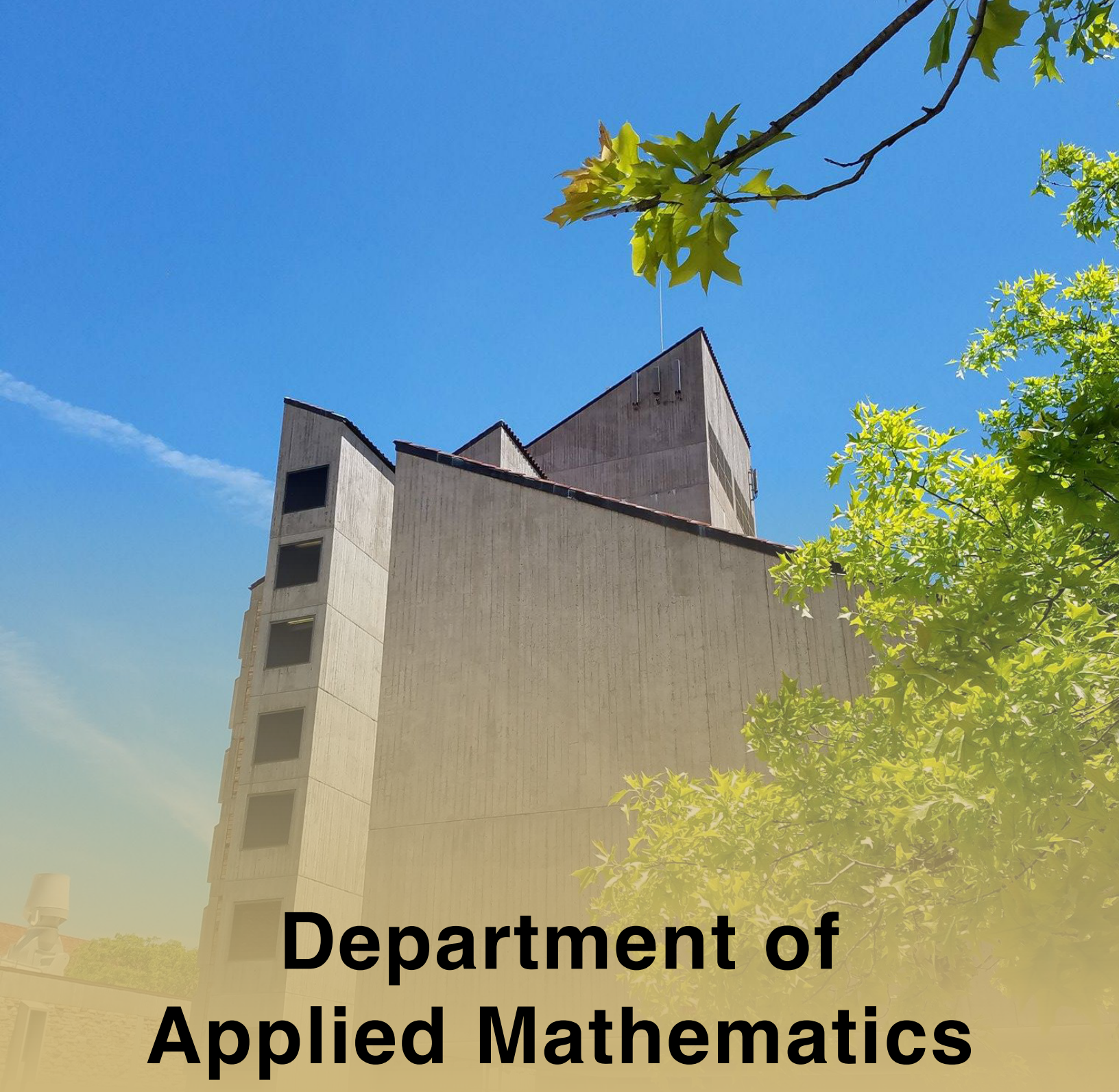

Department of Applied Mathematics

Newsletter 2016-2017

- University of Colorado Boulder -

In This Issue ...

Affiliated Faculty

Betterton, Meredith – Physics
Bradley Elizabeth – Computer Science
Cai, Xiao-Chuan – Computer Science
Calkins, Michael – Physics
Cary, John – Physics
Clauset, Aaron – Computer Science
Crimaldi, John – Civil, Env. Archit. Engineering
DeGrand, Thomas – Physics
Doostan, Alireza – Aerospace Engineering Sciences
Elkington, Scot – LASP
Evans, John - Aerospace
Flaxman, Samuel – Ecology & Evolutionary Sciences
Flyer, Natasha – Institute for Math Applied to Geosci.
Aimé Fournier – Mathematics
Fox-Kemper, Baylor - CIRES
Frongillo, Rafael – Computer Science
Glover, Fred – Leeds School of Business
Hauser, Thomas – Research Computing
Herzfeld, Ute – CIRES; Electrical, Comp. & Energy Engineering
Horányi, Mihály – Physics, LASP
Hrenya, Christine – Chem. & Biological Engineering
Hussein, Mahmoud I. – Aerospace Engineering Sciences
Jessup, Elizabeth – Computer Science
Kantha, Lakshmi – Aerospace
Kompala, Dhinaker – Chem & Biological Engineering
Laguna, Manuel – Leeds School of Business
Lomeli, Hector – University of Texas
Martins-Filho, Carlos - Economics
Meyer, Francois – Electrical, Comp. & Energy Engineering
Moyen, Nathalie – Leeds School of Business
Nychka, Douglas – NCAR, Institute for Math Applied to Geosci.
O'Rourke, Sean - Mathematics
Ostrovsky, Lev A. – NOAA
Parker, Scott – Physics
Pouquet, Annick – NCAR
Rajaram, Harihar – Civil, Env. & Archit. Engineering
Rey, Ana Maríe – JILA; Physics
Sankaranarayanan, Sriram – Computer Science
Scheeres, Daniel – Aerospace Engineering Sciences
Shull, J. Michael – Astrophysical & Planetary Sciences
Syvitski, James – INSTAAR; Geological Sciences
Toomre, Juri – JILA
Tufo, Henry – Computer Science
Varanasi, Mahesh – Electrical & Computer Engineering
Vernerey, Franck – Mechanical Engineering
Weidman, Patrick – Mechanical Engineering
Weiss, Jeffrey B. – ATOC
Werne, Joseph – Colorado Research Associates
Zylberberg Joel – Physiology and Biophysics

APPM Faculty

Department Chair: Keith Julien, Professor
Associate Department Chair: Anne Dougherty, Senior Instructor
Chair of Graduate Studies Fall 16': Per-Gunnar Martinsson, Professor
Chair of Graduate Studies Spring 17': Mark Hoefer, Associate Professor

Mark Ablowitz, Professor
Gregory Beylkin, Professor
James H. Curry, Professor
Vanja Dukic, Professor
Bengt Fornberg, Professor
Mark Hoefer, Professor
Keith Julien, Professor
Congming Li, Professor
Per-Gunnar Martinsson, Professor
James Meiss, Professor
Harvey Segur, Professor
David Bortz, Associate Professor
Jem Corcoran, Assocaite Professor
Manuel Lladser, Assocaite Professor
Juan G. Restrepo, Associate Professor
Eric Vance, Associate Professor
Stephen Becker, Assistant Professor
Ian Grooms, Assistant Professor
Yu-Jui Huang, Assistant Professor
Zachary Kilpatrick, Assistant Professor
William Kleiber, Assistant Professor
Jerrold Bebernes, Professor Emeritus
Bob Easton, Professor Emeritus
Tom Mantueffel, Professor Emeritus
Steve McCormick, Professor Emeritus
Anne Dougherty, Senior Instructor
Adam Norris, Senior Instructor
Sujeet Bhat, Instructor
Murray Cox, Instructor
Danielle Lyles, Instructor
Eric Thaler, Instructor
Brian Zaharatos, Instuctor
Silva Chang, Lecturer and Math Placement Advisor
Rachel Tutmaher, Lecturer, Learning Center Coordinator
Justin Cole, Instructor, Research Associate
Chao Deng, Instructor, Research Associate
Yolanda Slichter, Instructor, Reseach Associate
Ann DeFranco, Lecturer
Susan Hallowell, Lecturer
Jonathan Kish, Lecturer
Daniel "Seneca" Lindsey, Lecturer
Sandy Williams, Lecturer
Nicholas Featherstone, Lecturer and Research Associate
Xudan Luo, Lecturer and Research Associate
Philippe Marti, Lecturer and Research Associate
Benjamin Miquel, Lecturer and Research Associate
Igor Rumanov, Lecturer and Research Associate
Lucas Monzon, Research Associate
Steffan Muenzemaier, Research Associate

APPM Staff

Ian Cunningham, Office Coordinator and Undergraduate Program Assistant
Mary Fentress, Program Manager
Desiree Holtz, Accounting Tech
Emily O'Connor, Graduate Program Assistant
Jacob Tafoya, IT Manager
Jennnifer Corpuz, Student Assistant
Sabrina Macneir, Student Assistant
Danielle Hawley, Writer
Ashley Hopko, Writer and Photographer

Warm Welcomes

Justin Cole
Chao Deng
Yu-Jui Huang
Zachary Kilpatrick
Danielle Lyles
Xudan Luo
Eric Thaler
Eric Vance

Fond Farewells

Ann Defranco
Yiping Ma
Thomas Manteuffel
Philippe Marti
Steffan Muenzemaier

Visiting Scholars

Bruno Deremble, Florida State University
Ezio Iacocca, Chanlets University of Tech
Imran Khan, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir.

Graduates

Summer 2016 & Spring 2017

Spring 2017 Outstanding Graduate Award Winners

Outstanding Graduates for Research:

Derek Driggs, AMEN BS/MS

Outstanding Graduates for Academic Achievement (highest undergraduate GPA of graduating students):

Jonathan Reichanadter, AMEN BS/MS + EPEN BS
Ian Char, CSEN BS + AMEN BS
Matthew Hurst, ASEN BS + AMEN BS

PhD

Jeffery Allen
What's Cooler Than Being Cool? Ice Sheet Models Using a Fluidity-Based FOSLS Approach to Nonlinear-Stokes Flow Dissertation Advisor: Thomas Manteuffel, Ph. D.

Alyson Fox
Algebraic Multigrid (AMG) for Graph Laplacian Linear Systems: Extensions of AMG for Signed, Undirected and Unsigned, Directed Graphs Dissertation Advisor: Thomas Manteuffel, Ph. D.

Dale Jennings
Advances in MCMC Methods of Applications to Particle Filtering, DSMC and Bayesian Networks Advisor: Jem Corcoran

Inom Mirzaev
Analytical and Numerical Investigation of Long-term Behavior of Microbial Flocculation Equations Dissertation Advisor: David Bortz, Ph. D.

Wayne Mitchell
Low-communication, Parallel Multigrid Algorithms of Elliptic Partial Differential Equations Dissertation Advisor: Thomas Manteuffel, Ph. D.

Ben O'Neill
Multigrid Reduction in Time for Parabolic Problems Dissertation Advisor: Thomas Manteuffel, Ph. D.

Benjamin Sturdevant
Multiqrid Reduction in Time for Parabolic Problems, Advisor: Scott Parker

Master of Science

Jessica Gronski
Nathan Guillery
Nathan Heavner
Zhishen Huang
Romik Khajetourian
Eric Kightley
Victoria Li
Michelle Maiden
John Nardini
Gregor Robinson
Sama Shrestha
Junlong Sun

Master of Science & Bachelor of Science

Amy DeCastro
Derek Driggs
Lukas Goetz-Weiss
Gavin Medley
Jaden Pieper
Tyler Reichanandter
Erez Shani
Davis Yoshida

Bachelor of Science

Yasser Albarakat
CourtneyAnderson
James Benesh
Matthew Caverly
Aiden Coffey
William Farmer
Emma Griffey
Matthew Hansen
Kyle Harlow
Yijia Huang
Matthew Hurst
Britni Janoso
Caitlin Kayen
Mackenzie Kerm
Ji Hoon Kim
Ian Laga
Edmond Lee
Joshua Mellin
Bridget Morales
Joshua North
Thomas O'Hair
Craig Peck
Floyd Pierce
Jeremy Rapp
Lucy Rieves
Rachel Robey
Camryn Schultz
Himanshi Singhal
Sydney Sloan
Jeffery Tennant
Andi Vicksman
Nathaniel Voth
Ryan Weller
Alexis Wylie
Nathan Yeo

Letter from the Department Chair

July 17, 2017

Chair's Statement —Narrative

Keith Julien—Chair Department of Applied Mathematics (APPM)

Applied Mathematics at CU Boulder continues to be a vibrant unit with many moving parts and new initiatives. The past year was a tremendously busy time for all. Most importantly, AY16-17 was dominated by the academic review process (ARPAC), an internal and external evaluation of the unit required every seven years. The internal and external evaluations confirm that APPM is a healthy and dynamic unit that fulfills all of its missions with excellence and dedication. APPM was humbled and honored to note the external findings of comraderie and a healthy departmental climate.

The biggest, systemic issue is space, i.e., the reunification of the department from six locations to a single location. As chair, I can report that a process is now in place to address this, which is central to elevating the unit to new levels of excellence.

A significant event in the unit's history was approval by the CU Board of Regents for its second undergraduate degree, a BA in Statistics and Data Science to be offered in the College of Arts and Sciences.

The Regents stated, "The bachelors in statistics and data science is intended to produce alumni who will have a STEM-based understanding of statistics and its applications. The degree, which will be offered by the Department of Applied Mathematics in the College of Arts and Sciences, will prepare students for a wide range of careers in engineering, economics, data science, public health, epidemiology, insurance, forestry, psychology, social justice and human rights, and more. "No other university in the state offers an undergraduate degree program in statistics and data science, so this degree will increase the ability of CU Boulder to attract high-quality resident and nonresident students and enable the Boulder campus to place its alumni in highly desirable positions at top companies, national labs and graduate programs."

The new BA will officially begin in Fall 2018 and will be the culmination of a decade long effort in recruiting a critical mass of faculty of excellence capable of delivering a high-quality education to our students. Many thanks to Professor Vanja Dukic, Associate Chair Anne Dougherty and the statistics steering committee for their dedicated effort in bringing this venture to fruition.

AY16-17 saw the creation of the Association for Women in Mathematics (AWM) through the self organization of APPM's women faculty, staff and students. The unit strongly supports this Chapter whose purpose is to encourage women and girls to study and to have active careers in the mathematical sciences, and to promote equal opportunity and the equal treatment of women and girls in the mathematical sciences.

Beginning Fall 2017 APPM will have, for the first time in its history, an incoming cohort of first-

year graduate students with 50% women and 50% men. The impact of the AWM chapter has been immediate and significant.A major effort of the Chair is to provide upper administration with the rational for allowing the unit to recruit new faculty.

This has been made much easier because over the past five years APPM's student credit hours (SCH) have increased significantly; approximately a 43% increase to 24000 SCH for AY16/17. The

following summarizes APPM statistics for AY 2016-2017. APPM had twenty-two tenured and tenure track faculty, seven instructors, seven lecturers, eleven postdoctoral researchers and forty-nine affiliated faculty. Assistant Professor Yu-Jui Huang, Assistant Professor Zachary Kilpatrick and Associate Professor Eric Vance joined the unit as new faculty in Fall 2016. Beginning Fall 2017, APPM will welcome Associate Professor Daniel Appelö to the unit. Dr. Appelö is a computational mathematician with expertise in the area of high performance computing. APPM also saw some turnover in the instructor ranks in AY15-16 which led to two successful hires, Dr. Danielle Lyles and Dr. Eric Thaler.

AY2016-2017 also saw the retirement of Professor Tom Manteuffel. Without a doubt this comes with a wide spectrum of emotions. Professor Manteuffel is an eminent applied mathematician who has dedicated his career to the area of computational mathematics. His contributions to APPM and the community have been vast - he is a past President of SIAM (Society for Industrial and Applied Mathematics), a SIAM fellow (class of 2009) and a ULAM fellow of Los Alamos National Laboratories. Professor Manteuffel joined APPM in 1993 along with his close collaborator and colleague, emeritus Professor Steve McCormick. Over a period of two decades they built a world renowned computational mathematics group within APPM. They are especially known for their strong connections with the National Labs and creating and sustaining the Copper Mountain Multigrid Conference Series for which Manteuffel served as the Co-Chair and Director. Aside from the annual SIAM conference, this is the largest conference of its kind. Manteuffel's computational mathematics group has been dominant within APPM with Professor Manteuffel producing ~30 PhD's and mentoring ~ 20 postdoctoral fellows, who now form the fabric of the present day numerical community. APPM wishes Professor Manteuffel the very best, it is honored to have been graced with over two decades of significant contributions. Professor Manteuffel's active involvement in the unit will be sorely missed.

The APPM undergraduates have had several notable accomplishments. As in years past, our students did exceptionally well in the international Mathematical Contest in Modeling (MCM). This 4-day contest has continued to grow, with almost 17,000 3-person teams competing from around the world. APPM had 15 teams with two of the teams amongst the top 69 papers (Outstanding plus Finalists). One of the top CU teams consisted entirely of freshmen! Derek Driggs was awarded the College of Engineering's Outstanding Graduate in Research award. He also received a Gates Cambridge Fellowship for graduate study at the University of Cambridge. Joining Derek in Great Britain will be Matt Hurst, a double major in applied math and aerospace engineering. Matt received a Marshall Scholarship to attend graduate school at the University of London. Finally, Jonathan Tyler Reichanadter and Matt Hurst received the College of Engineering's Academic Achievement award, for the highest undergraduate GPA amongst the graduating students.

I would like to take this parting opportunity to thank faculty, staff, alumni and friends for their continued engagement, contributions and dedication in advancing the Department of Applied Mathematics.

Association for Women in Mathematics Changes Campus Climate

By: Ashley Hopko

After members of the Applied Mathematics Department at CU felt like there was a lack of resources and representation for women within the department, a group of women coordinated with administration in order to positively impact the lives of students and faculty. The Association for Women in Mathematics was founded a year ago and is helping the campus climate at CU to evolve. Although it started in the Applied Mathematics Department, it welcomes members from across campus and now has members from the Mathematics Department as well.

Alyson Fox helped to found the group, along side her colleague Amy DeCastro. “We started talking about creating the group over a year ago… when the department review asked what our feelings were on everything. Amy and I were actually part of the review …and discussed how our departments were lacking in representing different resources. We thought it would be good to start getting organized and create a community within our department,” said Fox.

The Association for Women in Mathematics has 3 main roles on campus. They work to advocate for underrepresented groups, spread awareness about the challenges those groups face, and finally attempt to build an inclusive community. They do this by hosting speakers for the department, holding open and inclusive meetings, providing role models and mentors for students considering a STEM career, recruiting more minorities and women into the programs, and finally checking in with current students to help address concerns they might have.

Due to a variety of factors, there is a huge problem nationally when it comes to retaining women in STEM majors. It is a “common problem,” said AWM members. Common problems of women in STEM fields include feelings of insecurity due to the lack of proper support. In the spring of 2017, the group hosted talks on campus that addressed how to deal with microaggressions and imposter syndrome. According to Merriam- Webster, a microaggression is “a comment or action that subtly and often unconsciously or unintentionally expresses a prejudiced attitude toward a member of a marginalized group,” while the imposter syndrome is “false and sometimes crippling belief that one's successes are the product of luck or fraud rather than skill.”

Check-ins with graduate students each semester also aim to help women stay on course with their education. This year, the group is hosting semi-monthly research seminars for undergraduate students and plans to hold AWM study sessions for both undergraduate and graduate students. For the Fall of 2017, the Applied Mathematics Department is expected to have the largest percentage of female graduate students in its history: half (or 8 out of 16) of the incoming class are women. Meredith Plumley, an AWM member, attributes this increase in female enrollment to the group’s involvement with recruitment for the department.

The AWM board currently consists of around 2 women and one faculty advisers. Sabina Altus, a graduate student in Applied Mathematics is the President. Krisztina Dearborn, a graduate student in Mathematics is the Vice-President. Danielle Lyles, Instructor in the Applied Mathematics Department is the faculty adviser. The board meets for semimonthly lunches to discuss future plans and challenges/opportunities facing the group. For more information, please see the following website: https://awmcub.wixsite.com/awmcuboulder.

Applied Math Undergrad Competed in The Amazing Race

By: Danielle Hawlwy

Floyd Pierce, an applied mathematics undergrad, competed on “The Amazing Race”, a popular CBS reality show. Contestants race across the world while completing challenges and solving puzzles. They can win prizes along the way, such as prepaid vacations. The winners are awarded one million dollars. Pierce on a team with Becca Droz, a rock climbing instructor who also lives in Boulder. In the second episode of the 29th season, Pierce and Droz successfully completed one of their first challenges by “keep[ing] the rhythm with a local samba group”. Pierce attends CU Boulder on a full-ride scholarship. He enjoys playing the drums, hiking, baseball, and of course, “The Amazing Race”.

LISA: a Game Changer for Statistics Program at CU

By: Danielle Hawlwy

Professor Eric Vance, a new APPM faculty member as of Fall 2016, has opened the Laboratory for Interdisciplinary Statistical Analysis, otherwise known as LISA. The foundation for LISA began at Virginia Tech in 1948 to assist agricultural researchers. When the program was revamped in 2008, Professor Vance became the first director of the new organization. He has since brought his work to CU Boulder. The laboratory aims to train statisticians and scientists, establish research infrastructure, and to engage the community in statistical analysis. In the upcoming spring semester, LISA will provide short courses and workshops to increase statistical literacy. LISA collaborators include Professor Vance, one post-doc, six graduate students, and five undergraduate students. These collaborators can help in many ways; they can design experiments, analyze and plot data, run statistical software, interpret results, and communicate statistical concepts to non-statisticians. Currently, all collaborators are within the Applied Mathematics department, but they hope to include members from other departments in the future

Headlining Faculty

By: Danielle Hawlwy

This semester, the Applied Math Department (APPM) welcomes a new associate professor, two new assistant professors, four new instructors, and two new lecturers. These faculty members have diverse academic and professional backgrounds, from degrees earned here at CU Boulder to degrees earned as far away as the Hong Kong University of Science and Technology. The diversity from these members has sparked exciting plans and insights within the department.

Dr. Eric Vance, our newest associate professor, will open the Laboratory for Interdisciplinary Statistical Analysis (LISA) in the near future. With LISA, he hopes to train students to become effective collaborators, provide research infrastructure to enable and accelerate research applying statistics, and improve statistical skills and literacy. Others, such as new instructor Dr. Eric Thaler, have come to CU Boulder with important field experience. Dr. Thaler recently retired from a 35 year career with the National Weather Service (a sector of NOAA) where he was involved with operational weather forecasting and research, training, and computer applications development. Instructor and research associate, Dr. Chao Deng, received his Ph.D. in Pure Mathematics from Sun Yat-sen University. The alternate perspective of Pure Mathematics from Applied Mathematics brings compelling differentiated findings. He was supported by two Natural Science Foundations of China in studying viscoelasticity and charged fluid. In both PDEs, Dr. Deng uses the harmonic analysis tools (including function space theory, frequency interaction argument) to study the endpoint properties of the nonlinearities, which together with the background modeling provides interesting insight into the linear/nonlinear interactions of the PDEs.

Alongside innovative projects for students and unique perspectives, many have brought important research to CU Boulder. Dr. Yu-Jui Huang, assistant professor, has brought research that is relevant not only to CU Boulder's College of Engineering and Applied Science, but also relevant to the Leeds School of Business and the College of Arts and Sciences. He previously specialized in solving Finance and Economics problems by using rigorous stochastic analysis, bringing applied mathematics into non-STEM fields. His current research interests include modeling healthcare and mortality, student loans, and stochastic games involving heterogeneous players.

The research of Dr. Zachary Kilpatrick, assistant professor, ventures into the networks of the brain. His research group studies nonlinear dynamics in mathematical models of neural systems, with

an emphasis on stochasticity in spatially structured networks of the brain. He has also been developing probabilistic models of how organisms make decisions in changing environments and has recently published his findings in SIAM Review. Dr. Danielle Lyles, instructor, also has experience with the brain. She received her Ph.D. in Applied Mathematics from Cornell University, where she studied mathematical neuroscience.

Following Cornell, Dr. Lyles had an NSF Mathematical Sciences Postdoctoral Fellowship at UC Davis in the field of theoretical spatial ecology. There, she continued her use of hybrid modeling techniques to explore the interplay between random “noise” and oscillations.

A handful of the new faculty’s research has developed within, or has roots within, APPM prior to the Fall of 2016. Dr. Justin Cole, instructor and research associate, completed his Ph.D. from Florida State University. His Ph.D. advisor was Ziad Musslimani, who was a postdoctoral fellow with APPM in 2000. Dr. Cole’s thesis topic was on the nonlinear Schrodinger equation, which can be used to describe both water waves and light propagation in glass-like media. He is currently working with Professor Mark J. Ablowitz to model and analyze light propagation in photonic topological insulators. These materials have a honeycomb lattice structure (like a beehive) and exhibit many intriguing properties such as localized edge states. Xudan Luo began with APPM as a visiting scholar and is now a lecturer and research associate. Her work involves direct scattering and inverse scattering problems of non-local non-linear Schrondinger equation and searching for soliton solutions. She is working with Professor Mark J. Ablowitz as her advisor. The help room is a valuable resource for students studying mathematics. Rachel Tutmaher has been and continues to be the help room coordinator. This semester she began her position as a lecturer teaching Calculus 2. She also teaches at Front Range Community College and formerly was a Research and Development Engineer at the Penn State Applied Research Laboratory. Rachel has a background in applied mathematics, classics, and physics with degrees from Bucknell University, Florida State University, and University of Colorado Boulder.

APPM is excited to witness the new plans and diverse insights transform CU Boulder’s intuitive alongside the progress of continuing faculty members. The 2016/2017 school year is sure to be a excellent with the accomplished faculty CU has gained.

Student Awards

Gates-Cambridge Scholarship

By: Danielle Hawlwy

Derek Driggs, an undergraduate applied mathematics major, has received a Gates-Cambridge scholarship. Each year, the highly-competitive scholarship is awarded to 95 student studying outside of the UK. The scholarship is a full-ride to Cambridge University for students with “outstanding intellectual ability”, “leadership potential”, and “a commitment to improving the lives of others.”

Driggs was shocked when he received the award. “I’m incredibly honored to be a Gates scholar. After reading the impressive biographies of past winners, I questioned whether I should even apply. When I told my advisor, Professor Becker, that I thought I had only a one-in-a-million chance of receiving the Gates, he told me that even if that’s true, a one-in-a-million chance is all you need. I’m thankful he gave me this advice,” Driggs said.

At the University of Colorado at Boulder, Driggs has done research with Professor Stephen Becker and Professor Keith Julien. At Cambridge, his research will focus on developing machine-learning algorithms to analyze images. He hopes to eventually create artificial intelligence that can use fMRI scans to assist medical practitioners in diagnostics. Beyond Cambridge, he hopes to continue performing research in computational mathematics, either as a university professor or in a corporate research group.

Driggs credits CU faculty with much of his success. He said, “This award reflects the dedication of CU’s faculty to its students more than anything else, especially in the Applied Math department. I hope students know that with some hard work, CU’s faculty can help them achieve success, however they choose to define it.”

We invite you to contribute to our Annual Fund Drive.
Donations are tax deductible and can be made at:
http://www.colorado.edu/amath/donate

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