

Message from the Chair

Hello! I very much hope this edition of the Mathematics Department newsletter finds you and your family well. It has truly been an unprecedented semester, in which we all had to navigate a new reality fraught with uncertainty and had to overcome challenges both in our private and in our professional lives.

Our faculty and students have shown remarkable grit, determination, flexibility, and compassion, and I am very proud and grateful to all, as we face these challenges together in the workplace and the larger community. The Baylor family has come together in this effort and we, in the Mathematics Department, have worked tirelessly to create a platform that gives our students the chance to succeed in this new environment.

The transition to an online setting has been swift, and I am thankful to all involved for their efforts and dedication. As a result, our students have the possibility to complete their coursework and stay on track as originally intended.

The present system of online delivery of courses will extend through the summer, with plans for returning to in-person teaching in the fall —contingent on directives from federal, state, and local government and public health officials.

Throughout this tumultuous time, life went on in the Math Department with many remarkable achievements to report on a multitude of topics.

During Feb. 28-29, Dr. Rob Kirby organized the Finite Element Rodeo, an annual meeting of researchers concentrated in Texas and Louisiana working in theory and applications of finite element methods for the numerical solu-



Dr. Dorina Mitrea,
chair of the Department
of Mathematics

tions of partial differential equations. Financial support from the Math Department and Dean Lee Nordt made it possible to bring together about 40 researchers from Baylor, The University of Texas, Austin, Rice University, Texas A&M; the University of Houston; Southern Methodist University and farther afield, on Baylor's campus.

Employing a unique format, with senior faculty and graduate students having the same time allotment, this event has featured more than 20 informative talks.

Along the way, the natural cycles in the life of a math department have continued, through promotions, graduations, retirements, and new hirings. Three of our graduate students are completing their doctorates and starting a new chapter in their careers. These are Jennifer Loe, advised by Dr. Ron Morgan, who accepted a post-doctoral position at Sandia National Lab in New Mexico; Tori Hudgins, advised by Dr. Jon Harrison, who has accepted a postdoctoral teaching fellowship in mathematics at the University of Dallas, and John Miller, advised by Dr. Markus Hunziker and Dr. Mark Sepanski, who will be

starting on a tenure-track assistant professor position at Rockhurst University. Heartfelt congratulations to all of them!

Congratulations to Dr. Daniel Herden who has been awarded tenure starting this August. One of our faculty, Charlotte Pisors, is retiring this year and, on behalf of the entire math department, I would like to express our collective appreciation for her 22 years of service to Baylor and for her dedication to educating our students for more than two decades.

I am also pleased to announce that Dr. Daniel Bossaller, who has earned a doctorate in mathematics from Ohio State University in non-commutative ring theory, will be joining us in August as a post-doctoral fellow.

One of the many embodiments of the new realities in which much of this semester has unfolded is the fact that this year's Three-Min-

ute Thesis competition hosted by the Graduate Student Association at Baylor ended up taking place over Zoom, rather than in person.

The winner was our very own Tori Hudgins – well done, Tori!

Thank you again for your generous support. We depend on you and your active engagement for continuing to be a vibrant and successful department. As in the past, I wish to leave you with one of my favorite math quotes, fitting the reality we all face:

“Life is like a math equation. In order to succeed, you have to know how to convert negatives into positives.”

... Life went on,
with many
remarkable achievements
to report. ...

Dr. Dorina Mitrea

Professor Profile: Amy Goodman

Teaching mathematics online brings joys, challenges

This semester has certainly offered its share of challenges for teaching and learning mathematics.

On very short notice, all teaching faculty got a crash course in online delivery. My transition was likely smoother than most.

Having designed and taught the course “Mathematics Through Technology” since 2004, and having taught Business Calculus in an asynchronous, completely online format since the summer of 2017, I had a lot of tools already in place to ease the conversion of my classes this spring.

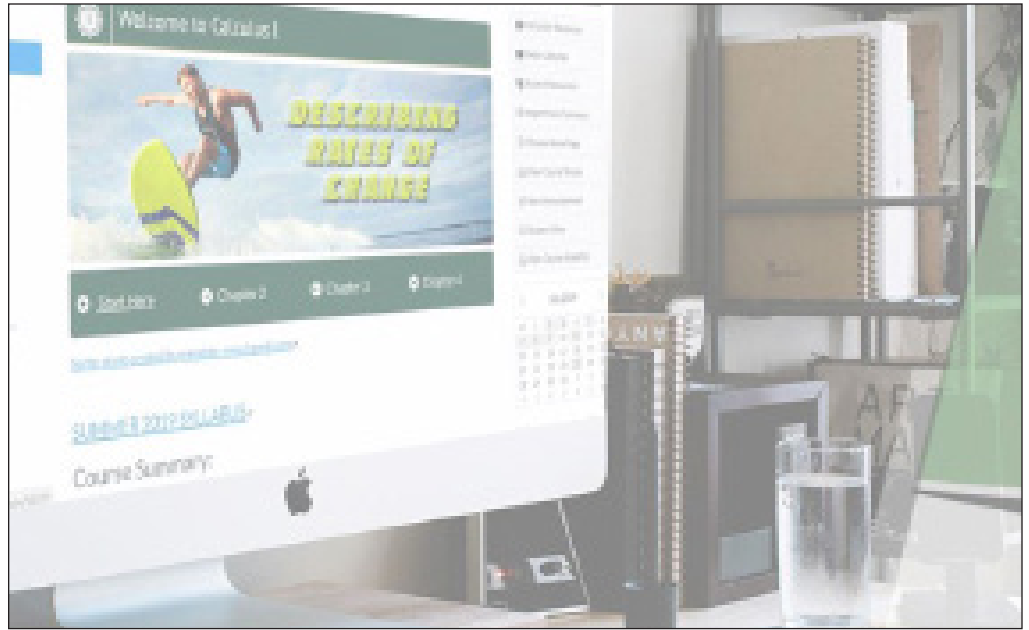
In my experience, one of the advantages to designing a course for the online learning environment is that, as an instructor, you must really think through how to organize your class and how to communicate with your students.

In addition, you have to deliberately consider how what you are teaching aligns with what you are assessing and with the skills students will need in order to be successful in future classes.

The end result is a carefully and deliberately crafted learning experience for students.

Building a class on that foundation makes for a very rewarding teaching experience. For example, I took the plunge and decided to personally appear in my videos, talking to my students through a webcam as I recorded myself lecturing and working example problems on my computer.

At the time, I thought it would make the content delivery feel more personal for my students. The feedback I have gotten is that



From classroom to laptop, from live to Zoom – teaching online has been a fascinating challenge for math faculty. "Though it takes time and deliberation, teaching online can be a personally rewarding experience for both students and faculty."

students feel like we are video chatting every day and even miss our conversations (yes, our virtual, asynchronous "conversations" about math) when the class is over.

It feels good to know that students are enjoying a personalized experience and are so deeply engaged in the course that they actually look forward to "going to class."

Of course, my biggest challenge in online teaching has been assessment – specifically, exams. Verifying student identity was my first priority, and, through online proctoring services with built-in identity verification, it was a problem I solved quickly.

Figuring out how to administer exams in an online class as effectively as I do in a face-to-face class was my second priority.

My in-class exams always consist of problems which students must work by hand, showing all their work and explaining their results in their own words.

Getting that process to translate smoothly to an online course has taken years of refining. However, with a Teaching Exploration Grant from the Academy for Teaching and Learning this semester, I have streamlined that process in a cost-free, one-click, platform independent way for students to submit their handwritten work.

It was just another opportunity to think through how my teaching practices are best supporting student learning.

Though it takes time and deliberation, teaching online can be a personally rewarding experience for both students and faculty.

Student group builds bonds among majors

By Meredith Pratt

Chartered in 2014, the Baylor Möbius Mathematics Society aims to bring students together to foster community and explore the world of mathematics outside of the classroom.

Membership is not limited to mathematics majors and students of all disciplines are encouraged to join.

This year, senior Blake Allan led the club as president, with the help of treasurer, junior Luke Bazaldua and Professor Steve Cates. Cates has served as a faculty advisor for the club since it was chartered.

"I joined [the club] as soon as I got here my freshman year," Bazaldua said. "I was looking for people who also liked math the way that I did.

"I felt a little isolated because

not a lot of people like math and so I went to the [Möbius] table at Late Night. They were very welcoming and had some cool demonstration pieces."

Reflecting on his time in the club, Bazaldua said, "It's been really, really good to have a community of people who enjoy the subject I'm also studying."

Möbius meetings consist of student-led presentations, discussions and activities. Some of the topics covered this semester in their "Series on Series" were the Taylor Series and the Riemann Zeta function.

Every semester, the Möbius Mathematics Society gives members the opportunity to attend a mathematical conference.

This spring, students were scheduled to attend the Math As-

Möbius Mathematics Society

sociation of America conference in Denton. However, this conference was canceled due to safety concerns related to the COVID-19 pandemic.

Diverse in their academic pursuits, but united by their common interests, Möbius members are what inspired the name of the club.

The name is derived from the Möbius strip, a unique mathematical symbol of perfect unity that represents the club's goal to create an organization that connects students from all backgrounds through math.

Ph.D candidate's perspective: John Miller

I came to Baylor from the University of Houston, where I studied mathematics while completing the requirements to be certified to teach high school.

I enjoyed my education classes and my experiences teaching, but I knew that I wanted to learn more mathematics and teach higher level courses, which led me to the Ph.D. program at Baylor!

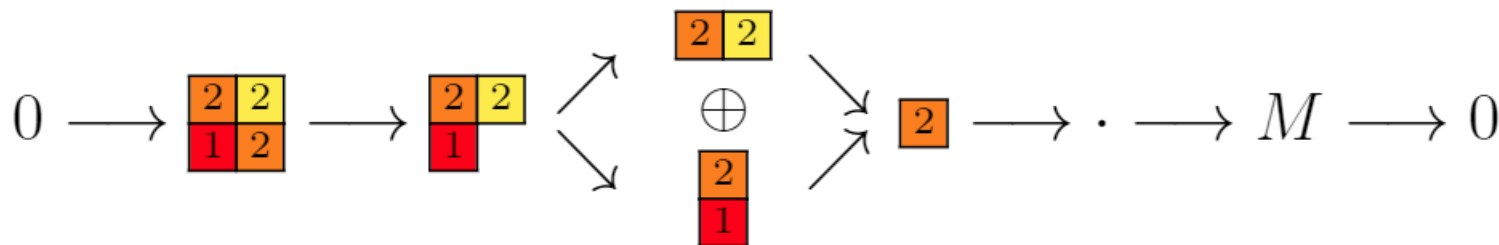
I have loved the experience of teaching while being a Ph.D. student, which has allowed me to grow in my ability and style. I am grateful to the department for supporting my attending a workshop of the Academy of Inquiry-Based Learning and for allowing me to use

inquiry-based methods in my classes.

My research, under the direction of Dr. Markus Hunziker —who has always been very supportive— uses a combinatorial approach to study representation theory.

This means we can take hard problems with complicated components and answer them with combinatorial descriptions, which gives awesome pictures like the following.

After graduation, I'll be starting as an assistant professor of mathematics at Rockhurst University in Kansas City.



COVID-19 put a heavy stamp on spring course work

By Dominique Granucci

While Baylor students were experiencing an extra week of spring break in March before distance learning began, professors were working on the frontline of establishing a new routine for university life online.

Dr. Lance Littlejohn, professor for MTH 4313 Number Theory, said he had never taught online classes or used WebEx, Zoom, or Kaltura before the pandemic. He credited much of the success in transitioning to online courses to the Baylor faculty. He said Baylor's team of tech experts helped walk him through the basic procedures and would immediately respond to his questions by email.

"Initially, it seemed like an out-of-this-world, impossible task," Littlejohn said. "I was scared to death to switch from face-to-face teaching after spring break, but within a week, I was feeling comfortable with teaching my classes online."

Littlejohn continued his lectures via WebEx. He met with his classes for online sessions every Tuesday and Thursday at the regular class time.

"My students are now scattered across 15 time zones in the world," Littlejohn said in April, "so it's not as easy for some students to meet during our regular online class time. But, despite the hardships for some students, it seems to be working without any serious issues."

Although lecture scheduling was able to proceed easily, Dr. Littlejohn said other challenges have arisen from distance teaching.

"I have spent an enormous amount of time typing my notes for my MTH 4313 Number Theory course ... since spring break, I have probably averaged 10 to 12 hours per

day, including weekends, working on this one online course."

Baylor mathematics professor Dr. Markus Hunziker also said the amount of time needed to prepare lectures has greatly increased since distancing learning began. He said this is because the notes need to be matched up with the lectures beforehand, instead of developing the examples on a blackboard, which is easier to do on the spot.

"If I do a video lecture, then I have to have the transcript ready, and I have to write the notes very carefully, which takes a lot longer," Hunziker said.

Hunziker said another challenge with distance learning is that he is not able to incorporate humor into his teachings in the same way he is able to during in-person classes. The lectures now lean heavily toward being content based.

"In person, I can see people and their faces and their interactions. This is something I miss the most out of my classes," Hunziker said.

Littlejohn has also navigated the waters of new communication styles in online learning.

"All my life, I had taught face-to-face classes and I felt comfortable in that setting. But, by the second online class, my students and I felt comfortable with our new settings," Littlejohn said.

Littlejohn also said that his students have still been able to relay their academic needs or misunder-

standings to him through live online lectures, and that communication has worked out fine.

"My students feel comfortable in stopping me mid-sentence to ask questions," Littlejohn said.

The professors have each found a way to replicate in-person office hours, allowing students the opportunity to receive further assistance in their learning.

In Hunziker's class, students can schedule one-on-one meetings over Zoom if they need clarification on previous lectures. In Littlejohn's class, there are specific WebEx office hours set up during the week in which students are free to pop in during the allot-



Dr. Lance Littlejohn

ted time.

"Often, I feel like the lonely Maytag repairman but, per week, several students do join in on my office hours to clear up difficulties they might be encountering," Littlejohn said.

Many resources have remained available for students. Free tutoring for those enrolled in 1000-level mathematics classes continues online by e-mail only. From Monday through Friday, different math tutors have been assigned to specific times in which students can email them for assistance.

The process for completing exams has also been affected and taken into consideration by professors.

Hunziker said he decided against

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Professors, students adapt to remote instruction

(continued from page 4)

using security browsers for exams. Instead, students take their tests live on Zoom in front of him, and then email them to him afterwards.

“A lot of students struggle with the online browsers. Sometimes things go wrong. I have had absolutely no problems with my tests,” Hunziker said. “Even with Proctorio, people can cheat. It’s not an absolute safe system either.”

For Littlejohn’s classes, testing schedules also have been affected by the virus.

“Instead of giving a second mid-term examination and a final comprehensive examination like I laid out in my original syllabus, I decided to give three lengthy take-home assignments after spring break, each worth 15% of their final grade.”

With such changes in testing schedules, lecture meetings and communication, it is clear the pro-

fessors are not the only ones that have had to make adjustments. Students, too, have endured their own new challenges when it comes to distance learning.

Lindsey Sather, a freshman at Baylor, said her experience in the Calculus 2 course has drastically changed since online classes began, especially since she is no longer surrounded by her fellow classmates. She said her peers are a supportive resource for her, especially in mathematics.

“Learning is easier when done with others, but with online classes, communication with the other students has become difficult,” Sather said. “Not only does this make it harder to learn, but it also makes it harder to stay motivated. We need that support system.”

Although students and professors have both experienced challenges during the pandemic, benefits to online learning have also been recognized.

Hunziker said that since the

switch to online classes, he has posted his exam reviews online in video formats and plans to continue this adopted practice even after distance learning has ended.

“If you’re summarizing material and want to emphasize what kind of mistakes to avoid, and you just say them in class for a test review, it goes in one ear and out the other,” Hunziker said. “If you have a video, everything is to the point. It’s relatively short, and they can watch it several times.”

The department has endured both the benefits and struggles of online classes. In the words of Dr. Littlejohn: “Teachers should always be able to adapt to their surroundings and to the needs of their students,” Littlejohn said. “This semester, I took it as a personal challenge to rise above the COVID-19 pandemic crisis and the resulting shelter-in-place orders and do my very best to give my students the kind of course that they deserved.”

Professor Rob Kirby's story: no 'cookbook' apps

I got interested in numerical analysis while a student at the Texas Academy of Mathematics and Science in the early 1990s. Computer-based calculus projects led us to develop Newton's method and Fourier series for ourselves.

My differential-equations class was taught by an "old timer" whose past experiences at Oak Ridge National Laboratory made him suspicious of tidy, cookbook techniques that only work on simple problems.

His opening lecture was on SIR epidemic models and basic numerical approximations, and as we learned variational parameters and other techniques, our homework

involved confirming our analytical solutions with numerical results.

After finishing my undergraduate degree at Texas Tech, I joined the first class of Computational and Applied Mathematics at UT-Austin, in what is now the Oden Institute. There, I took classes from engineers and computer scientists as well as mathematicians. I have carried this interdisciplinary outlook with me in my own research on numerical partial-differential equations. In addition to research on accuracy and efficiency of methods, I have dedicated a large effort to software projects that seek to automatically generate efficient

low-level programs from a domain-specific language for PDE.

Much of this laid the groundwork for the FEniCS (<https://fenicsproject.org>) and Firedrake (<https://firedrakeproject.org>) projects. Such tools greatly decrease the time-to-simulation for problems in many engineering and science disciplines, while increasing code correctness and even enabling powerful methods that most dare not code by hand!

I joined the Baylor faculty in 2012 and am glad to be a part of Baylor's rich tradition of teaching, research, and the integration of faith and learning.

Business Fellow balances life, equations

By Maddie Fossler

Pursuing multiple majors and her athletic career running cross country and track, senior Isabella Lackner has learned how to balance more than just equations during her time at Baylor.

Through the Business Fellows program, Lackner has obtained majors in accounting, finance and math, as well as her Masters of Taxation with a minor in economics, all within four years. Her experience with the Baylor Department of Mathematics extends even further than her degrees, however.

"The most rewarding part of obtaining this degree was getting three articles published in reputable academic journals," Lackner said. "As a sophomore, I was taking Foundations of Math with Dr. Hagelstein when he offered me the opportunity to perform research as part of a class, which he made for myself and two other students. This was a very rewarding opportunity as it allowed my fellow researchers—Dr. Hagelstein, Dr. Piziak, James Otto, and Austin Persona — and me to explore the implications that re-balancing has for different asset (equity/bond)

allocations in a portfolio. Not only did we find that rebalancing is generally not more favorable than a non-rebalancing strategy, which is contrary to what investment advisors typically recommend, but also our article, "Fixed and Dynamic Asset Allocation in the Accumulation Phase," was published in the

Journal of Finance and Investment Analysis."

Continuing her research with Dr. Hagelstein, Lackner was able to contribute to the articles "Markowitz Portfolios with Graham Bands in the Accumulation Phase" and "The Efficient Frontier and International Portfolio Diversification in Taxable and Tax-Privileged Accounts." She described getting her work published as one of her "proudest achievements."

Although obtaining her degrees has been challenging at times, Lackner said her decision to major in math has been "an enriching experience," leaving her well-equipped for the future.

"Beyond teaching students mathematical equations and theorems, mathematics instills something even deeper in students which we will have with us the rest of our lives," Lackner said. "Mathematics taught me invaluable problem solving and critical thinking skills that I know will provide profound benefits in my future career.

Every four-page homework problem I've solved or proof I've completed has further enhanced my reasoning skills. As I completed my math major, I noticed that my performance in my other classes reaped enormous benefits from my critical thinking skills that I had cultivated during my mathematics classes."

Lackner said one of the most invaluable lessons she has learned throughout her years in the math department is resilience.

"As a cross country and track



Isabella Lackner

athlete at Baylor, I already knew the importance of being resilient. However, mathematics showed me the importance of having it from a sheer academic lens," Lackner said. "Sometimes, my approach to a problem would not work or my homework problem would seem never-ending. Those were the times that tested my resilience. When I pushed through these barriers and arrived at a solution, the delayed gratification of having solved the problem was enough to encourage me each time I hit a roadblock. Additionally, when I interned on the buy-side in finance, my research skills helped me to perform better analyses on prospective investments."

Neither graduation nor the impact of COVID-19 have succeeded in slowing Lackner's fast-paced lifestyle and commitment to learning.

"I am currently studying for the four Certified Public Accountant exams, which I will take this summer," Lackner said. "In the fall, I will be starting as an audit assistant with Deloitte in Houston, Texas. Long-term, I am interested in working in the financial sector and possibly getting my Ph.D., likely in financial mathematics or finance."

"Mathematics instills something even deeper in students, which we will have with us the rest of our lives."

Math department honors Vivienne Malone-Mays

By Briana Boland

On Feb. 26, 2019, Baylor dedicated a memorial to Dr. Vivienne Malone-Mays on the third floor of the Sid Richardson building. Fifty-three years earlier, Malone-Mays had walked on Baylor campus as Baylor's first African American professor.

Her journey to Baylor was not a smooth one. In 1961, Malone-Mays — a Waco native— was rejected by Baylor because of her race. Malone-Mays went on to receive her doctorate degree from the University of Texas, where she was the only African American — and woman — in her class. Upon receiving her diploma, Malone-Mays became the fifth African American female to earn her Ph.D. in mathematics in the United States.

In 1966, she became a professor at Baylor, which had recently integrated a couple of years earlier. Malone-Mays spent the remainder of her career teaching mathematics at Baylor.

In 1971, Malone-Mays was honored as Outstanding Faculty Member of the Year.

Howard Rolf, chair of the mathematics department during the majority of Malone-Mays's career, remembered her resolve.

"She was determined to succeed. And Baylor is a better place because of Vivienne," Rolf said at the memorial's dedication ceremony. After nearly three decades serving the Baylor community, Malone-Mays retired in 1994.

Today, her memory is immortalized in the form of a bronze bust and three plaques detailing Malone-Mays's story. According to the memorial, "Malone-Mays epitomized African American achievement in the face of institutionalized



racism, helping create a rich, vibrant community in the face of adversity."

During the dedication ceremony, the bust was revealed to a crowd of onlookers. Among the speakers at the event were Dr. Lance Littlejohn, chair of Baylor's mathematics department at the time of the ded-

ication; Robert Darden, a Baylor journalism professor; President Linda Livingstone; Dr. Howard Rolf; Dr. Edray Goins, president of the National Association of Mathematicians and Patsyanne Wheeler, Malone-Mays' daughter.

Dr. Littlejohn offered a reminder to the crowd after listing a myriad of Malone-Mays's achievements.

"She was so much more than the first of this and the fifth of that," Littlejohn said. "She had the distinguished career as an educator, researcher, musician, community leader and organizer and, last but not least, civil rights leader."



Tori Hudgens: A Reflection

As I near the end of my Baylor journey, I'm feeling nostalgic about the adventures that have led me here.

I've planned to be a teacher since before I was officially in school. Upon high school graduation, I left my home in Maryland to pursue a degree in mathematics education (grades 7-12) at Union College in Lincoln, Nebraska, and was certain that teaching high school math was all I would do for the rest of my career. I taught in Lincoln public schools for three years and loved working with high schoolers. At the same time, though, I craved spending a little less time managing teenage behavior and more time teaching mathematics.

On a whim, I took the Graduate Record Examinations (GRE) and as a result I got invited to the Big Ten+ Graduate School Exposition at Purdue University. I felt out of place there. Everyone I met kept asking what sort of research I wanted to do, and I didn't even know what research in mathematics was.

Through a series of fortunate events, I found myself at the very last minute being introduced to Dr. Lance Littlejohn, who was the Baylor Mathematics Department chair at the time.

I knew nothing about Baylor, but when I shook his hand, I became strangely and instinctively certain that he was a Christian and that I could be honest with him.

When he asked what I was searching for, I told him that I was interested in mathematics and maybe research but had no idea what that meant. Mostly, I just wanted to be a teacher.

He was so kind and even excited about this interest that I found myself wanting to attend Baylor, even though I had no intention to move to Texas.

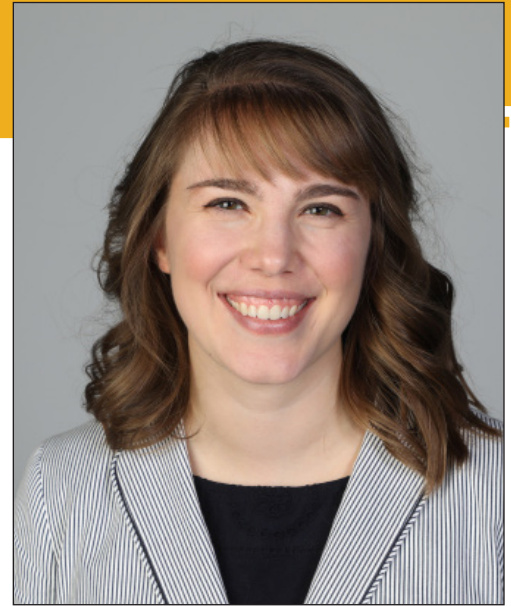
So, I said a prayer that went something like this, "God, if you have a place for me somewhere at a graduate school, would you please pay for it? Wherever you pay, I'll go." I was accepted by two of the schools I applied to. Only Baylor offered me a debt-free education.

Everything about this journey has been what I have needed to grow, mathematically and personally.

My professors have pushed me, yet also supported me. I knew very little about physics, and yet found a fantastic advisor in Dr. Jon Harrison, who has given me the tools I need to work in mathematical physics, particularly quantum graphs, and has mentored me in what it looks like to make mathematics my life work.

I have finally learned what mathematical research looks like and am excited to blend this knowledge with teaching as I mentor undergraduates in the future.

I have put down deep roots in Waco over the last five years, both on and off campus.



It's finally time to go get that job that I've been dreaming of, and now it's hard to think about leaving Baylor. But all that I have learned in the Baylor Department of Mathematics and the Waco community has prepared me to take that step with confidence and anticipation.

Thank you, fellow Bears!

Summer 2020 Newsletter

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