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Humboldt State University

MINI-FOCUS

THE NEWSLETTER OF THE GOLDEN SECTION OF THE MAA

Federico Ardila Wins Section Teaching Award

Federico Ardila, of San Francisco State University, won the 2019 MAA Golden Section's Distinguished College or University Teaching of Mathematics Award. The award was presented at the 2019 Golden Section Meeting at AIM (the American Institute of Mathematics) in San José, California, on February 23, 2019. (Federico Ardila's complete award citation can be found online at http://sections.maa.org/golden/Teach.html).

Federico Ardila earned both his B.Sc. (1998) and PhD (2003) in Mathematics from the Massachusetts Institute of Technology. After earning his PhD, Federico spent two years as an MSRI-Microsoft Postdoctoral Fellow before joining the Department of Mathematics at San Francisco State University in 2005 where he is now Professor. Federico has also been an adjunct professor at Universidad de los Andes, Bogotá, Colombia, since 2006.

As a student, Federico competed and placed in the Iberoamerican Mathematical Olympiad, the International Mathematical Olympiad, and the William Lowell Putnam Mathematics Competition.

continued on the next page

Jordan Schettler Wins Section Award for New Teachers

Jordan Schettler, of San José State University, won the 2019 MAA Golden Section's Distinguished College or University New Teacher of Mathematics Award. The award was presented at the 2019 Golden Section Meeting at AIM (the American Institute of Mathematics) in San José, California, on February 23, 2019. (Jordan Schettler's complete award citation can be found online at http://sections.maa.org/golden/Teach.html).

Jordan Schettler earned a B.Sc. in Mathematics (summa cum laude) from the University of Tennessee in 2006 and a PhD in Mathematics from the University of Arizona in 2012. Following that, Jordan was a Visiting Assistant Professor of Mathematics at UC Santa Barbara, before he arrived at San José State University in 2015 where he is now an Assistant Professor of Mathematics. Outside of SJSU, Jordan has served as co-director of the Santa Clara Valley Mathematics Project (SCVMP) that provides professional development programs for K-12 teachers. In his three years at SJSU, Jordan has proven

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Ardila: Teaching Award

(*Continued from the previous page*)

Professionally, Federico has been recognized with several awards for his research, his service, and (most pertinent to the present award) his teaching. In 2016—2017, Federico won the SFSU Distinguished Faculty Award for Excellence in Teaching, but his passion for teaching shone even as a student when in 2001 Federico won the MIT Department of Mathematics Housman Award for Excellence in Teaching.

Of his many publications, Federico has co-authored at least 13 papers with more than 12 of his students. He is also one of five co-directors of the MSRI Undergraduate Program (MSRI-UP). The emphasis of this program is to help encourage talented students from underrepresented groups to pursue graduate education in mathematics, and indeed it has become a transformational program for diversifying the mathematics profession. Federico has also worked closely with its teaching assistants and postdocs, mentoring them towards successful completion of their degrees as well as to prestigious academic positions.

Perhaps one of Federico's most fascinating enterprises has been his SFSU-Colombia Combinatorics Initiative. As part of this initiative, Federico developed several new courses and teaches them jointly between SFSU and Universidad de los Andes, Bogotá, through a video conference system. To date, more than 200 students have officially enrolled in the courses that have been offered through this initiative, and approximately 50 of them have pursued PhDs in the mathematical sciences.

If you want to experience Federico's magic for yourself, we invite you look for him on YouTube. He even has his own channel with 1,462 subscribers and hundreds of thousands of total views, including viewers from 155 countries!

The Golden Section congratulates Federico Ardila, an extraordinarily effective and inspiring teacher.

Schettler: New Teachers Award

(*Continued from the previous page*)

himself to be consistently able to make his classes engaging and to create an atmosphere where every student is excited to speak up. He is well organized and clear, his enthusiasm and positivity are infectious, and his charisma is undeniable. In fact, Jordan is the rare teacher whose influence on students transcends just being great in one class and becomes a life influence. To that last point, a former student, Cali Ferrari, testifies:

"One thing that particularly struck me is how much Schettler truly cared about his students' success. He would regularly meet with students outside of his regular office hours, sometimes even on weekends or evenings, to ensure they were comprehending the class material. The fact that Dr. Schettler was willing to sacrifice his own personal time to help his students grow in their understanding speaks volumes of the type of professor he is; it shows how seriously he views his career and how passionate he is about seeing his students succeed in life."

Perhaps Jordan's most influential achievement in teaching, however, may well be a class he developed over the last year and taught for the first time this past fall, *Mathematics in Art, Music, and Politics*. This is a new quantitative reasoning course for non-STEM majors at SJSU that is run in "arena rock" style, with 400 students in a large lecture hall and is still pedagogically effective.

Finally, the chair of the Department of Mathematics at UCSB in his letter of support quoted one faculty member as having said, "Whoever hires Jordan will have won the lottery." And his current department chair agrees, stating, "Jordan is fantastic. Every department needs a Jordan Schettler."

The Golden Section congratulates Jordan Schettler, an extraordinarily effective and inspiring new teacher.

Teaching Awards: Call for Nominations

2020 MAA Golden Section Distinguished College or University Teacher of Mathematics Award (General)
&
2020 MAA Golden Section Distinguished College or University New Teacher of Mathematics Award

The MAA has two awards for distinguished college or university teaching of mathematics: the Deborah and Franklin Tepper Haimo Award (instituted in 1991) and, for beginning college or university teachers of mathematics, the Henry L. Alder Award (instituted in 2003). The recipient of the Golden Section Teaching Award (General) is nominated by the Section for the MAA Haimo Award. The recipient of the Golden Section New Teaching Award is nominated by the Section for the MAA Alder Award if the recipient holds a PhD. The Golden Section has a two-step nomination process that consists of (i) the initial nomination, and (ii) the full nomination. The initial nomination is very simple and requires the filling out of a one-page form together with a one-page summary that supports the nomination. After screening the initial nominations, the Teaching Awards Committee will invite the nominators of clearly competitive nominations to submit full nominations.

Members of the Golden Section are encouraged to nominate their exceptional colleagues for the two Golden Section Distinguished Teaching Awards (New Teacher and General). The formal Call for Nominations and the Nomination Form files are available at

http://sections.maa.org/golden/Teach.html.

These files describe the award and eligibility requirements. The initial nomination deadline is

Friday, May 15, 2020

Please direct questions to John Thoo, Teaching Awards Committee Interim Chairman, at the Department of Mathematics and Statistics, Yuba College, 2088 N Beale Rd, Marysville, CA 95901-7605, jthoo@yccd.edu.

Interested in serving in a leadership role? (Chair cycle, Teaching Award Cmte, etc.)

Interested in hosting the section meeting?

Please contact one of the officers listed on the cover for more information.

⇒⇒⇒ We want you! ⇐⇐⇐⇐

Previous General Teaching Award Winners

An asterisk precedes names of those who went on to win a national Haimo Award.

1992 **G. D. Chakerian**, UC Davis
1993 ***Paul R. Halmos**, Santa Clara University
1994 **Jane Day**, San José State University
1995 ***Edward M. Landesman**, UC Santa Cruz
1996 **G. Thomas Sallee**, UC Davis
1997 **Jean J. Pedersen**, Santa Clara University
1998 **Donald C. Pfaff**, University of Nevada, Reno
1999 ***Leonard F. Klosinski**, Santa Clara University
2000 ***Evelyn Silvia**, UC Davis
2001 **Wade Ellis, Jr.**, West Valley College
2002 ***Paul Zeitz**, University of San Francisco
2003 **Peter Tannenbaum**, Fresno State
2004 ***Gerald L. Alexanderson**, Santa Clara Univ.
2005 **Russell Merris**, Cal State East Bay
2006 **Tatiana Shubin**, San José State University
2007 **William Fisher**, Chico State University
2008 **John B. Thoo**, Yuba College
2009 ***Allan J. Rossman**, Cal Poly San Luis Obispo
2010 **Dennis Smolarski**, Santa Clara University
2011 **Joseph Conrad**, Solano Community College
2012 ***Matthias Beck**, San Francisco State University
2013 **Steven Blasberg**, West Valley College
2014 **Duane Kouba**, UC Davis
2015 **Michelle Manes**, Univ. of Hawai'i at Mānoa
2016 **Serkan Hoşten**, San Francisco State University
2017 **Jesús De Loera**, UC Davis
2018 **Frank Farris**, Santa Clara University
2019 **Federico Ardila**, San Francisco State Univ.

Previous New Teaching Award Winners

An asterisk precedes names of those who went on to win a national Alder Award.

2016 **Martha Shott**, Sonoma State University
2018 **Elizabeth Gross**, Univ. of Hawai'i at Mānoa
2019 **Jordan Schettler**, San José State University

Remembering Roger Charles Alperin

Roger Charles Alperin, a career mathematician, passed away peacefully on November 21, 2019 at his home in Carlsbad, California. He was 72.

Roger received a PhD in mathematics from Rice University in 1973. He went on to assistant professorships at Brown University (1973-1976), Haverford University (1976-1977), Washington University (1977-1978), and the University of Oklahoma (1978-1987), where he eventually became a full professor. He later took a full professorship at San José State University from 1987 to 2014, where he served as chairman from 2002 to 2004 and ultimately became Emeritus in 2015.

Roger leaves a substantial mathematical legacy. He published and presented extensively in the fields of group theory, algebra and number theory, and geometry and mathematical origami. He had a special passion for origami and devoted twenty years to developing foundational elements of the mathematical theory of origami constructions, folds, and numbers. Roger continued publishing and presenting in retirement and continued to work on math projects until his passing. In September of 2018, he presented three papers at the 7th International Meeting on Origami in Science, Mathematics and Education.

Roger will be remembered for his wonderful sense of humor, warm smile and commitment to family. His other interests included travelling, hiking, and beachcombing, especially for sea glass and seashells.

Roger was born on January 8, 1947 in Cambridge, Massachusetts. His late parents were Gladys (nee Swartz) and Melvin Alperin. His survivors include his beloved wife Gaye Lending Alperin; his sons from his first marriage, Howard (wife: Patricia) Alperin and Joshua (wife: Pilar) Alperin; and his granddaughter Alicea Alperin. He will be remembered as a loving stepfather to Marissa Holloway and Kara Solomon and an adoring grandfather to their children, Zoe Hormell, and Sophia and Mollie Solomon.

News from the Section

Compiled by Walden Freedman, Mini-Focus Editor

Editor's Note: News is included from institutions who replied before the deadline. To avoid being left out next year, please watch for the E-mail call for news each fall season or contact a section officer.

California State University, East Bay, Hayward, CA

New Hires: We were delighted to welcome Dr. Andrea Arauza Rivera as an Assistant Professor of Mathematics in Fall 2018. Dr. Arauza Rivera received her PhD from UC Riverside in 2018. Her work is at the intersection of functional analysis and fractal geometry and she has already had an impact by engaging with students at CSUEB in "topics" classes and beyond. Dr. Arauza Rivera is a Chicana mathematician and is committed to supporting and inspiring a new generation of diverse mathematicians.

Retirements: Dr. Massoud Malek announced his retirement effective December, 2019. He will be returning to the classroom through the Faculty Early Retirement Program in Fall 2020.

Events: CSU East Bay and the Department of Mathematics were honored to host the Pacific Math Alliance (PMA) Conference on October 12, 2019. Over 200 students and faculty from across the region attended to give and hear talks about mathematics and the diverse experiences that lead individuals to enter the mathematics profession. There were opportunities for students and faculty to learn about research, creating community and mentoring. Dr. Andrea Arauza Rivera was the local organizer and did an amazing job coordinating and hosting the event.

Projects/Grants: CSUEB SEED Project: In Summer 2019, CSUEB began the first year of the Supporting Excellence, Effectiveness and Diversity (SEED) in STEM Teacher Education project. This five-year Noyce Scholarship project, focuses on three areas: 1) increasing the number and diversity of high school math and science

teachers obtaining their credentials at CSUEB, 2) improving professional development for the Noyce Scholars to provide guidance and support as they become highly effective teachers in schools with diverse student bodies and 3) informing understanding of how best to attract, prepare, and provide ongoing support in order to retain highly effective STEM teachers. This NSF funded project will support 45 new teachers over the five years of the $1.2 million grant.

SEMINAL Phase 2 Project: The SEMINAL (Student Engagement through an Institutional Network for Active Learning) network is an NSF-funded, national effort to better understand how to infuse Precalculus through Calculus 2 (P2C2) courses with active learning. The Department of Mathematics at CSU East Bay is one of nine SEMINAL Phase II partners working collaboratively to implement and sustain pedagogical changes in support of increased student success. The SEMINAL team at CSU East Bay is focusing on building momentum for active learning at the departmental level through a Community of Practice (CoP) model. The CoP works collaboratively, sharing active learning tasks, a pacing guide, and teaching tips for the courses. Members of the CoP support one another's individual active learning implementation via regular monthly meetings.

Other News: With the move to semesters in Fall 2018 and the elimination of developmental mathematics across the CSU, the Department of Mathematics at CSU East Bay has implemented several new programs to support first year students. These include a new Math Lab and an embedded peer support program (Learning Assistants). These efforts, together with new course structures and support from instructors and graduate teaching associates, are focussed on creating opportunities for students to find community and connection at the university.

Humboldt State University, Arcata, CA

The Forty-Eighth Annual State of Jefferson Mathematics Congress was held October 4-6, 2019 at Lake Siskiyou, CA. Students and/or faculty from Chico State, Oregon Institute of Technology, Sierra College, Sonoma State, Sacramento State, and others attended. The Forty-Ninth State of Jefferson Mathematics Congress takes place at a location TBA, September 25-27, 2020. For further details, see https://sites.google.com/view/sojmc/.

HSU's biannual Kieval Lecture featured Dr. Frank Farris of Santa Clara University with "Seeing Symmetry: The Artful Mathematics of Wallpaper Patterns" (April 2019) and Dr. Zvezdelina Stankova of UC Berkeley with "Mission Possible or Impossible?" (October 2019).

University of the Pacific, Stockton, CA

The Euler Archive is now being hosted on the University of the Pacific's Scholarly Commons site. This online, digital archive covers about 97% of Euler's original publications (most of which are written in Latin or French), and includes PDF scans of originals, summaries in English, and some translations (most of which are in English or German). Erik Tou (University of Washington, Tacoma) and Chris Goff (UOP) are the archive's directors. To access the files, visit: https://scholarlycommons.pacific.edu/euler/

Yuba College, Marysville, CA

The department hired two tenure-track faculty, Mark Lydon (PhD UC Davis) and Dylon Noack (PhD UC Riverside). Mark taught at Sonoma State University and Napa Valley College and Dylon at UC Riverside. Mark is also in the current cohort of AMATYC's Project ACCESS (akin to MAA's Project NExT). Dylan presented a talk at this fall's AMS Western Region Section Meeting and will be presenting at the upcoming JMM in Denver. This semester in October, led by Mukta Sharma, 23 students participated in Round 1 of the AMATYC Student Mathematics League competition. Led by Erika Noffsinger and Christopher Noffsinger, the department continues to be busy adapting curriculum to comply with California bill AB 705 curriculum requirements. Karsten Stemmann is the new department coordinator (chair). Finally, the department lost retired faculty member Kirk Wardlaw who died in December.

MAA Congress Report

by Ed Keppelmann, Congressional Representative

It has been a busy year, and while sometimes uncertain, certainly one filled with promise and meaningful things to come for and from the MAA. During our July 31st meeting just before MathFest in Cincinnati, Ohio, the congress was treated to a heartfelt and enormously inspiring message by our new President Michael J. Dorff. President Dorff is knowledgeable about BIG and experienced in helping countries all over the world establish meaningful mathematics programs of all kinds. This and more are all reflected in the MAA's vision, core values, and mission which congress approved:

VISION: *We envision a society that values the power and beauty of mathematics and fully realizes its potential to promote human flourishing*.
VALUES: *Community*, *inclusivity, communications*, *teaching*, *and learning*.
MISSION: *Advance the understanding of mathematics and its impact on our world*.

Here are some of the MAAs many outreach initiatives (including some opportunities for yourself and all our students!)

PIC Math (Preparation for Industrial Careers in Mathematics) Program 2020-2021 is taking applications through March 1st, 2020 at https://www.maa.org/programs-and-communities/professional-development/pic-math
Now, don't think like I originally did that this is not for those who have plenty of students to teach and work with in the traditional settings and who know dangerously little about BIG (Business, Industry Government) things. This may actually be just the program for you – faculty are trained on these opportunities so that they may better lay them out for their students – there are also problem ideas and connections for current students and more.

With the support of a generous donation from Philippe and Claire-Lise Tondeur, the MAA is offering financial support for a round of **BIG Career Activities at MAA Section Meetings**. This seed funding aims to kick-start or enhance ongoing inclusion of BIG career events at section meetings. The efforts are coordinated with SIAM and AMS activities and two online resources: the new MAA Connect online platform will be a place that sections can share information and experience about running career events. Sections will be able to offer a mock interview game where participants get a chance to respond to potential applicant interview questions – both those that are legal and those that aren't because, after all, once the question is asked you have to say something appropriate. There will be a résumé review service and coordination with a former PIC Math participant.

Programs for Visitors, Instructors, TAs, Adjuncts, and Lecturers (VITAL) faculty are being developed.

StatPREP regional workshops are being scheduled for Summer 2020. This is a chance to learn about teaching data-centered statistics (with lots of rich discussions) to your students. See https://www.maa.org/programs-and-communities/professional-development/stat-prep

The MAA offers funding opportunities for the following programs: (all applications due Feb 12, 2020):
Dolciani Mathematics Enrichment Grants (DMEG) for middle and high school math initiatives. ($5000 max)

Tensor-SUMMA grants to support achievement by underrepresented groups – both at the high school and college level. ($6000 max)

Tensor Women and Mathematics grants – similar to Tensor Summa but for women and girls.

The USA will host the **International Math Olympiad** in the summer of 2021. The last time the USA did this was in 2001. At that time 83 countries participated but it is expected that 114 countries will be involved next year including some such as Iran, Cuba, and Syria who either don't get along with the USA so well or with each

other. The security challenges are immense. I am very intrigued by how all this works and maybe for the FOCUS 2021 edition we can get someone to comment more about this. As I understand it there are roughly two days between when the competition ends and all the papers are graded and the results tabulated. That time is an enormous opportunity to share the sights and sounds of Washington, DC, with all those visiting kids but also a huge challenge to keep them all safe. In addition to that, I am not sure I see how the logistics of the competition will all work out. Traditionally, each team has an adult coach who meets with the problem committee and negotiates the problems before they are given. Back in 2001 it was relatively easy to keep coaches and participants separate after those meetings but now in the age of texting and social media how will it all work? And even if you are not planning to be involved in the Olympiad yourself I think there are some huge takeaways that everyone can be proud and amazed about: (#1) All the problems at the Olympiad, while exceedingly challenging, are all at the pre-calculus level. Tell that to your students if they think they are only studying baby math! (#2) So often we hear how bad the US public math education system is compared to other countries and while maybe public education cannot take too much credit here, we need to remind people that our Olympiads are very often the very best in the world.

The **joint meetings** this year in Denver will be the **last one co-sponsored by the MAA and AMS**. Hereafter it will be run solely by the AMS. Discussions are continuing vigorously about what JMM will look like starting in 2021. From my viewpoint at the level of math circles, I can say that the AMS is really stepping up to keep math circles and other outreach efforts and special interests alive and well at JMM. After seeing the success of a JRMF at MathFest, the AMS has worked hard to squeeze this event in again (even after all the schedules were quite well-established) for Denver. I have also been invited to a special planning breakfast at JMM hosted by the AMS to help plan for the years to come. While Math Fest 2019 was my last congressional meeting I will still be a member of congress until July 1, 2020. It has been a joy to serve and while I certainly agree that it is essential to give the opportunity to other people to serve their organization in this way, I am still a bit sad I won't be around to further work on the many challenges and questions the congress is still trying to even begin to solve. Here are some of the things that the members of congress have said they wish the MAA could do more of. Please feel free to share your ideas (or yell hey to these as well) with me at keppelma@unr.edu.

Keep congress more involved with decisions on policy.

Help members of congress be a conduit for communication between their sections and the board of directors.

Improve representation of congress including more members at large (such as for Canada, BIG, high school teachers, etc.).

Establish an international membership where people from outside the USA can join the MAA and one section of their choice.

Accredit math programs so departments could credibly ask for more resources.

Collaborate with AAAS and be more active in public policy.

Develop programs to engage random citizens in math outreach efforts.

Financially support micro-courses at section meetings.

Provide more support and programs and solicit more advice from retired persons.

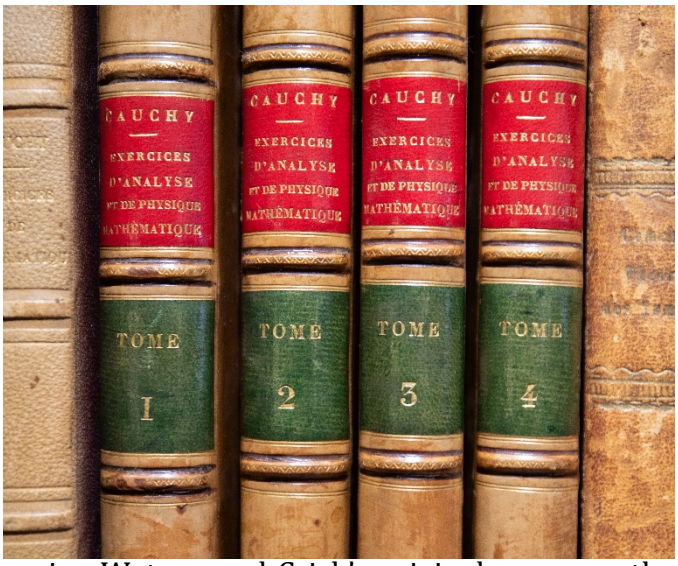
Host a registration platform that sections can use to collect money for meetings.

Report on the Section Meeting at the American Institute of Mathematics, February 23, 2019

by Ed Keppelmann, photos by Jonathan E. Shapiro

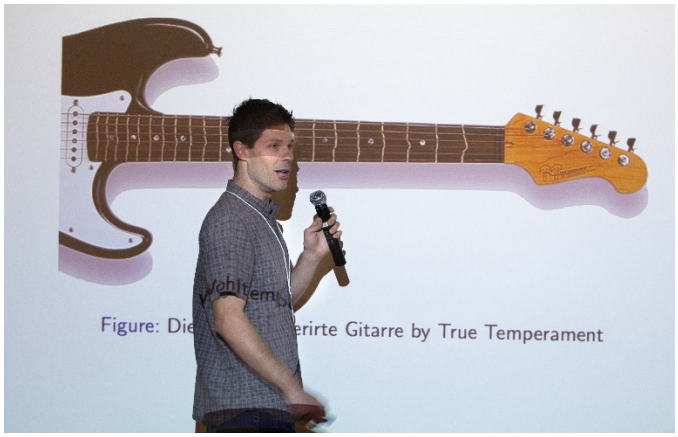
On February 23, 2019 the Golden Section was treated to a unique meeting location hosted by the American Institute of Mathematics. AIM is currently located at the corporate headquarters

of Fry's Electronics in San José. The section is indebted to Fry's as we used their lunchroom for all the presentations. In addition to all the great talks, poster session and mathematical art showcase, attendees had the opportunity to tour the AIM facilities and extensive library as well as the rare book room featuring over 5000 items from the 15th to the 20th century in both math and science. I personally have always delighted in



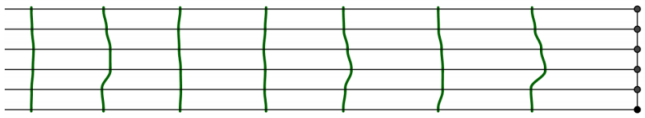
seeing Watson and Crick's original paper on the double helix structure of DNA with the authors' own notes in the margins. Attendance of 144 was down slightly from the 151 we had at CSU East Bay in 2018 although the percentage of students at 40.9% was up from 38.4% in 2018.

The day was dominated by some amazing bright young mathematical talent. We had **Jordan Schettler** of San José State University, this year's winner of the section's Distinguished College or University New Teacher of Mathematics Award, as our first speaker. However, at the time of Jordan's speech he did not know he had won. It was not until after his talk during the Q & A when he was asked if he had ever heard of the Alder award that it was revealed in a surprise ceremony that he was the 2019 Golden Section's nominee for the national Alder award for most promising young teacher. Jordan's family (wife Dana and children Lukas and Quinn) along with the Dean from San José State were all there to congratulate him.



Jordan started the morning by telling us about the issues involved in tuning string instruments like the guitar. The pitch of sound produced by a vibrating string is a result of both the string's vibration frequency and its wavelength. By shortening the string (in a guitar this is done by pressing one's finger on frets to hold the string down) one can produce different notes as a simple fraction like 3/2, 4/3 or 5/4 of the natural string frequency. This acts to raise the sound by fractions of an octave. When holding several strings down at different locations (as determined by the various frets on the guitar) a multitude of interesting chords can be produced. Much of music derives its beauty from performing a variety of scales and partial scales (or simultaneous parts of scales in the case of chords) at various rhythms and volumes. A full scale should start and stop at the same note exactly one octave higher. To go up one octave requires that the frequency be precisely doubled. But for example, the basic ratios required to the harmonic scale GDAECG do not fit together quite properly to produce exactly one octave higher at the end. This is the classic tuning problem and it always requires some compromise which is handled differently on different instruments. In joint work with (then undergraduate, currently graduate student) Mitchell Chavarria, Jordan has developed a tuning system that employs the action of the dihedral group D_{12} acting on a regular dodecagon. This is in fact quite similar (but now mathematically optimal) to what JS Bach did for his harpsichord, but on a guitar it leads to curved frets as opposed to the usual ones

employed. The figure below comes from Jordan's paper with Mitchell that is available at http://archive.bridgesmathart.org/2019/bridges2019-279.pdf . The authors comment that "The squiggly line frets seen here are constructed from cubic splines to allow for smooth pitch shifts via string bending, a common technique in both blues and rock." The article includes links to a variety of audio files where various genres of pieces are played electronically using this tuning scheme.



To keep in the Alder tradition of great young teachers, **Elizabeth Gross** (the section's 2018 new teacher winner now at the University of Hawai'i at Mānoa) was up next with an engaging foray into algebraic systems biology. On the level of biological function, the heart of any living thing must be the set of biochemical reactions that keep the organism acting in tune with its environment. These biochemical pathways can be amazingly complex as chains of chemical reactions take place in (hopefully perfect) internal timing. For example, cells of various types must know when to reproduce or when to die – something that cancerous cells do not do appropriately. Understanding these dynamical systems is certainly essential in the development of new gene therapies. The theory of mass action kinetics produces a model like the one shown below which consists of 31 parameters and 19 ordinary differential equations. This is joint work by Elizabeth with Heather Harrington, Zvi Rosen, and Bernd Sturmfels (who spoke at the UC Davis section meeting in 2016). The title of the article is "Algebraic Systems Biology: A Case Study for the Wnt Pathway". We considered leaving the

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(1)\quad
\begin{aligned}
\dot{x}_1 &= -k_1x_1 + k_2x_2\\
\dot{x}_2 &= k_1x_1 - (k_2+k_{26})x_2 + k_{27}x_3 - k_3x_2x_4 + (k_4+k_5)x_{14}\\
\dot{x}_3 &= k_{26}x_2 - k_{27}x_3 - k_{14}x_3x_6 + (k_{15}+k_{16})x_{15}\\
\dot{x}_4 &= -k_3x_2x_4 - k_9x_4x_{10} + k_4x_{14} + k_8x_{16} + (k_{10}+k_{11})x_{18}\\
\dot{x}_5 &= -k_{28}x_5 + k_{29}x_7 - k_6x_5x_8 + k_5x_{14} + k_7x_{16}\\
\dot{x}_6 &= -k_{14}x_3x_6 - k_{20}x_6x_{11} + k_{15}x_{15} + k_{19}x_{17} + (k_{21}+k_{22})x_{19}\\
\dot{x}_7 &= k_{28}x_5 - k_{29}x_7 - k_{17}x_7x_9 + k_{16}x_{15} + k_{18}x_{17}\\
\dot{x}_8 = -\dot{x}_{16} &= -k_6x_5x_8 + (k_7+k_8)x_{16}\\
\dot{x}_9 = -\dot{x}_{17} &= -k_{17}x_7x_9 + (k_{18}+k_{19})x_{17}\\
\dot{x}_{10} &= k_{12} - (k_{13}+k_{30})x_{10} - k_9x_4x_{10} + k_{31}x_{11} + k_{10}x_{18}\\
\dot{x}_{11} &= -k_{23}x_{11} + k_{30}x_{10} - k_{31}x_{11} - k_{20}x_6x_{11} - k_{24}x_{11}x_{12} + k_{25}x_{13} + k_{21}x_{19}\\
\dot{x}_{12} = -\dot{x}_{13} &= -k_{24}x_{11}x_{12} + k_{25}x_{13}\\
\dot{x}_{14} &= k_3x_2x_4 - (k_4+k_5)x_{14}\\
\dot{x}_{15} &= k_{14}x_3x_6 - (k_{15}+k_{16})x_{15}\\
\dot{x}_{18} &= k_9x_4x_{10} - (k_{10}+k_{11})x_{18}\\
\dot{x}_{19} &= k_{20}x_6x_{11} - (k_{21}+k_{22})x_{19}
\end{aligned}
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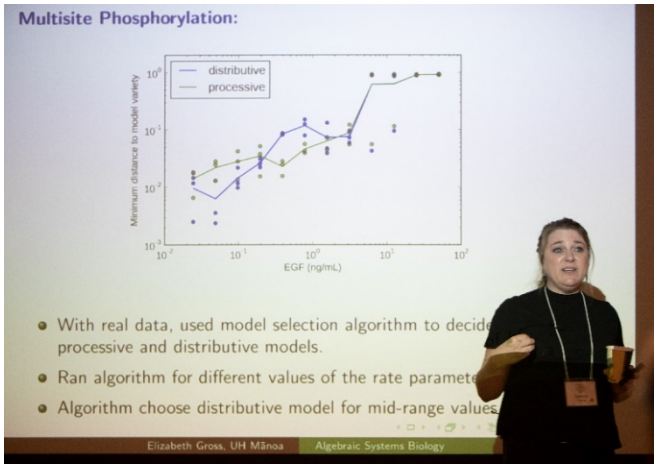
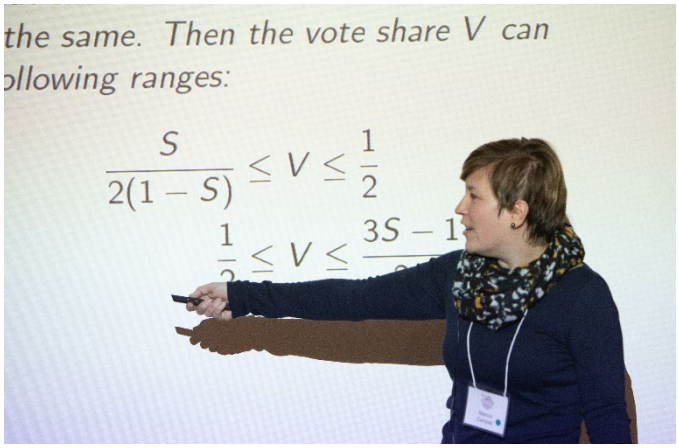


solution of the system as an exercise for our bright Golden Section readers but then we realized that there are yet five more conservation law equations which alas we don't have room to present, so you are all off the hook for now! However, by noting the form of the system we can point out that the steady state solutions arise as the roots to this system. This is a highly complex algebraic geometry problem. It turns out that in the correct setting, this system has nine distinct zeroes. This is only the beginning of what biologists want to know about such systems. How and when does the system shift between steady states and do some states limit which other states can be obtained? How can the system be studied experimentally when we use chemical concentration data to determine parameter values?

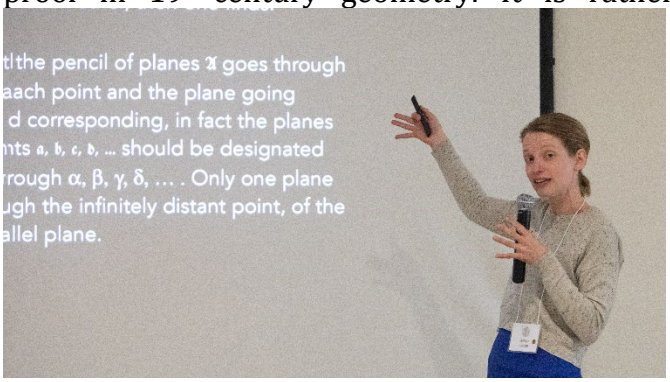
Again from San José State the section next welcomed **Marion Campisi** on the subject of gerrymandering in advance of the 2020 census. The US House of Representatives currently has 435 seats. After one of these is allotted to each of the fifty states, a mathematical scheme is used whereby each of the next 385 seats are allotted in turn to the state with the highest priority according to a formula involving the state's population and how many seats it has already been allotted in the process. This method of equal proportions seeks to make the number of people represented by each seat as equal as possible across the country. Once a state has been allotted some number $n > 1$ of congressional seats, the issue of gerrymandering comes into play as each state determines the regions of its state allotted



for each seat. In the classic sense, the technique of gerrymandering refers to the party in power drawing its districts in order to maximize its number of election victories. This can be done by both packing (where most of the opponent is isolated into a few districts where it will win overwhelmingly) and cracking (where the rest of the opponent is spread across many districts where it will lose but perhaps by very small margins in some cases). With the current data available to mapmakers it is possible to gerrymander to a large degree using districts of conventional shape – i.e., this can be done effectively in hard to detect ways. In joint work with Thomas Ratliff, Andrea Padilla, and Ellen Veomett (the paper is titled "Declination as a Metric to Detect Partisan Gerrymandering"), the authors explore a new measure to detect when there is lots of packing and cracking going on. In 2017 the Supreme Court took up a case involving a measure called the efficiency gap based on 2010 census data. The court agreed that gerrymandering was a huge threat to the integrity of the constitution but no one could agree on how it should be detected. The efficiency gap (EG) measures the winning margin in districts won by a party to the losing margin in districts lost by a party.

It makes intuitive sense that when there is a lot of packing and cracking these numbers will be quite different. The problem with the efficiency gap is that it can be very volatile with respect to changes in voter turnout across a state. In other words, if a big sto rm were to ravage part of a state on Election Day making it hard for voters to get to the polls, then gerrymandered districts might appear to be fair when they were in fact designed with partisan intent. In contrast, the declination (first proposed by Gregory S. Warrington) is a clever geometric representation of the packing cracking question that uses a two-dimensional plot of a party's vote percentage in each district won and then separately in each district lost. Marion and her coauthors showed that the declination angles formed with a central point and the centers of mass with winning and losing districts provide a much more robust measure with respect to variations in voter turnout across a state. Thanks to this work, declination may be the new measure to use for gerrymandering debates in the future, presuming of course that judges and the public can be properly educated about the issues involved.

After a delightful lunch and plenty of time for the art and poster exhibits, we were treated to some math history by **Jemma Lorenat** of Pitzer College. The talk centered on some intriguing philosophical debates about understanding and proof in 19th-century geometry. It is rather



amazing and quite eye-opening that some geometers of that era, for example, Karl Christian Von Staudt (1798-1867) or Jakob Steiner(1796-1863), felt that three-dimensional geometry could only be properly understood by those who could intuit their meaning internally without reference to outside stimuli such as diagrams. A person was expected to use their inner power of representation called *Vorstellungskraft* . In fact, "Geometrie der Lage" (1847) by Von Staudt is 232 pages long and has absolutely no figures. Part of this belief was surely rooted in a lack of confidence in properly representing three-

dimensional figures on two -dimensional paper in that era, but there was certainly also a kind of elitism that mathematics was not meant for everyone. Here is a quote from Felix Klein (1926) that comments on the issue[1]: "Steiner used no figures in his lectures. The active thinking of the listener was supposed to generate such a clear picture in his imagination that no material image would be needed." Regarding another mathematician, Klein states "when teaching geometry … he would purposely darken the room!"

The day closed with MAA Secretary **James Sellers** teaching us about some aspects of infinite series too often forgotten in 2nd-semester calculus. In particular, large amounts of time spent on

theorems about convergence of infinite series either confuse the student in abstractness about what is really going on or they give the mistaken impression that only geometric and telescoping series can actually be summed. There is in fact a nice class of series that starts with a geometric series and can be summed in a way that Calculus II students can definitely appreciate. To have a glimpse of this we share these formulas. Let m be an integer with $|m| > 1$ and n any natural number or zero and define

$$a(m,n) = \sum_{k=1}^{\infty} \frac{k^n}{m^k}$$

By noting that $a(m,0)$ is a summable geometric series and using the binomial theorem (also something James argues is good for first-year calculus students) one can show that

$$a(m,n) = \left(\frac{1}{m-1}\right)\left[1 + \sum_{j=0}^{n-1} \binom{n}{j} a(m,j)\right]$$

And thus these series can be summed inductively. One can show for example that

$$\sum_{k=1}^{\infty} \frac{k^2}{2^k} = 6 \text{ or that } \sum_{k=1}^{\infty} \frac{k^3}{2^k} = 26$$

The paper with all the details is titled "Beyond Mere Convergence" and is available from James's website at Penn State University http://www.personal.psu.edu/jxs23/papers.htm The paper also covers series summation methods using power series – another area which young calculus students could be more exposed to. This part of the story also begins with the geometric series

$$f(x) = 1 + x + x^2 + x^3 + \cdots = \frac{1}{1-x}.$$

By applying the operator $x\frac{d}{dx}$ any number of times and then evaluating at some x with $0 < x < 1$ we can get a variety of similar results. As a further little gem, the functions obtained involve polynomials whose coefficients are the Eulerian numbers $A(n,m)$. The Eulerian number $A(n,m)$ is the number of permutations of $\{1, 2, \ldots, n\}$ in which exactly m elements are greater than the element listed before them. For example, with {1, 2, 3, 4} the identity permutation has three elements larger than what comes before and the permutation $\left(\begin{smallmatrix}1&2&3&4\\4&3&1&2\end{smallmatrix}\right)$ has just one such number (i.e., 2 at the end). To illustrate the counting, note that $A(3,1) = 4$ as illustrated by

$$\left(\begin{smallmatrix}1&2&3\\1&3&2\end{smallmatrix}\right), \left(\begin{smallmatrix}1&2&3\\2&1&3\end{smallmatrix}\right), \left(\begin{smallmatrix}1&2&3\\2&3&1\end{smallmatrix}\right), \left(\begin{smallmatrix}1&2&3\\3&1&2\end{smallmatrix}\right)$$

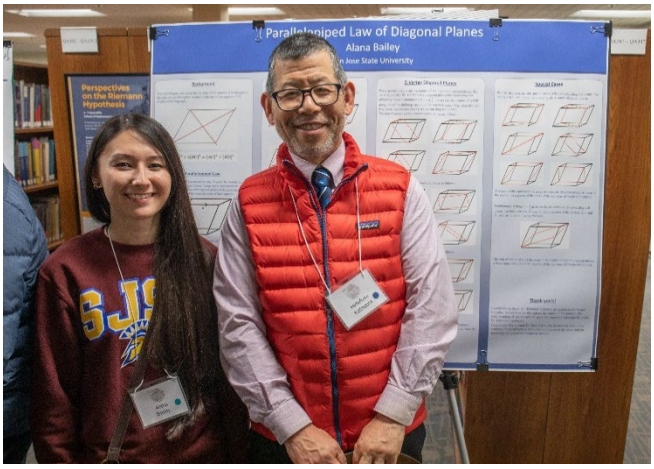
As per usual we had an outstanding slate of poster presenters:

Raymart Ballesteros and **Brian Knight** of Cal Poly San Luis Obispo with faculty sponsor Charles Camp presented *Glacial Cycles and the 100 Kyr problem*. This deals with the phenomenon in the Pleistocene era (1.25 million years ago to 12.5

[1] Felix Klein, *Development of Mathematics in the 19th Century*, Transl. by M. Ackermann, 1975, Math Sci Press, p. 116

thousand years ago) where large land-based ice sheets changed in size according to a 100,000-year time scale. There are two models for these sheets which the authors study as a forced dynamical system to try and understand the phenomena. This work was part of a Frost Summer Undergraduate Research project in 2018. (See page 20 for image.)

Alana Bailey of San José State with faculty sponsor Hidefumi Katsuura presented the *Parallelepiped Law of Diagonal Planes.* This is a three-dimensional extension of the parallelogram diagonal law in the plane which says that if you



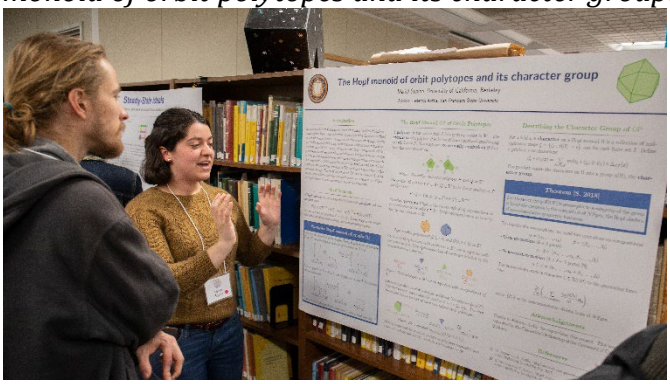
sum the squares of the lengths of the sides of a parallelogram you get the sum of the squares of the lengths of the diagonals.

Frost Research Fellow **Jason Brown** of Cal Poly San Luis Obispo with faculty sponsor Linda Patton examined *Geometric Properties of the C-Numerical Range over Diagonal Matrices.* Given two $n \times n$ matrices A and C the author defines $W_C(A)$ to be the set of traces one can obtain from $CUAU^*$ where U and U^* are complex diagonal matrices with UU^* =I. It is shown that when $n = 2$ we get an ellipse. Furthermore, when A is $n \times n$ is such that $a_{ij} = 0$ when $i \not\equiv_n j + 1$. then $W_{C(A)}$ will have n-fold symmetry for any C.

Carlos Munoz of San José State with faculty sponsor Elizabeth Gross (now at University of Hawai'i at Mānoa) presented *Steady-State Ideals.* Carlos uses the law of mass action kinetics to study chemical reaction networks (consisting of a chemical complex, numerous chemical species, and numerous reactions) and their steady-state ideals (see the description of Gross's lecture above). He studies the situation arising when these ideals are monomials and analyzes what kind of network operations will preserve such ideals.

Joel E. Pion and **Ryan S. Zesch** of Cal Poly San Luis Obispo with faculty sponsor Eric Brussel presented *Curves, Conics and Cryptography, Oh My*. Pell conics are the little brother of elliptic curves. The authors study these and their group structure with respect to various rings. Some of the cryptography algorithms for elliptic curves are translated to these Pell conics.

Mariel Supina of UC Berkeley with faculty sponsor Federico Ardila presented *The Hopf monoid of orbit polytopes and its character group*.



Permutahedra are combinatorial objects which have a structure called a Hopf monoid. Mariel introduced a generalized type of permutahedra called orbit polytopes that are fixed under the action of the symmetric group. Her main theorem states that the character group (the characters on a Hopf monoid) is isomorphic to a subgroup of the group of invertible elements in *NSym*, the Hopf algebra of noncommutative symmetric functions.

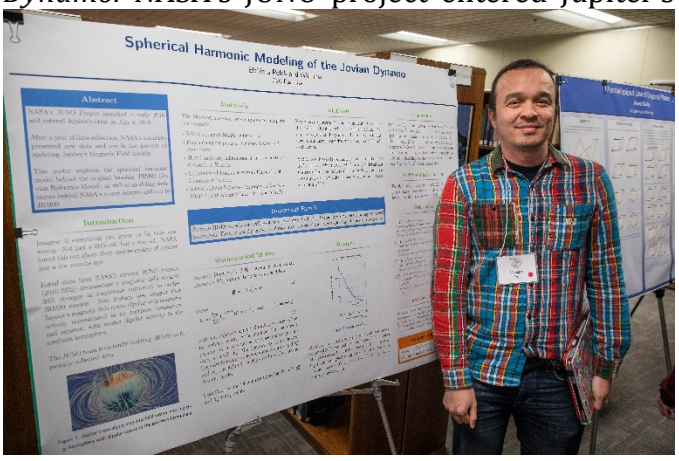
Ravi Cho of San José State with faculty sponsor Tim Hsu presented *Blue Red Hackenbush Spiders.* A blue red Hackenbush is a combinatorial game played on a graph with blue and red edges which are attached to the ground. Players alternate by removing an edge of their color (and also all edges cut from the ground). The first player who cannot move loses. Since the analysis of individual spiders is NP-hard there are lots of conjectures

and some results about special cases of such graphs called Hackenbush spiders. These have edges which meet at a common body point and are connected linearly (i.e., these connections are the legs) to the ground.

Kyle Hammer of CSU Chico with faculty sponsor Thomas Mattman presented *L-functions of Graph Covers.* A Galois cover for a graph refers to a certain embedding of the graph in complex 2 dimensional projective space and the resulting Galois covering group. For certain classes of such graphs there are nice results about the number of spanning trees as a function of the covering group.

Jodi McWhirter of San Francisco State with faculty sponsors Federico Ardila and Mathias Beck presented *Discrete Volumes of Coxeter Permutahedra.* A classification of permutahedra exists into four classes of type A, B, C, and D. Furthermore, these objects associate Ehrhart polynomials which yield structural information. New techniques involving signed graphs arising from type A and B permutahedra yield new insights into calculating these polynomials.

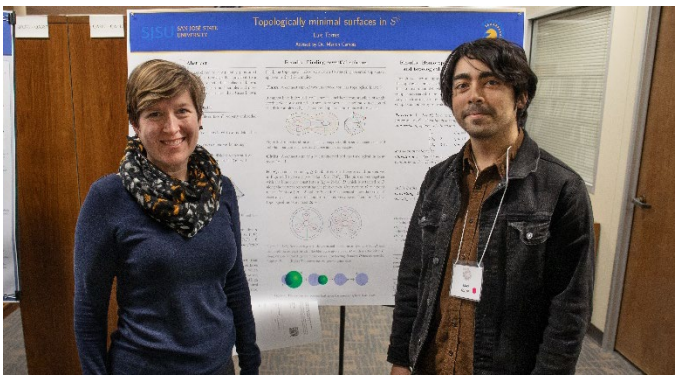
Will Tran and **Elzbieta Polak** of CSU East Bay with faculty sponsor Jesús Oliver presented *Spherical Harmonic Modeling of the Jovian Dynamo.* NASA's JUNO project entered Jupiter's



orbit on July 4, 2016. With all the data collected since then, great advances in understanding the magnetic field of Jupiter are possible. This is a large update to the so-called JRM09 (Jovian Reference Model).

Maria Isabel Perez, **Jewell McMillon**, **Chiemi Kato**, and **Anna Schindler** of San Francisco State with faculty sponsor Federico Ardila presented *Spectra of Tropical Laplacians of Classical Root Polytopes*. Babaee and Huh introduced the tropical Laplacian of a tropical surface. Perez et al. construct four families of tropical surfaces arising from root polytopes and compute their spectra, confirming that they have exactly one negative eigenvalue. This is as anticipated by results of Babaee and Huh. (See page 20 for image.)

Luis Torres of San José State with faculty sponsor Marion Campisi presented *Topologically minimal surfaces in S^3.* The Bachmann index of a surface S in a three-manifold M is the minimal n such that



the nth homotopy group of the disk complex of S in M is nontrivial. Surfaces with a well-defined index are said to be topologically minimal. New constructions are presented of natural high index surfaces that previously had to be constructed by artificial ad-hoc methods.

THE MATHEMATICAL ASSOCIATION OF AMERICA – GOLDEN SECTION
Saturday, February 29, 2020, at Mills College

All talks take place in Lisser Hall 101

Lunch in Faculty Dining Room, Rothwell Center

Poster Session and Mathematical Art Exhibition in Lisser Hall, follow the signs

Registration 8:00—11:00 am **Refreshments** 8:30—10:30 am
Lisser Hall Lobby

8:45–9:00 **Opening Welcome**
Presider: Cornelia Van Cott

9:00–9:50 **Andrea Arauza Rivera**, CSU East Bay
Fractals, Binary Counting, and Towers of Hanoi
Presider: TBA

9:50–10:05 **Golden Section Business Meeting and Congressional Report**

10:10–11:05 **Ami E. Radunskaya**, Pomona College
Of Mice and Math: mathematical models in medicine
Presider: Maia Averett

11:10–12:00 **Michael Dorff**, Brigham Young University
How mathematics is making Hollywood movies better
Presider: Ed Keppelmann

12:00–1:00 **Lunch** (Faculty Dining Room, Rothwell Center, see map)
Cost: $20 in advance. You must have a ticket to have lunch, tickets to be purchased in advance while registering.

1:00–2:00 **Student Poster Session/Mathematical Art Exhibition**
Lisser Hall (follow the signs)
Organized and curated by Stacy Speyer

2:10–3:00 **Carl Pomerance,** Dartmouth College
Is 73 *the best number*?
Presider: Alexandra Michel

3:10–3:25 **Teaching Awards Ceremony**
Presider: John Thoo

3:30–4:20 **Jay Cummings**, Sacramento State University
The Mathematics of Juggling
Presider: Cornelia Van Cott

Program Abstracts

Andrea Arauza Rivera, CSU East Bay, *Fractals, Binary Counting, and Towers of Hanoi*

Abstract: A rather unexpected connection exists between binary counting, the Towers of Hanoi puzzle, and fractal geometry. Just as one can count using the digits 0 through 9, we may count in binary with just the digits 0 and 1. Binary counting can be used to generate an optimal solution to the Towers of Hanoi puzzle. This famous puzzle involves moving a collection of disks from one peg to another while never placing a large peg on top of a smaller peg. Once we find an optimal way to solve the Towers of Hanoi puzzle, we will explore the connection to fractal geometry and look further at what properties make fractal sets so complex.

Ami E. Radunskaya, Pomona College, *Of Mice and Math: mathematical models in medicine*

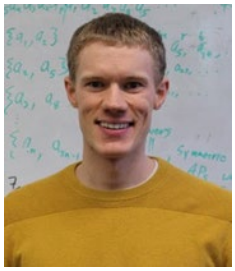
Abstract: The title is meant to suggest that mathematics can be a link between experimental science and practical medicine, although in reality only a few mice will actually appear in this talk. I hope to tell you a story of discovery through interdisciplinary collaboration. In particular, I will tell you about some collaborations between mathematicians and scientists in which I have taken part. How can we design cancer vaccines? How can we make the ideal time-release tablet? How much blood-thinner should we prescribe? What are the best shoes to wear to improve your balance? When do we need to perform a Caesarian? These problems illustrate different types of mathematical models, and different mathematical techniques used to reach different goals, but all of them bridge the gap from bench to bedside, and beyond.

Michael Dorff, Brigham Young University, *How mathematics is making Hollywood movies better*

Abstract: What's your favorite movie? Star Wars? Avatar? The Avengers? Frozen? What do these and all the highest earning Hollywood movies since 2000 have in common? Mathematics! You probably didn't think about it while watching these movies, but math was used to help make them. In this presentation, we will discuss how math is being used to create better and more realistic movies. Along the way, we will discuss some specific movies and the mathematics behind them. We will include examples from Disney's 2013 movie Frozen (how to use math to create realistic looking snow) to Pixar's 2004 movie The Incredibles (how to use math to make an animated character move faster). Come and join us and get a better appreciation of mathematics and movies.

Carl Pomerance, Dartmouth College, *Is* 73 *the best number*?

Abstract: According to Sheldon Cooper, the often annoying lead character in the TV sitcom *The Big Bang Theory*, 73 is the best number. And he's eager to tell you why. But is it really? In joint work with Chris Spicer (Morningside College in Iowa), we show that Sheldon just may be right.



Jay Cummings, Sacramento State University, *The Mathematics of Juggling*

Abstract: The mathematics of juggling began with the goal to characterize, and then study, physical juggling patterns. In the past few decades this study has expanded, inspiring questions from several areas of mathematics. In this talk we will discuss some of the classic results from this field as well as some recent research.

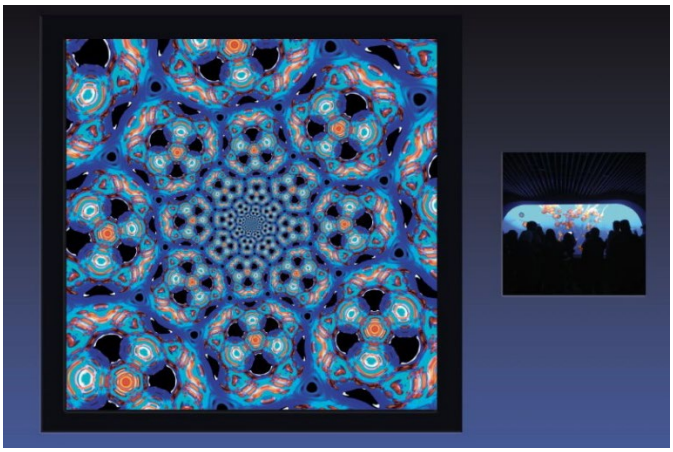
Mathematical Art Exhibition

by Stacy Speyer with art work photos by the artists

The 2019 Meeting of the Golden Section marked the fourth year that the meeting included an exhibition of mathematical art. Participating in the Mathematical Art Exhibition were Dan Bach, Frank Ferris, Stan Isaacs, Caroline Liu, Nick Mendler, Carlo Séquin, and myself, Stacy Speyer. Helping me to organize the event was Nick Mendler and Aida Rivera. Here are two entries in the show with artists descriptions of their work. See page 19 of this newsletter for two more!

Caroline Liu (cwliu@scu.edu)

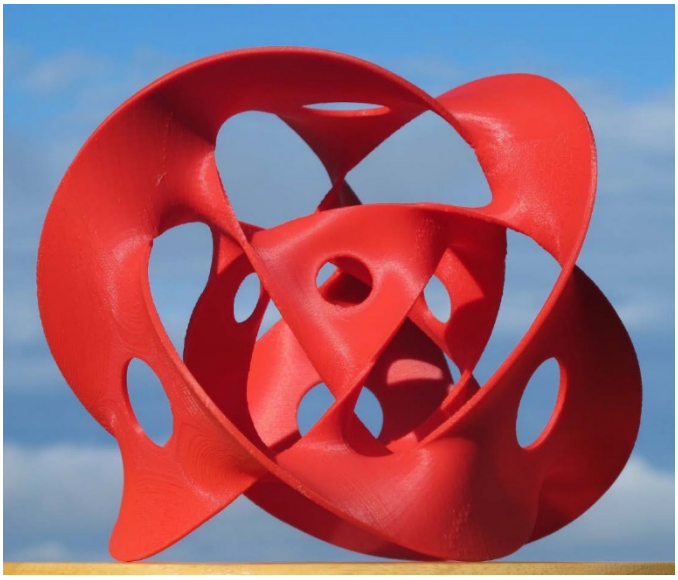
Title**: Jellyscope I**



A kaleidoscopic spiral of glowing jellyfish floating in an aquarium is shown on the left. On the right, the original photo used to create the spiral is presented for consideration. I started with the original photo I took in the dark, crowded exhibits at Monterey Bay Aquarium and created a p31m wallpaper. This particular wallpaper has rhombic cells that have mirror reflections on all sides and also a mirror cutting diagonally across forming two inner triangles. The cells have 3-fold symmetry on each corner. It also has 3-fold symmetry, glide reflections, but no mirrors, at the center of each inner triangle. This wallpaper is then curled around into a consistent pattern, namely a Fibonacci spiral, a pattern often found in nature. The result produces a mesmerizing and otherworldly perspective, pulsing with orbs of energy.

Carlo H. Séquin (sequin@berkeley.edu)

Title: **Two-Level Borromean Soap Film, Suspended by Six Circles**



I start with the simplest Borromean soap film surface and place a smaller copy inside so that they just touch. To obtain a proper border configuration for a 2-manifold, I transform the six areas where two ovals touch into skewed crossing of two smooth curves. This results in a border curve system consisting of six simple interlinked loops. I force these loops to be perfectly circular, and then construct a soap-film on this border structure. To enhance the transparency of this sculpture and allow a better look at the inside geometry, I also cut out eight small circular holes from the two sets of 3-sided face patches in the outer and inner levels of the soap film. The 2-manifold is single-sided, of genus 6, and has 6+8 punctures.

Are you interested in showcasing some of your mathematical art at the 2020 Golden Section Meeting at Mills College? See page 19 about how to submit your work for inclusion in the Mathematical Art Exhibition at Mills College. If you have questions, send a note to me, Stacy Speyer, at cubesandthings@gmail.com

THE MATHEMATICAL ASSOCIATION OF AMERICA – GOLDEN SECTION

Saturday, February 29, 2020, at Mills College

Same-day registration and **refreshments** will be in the lobby of Lisser Hall, with the **talks** in Lisser Hall 101. **Lunch** will be in the Faculty Dining Room in the Rothwell Center. The **poster session** and **mathematical art exhibition** will be in Lisser Hall (follow the signs).

How to Register in Advance

All participants should first register online on the Golden Section webpage (links at top of webpage) at

http://sections.maa.org/golden/MAAMILLS2020.htm

You can complete the registration by payment with a credit card (with no surcharge – the Golden Section is paying all fees!) or by regular mail. For the mail option, send a check (**arriving** no later than Friday, February 15, 2020 and made payable to the MAA) to

MAA 2020 Meeting & Luncheon
Department of Mathematics and Statistics MS084
University of Nevada Reno
Reno, NV 89557

If you experience any problems, contact Ed Keppelmann at keppelma@unr.edu or (775) 722-0658.

Regular	$20
Retired/Unemployed	$10
Student (all levels)	$5
Speaker, poster/art presenter, student volunteer	Free (register online with pay by mail option)
Luncheon	$20 (in advance)
Suggested donation to support student members	$10

Please consider sending an extra $10 donation to support student members.

Directions

Mills College is located immediately off of Highway 580 in Oakland at the junction of 580 (MacArthur Freeway) and Highway 13 (Warren Freeway), approximately seven miles from the Bay Bridge. There are three MacArthur Blvd exits from 580 east, so please follow the directions carefully.

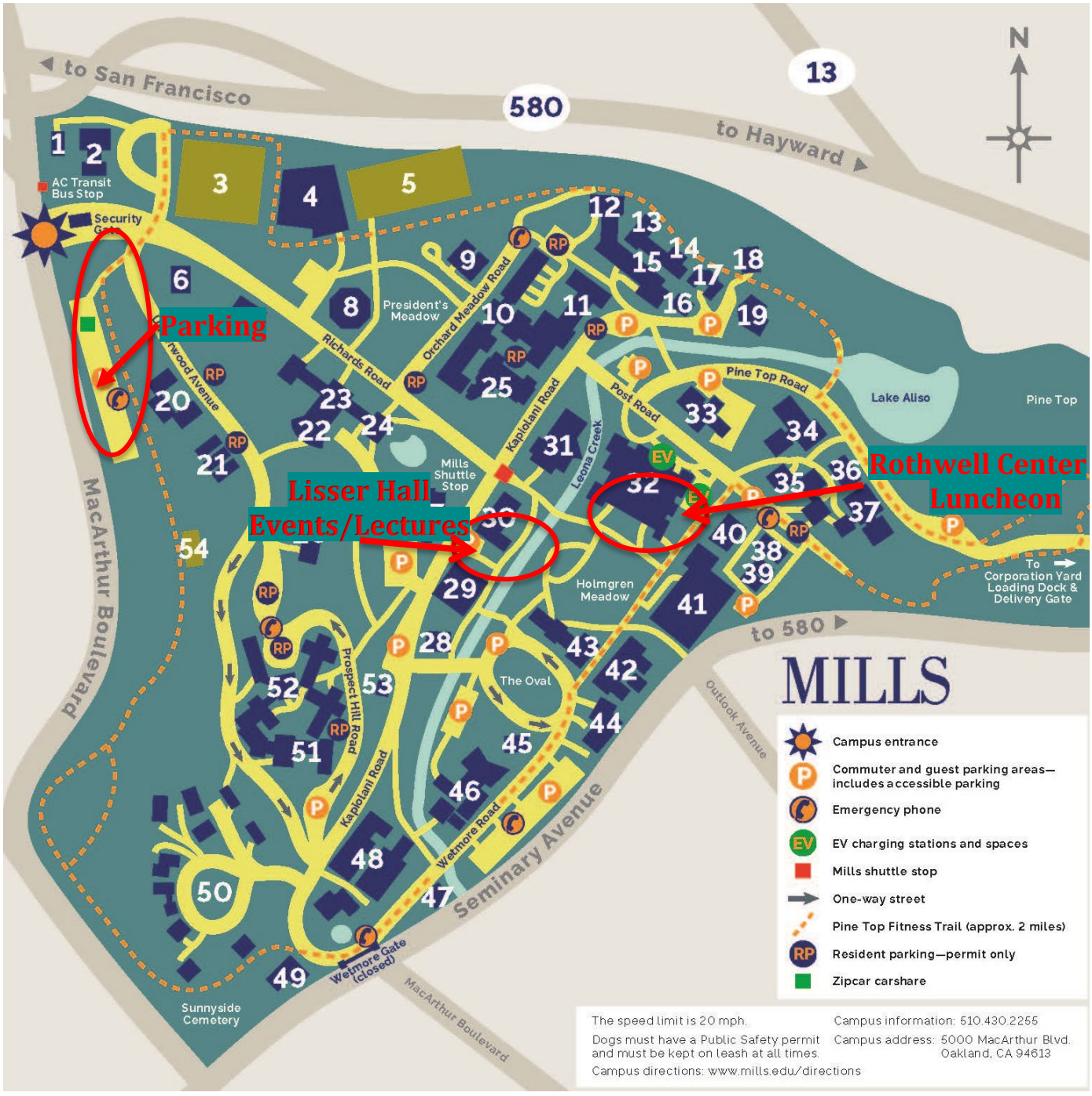
Via 580 east (from points north and west): Take I-580 east toward Hayward/Stockton. Take the second MacArthur Blvd exit (after High St.). Bear right onto MacArthur Blvd. The Mills gate will be immediately ahead on your left.

Via 580 west (from points south and east): Take I-580 west to the MacArthur/High St. exit (Exit 25) just after the junction with Highway 13. Turn left at the bottom of the ramp and then turn left at the light onto MacArthur Blvd. The Mills gate will be immediately ahead on your left.

Parking Information and Meeting Location

No parking permit is necessary. After entering through the Mills gate on MacArthur Blvd, take the first right turn and park in the lot next to the gate. After parking, proceed on foot to Lisser Hall (building 30 on the campus map). Participants who need to park closer due to mobility issues should stop at the gate and ask for a guest pass. The gate attendant will give further directions regarding where to park.

See the map on the next page and for more information see https://www.mills.edu/directions.php



Thanks to Phil Bond (outside photos) and Teresa Tam (inside photo)

Call for Mathematical Art Exhibits

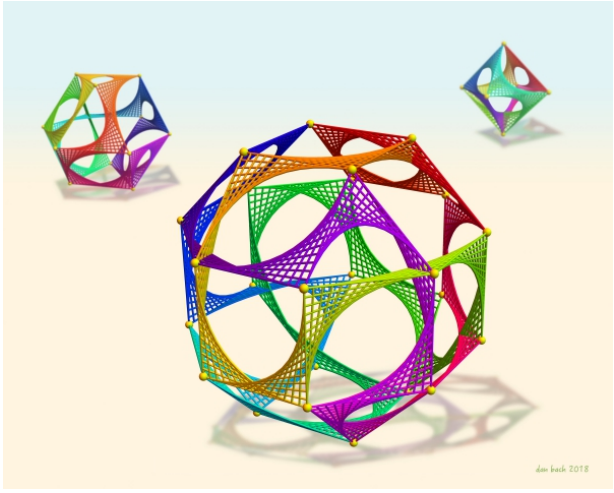
The Golden Section will host its fifth mathematical art exhibition. The exhibition will take in Lisser Hall during the break between the morning and afternoon sessions (1:00 to 2:00 pm). During that time, the artists will be present to discuss their works with viewers. If you know anyone who produces art with a strong mathematical theme or content, please encourage them to submit their piece for consideration in the exhibition. Artists are expected to register for and attend the meeting. Artists are also responsible for their pieces throughout the meeting. Artist participants will be able to set up their work in a locked conference room, to prepare it for viewing during the exhibition.

Submissions: Please email at most two photos (< 10 MB each) of each piece you would like to submit, along with a brief description (< 100 words) of the piece to Stacy Speyer at cubesandthings@gmail.com.

Deadline: Monday, January 27, 2020

Works shown at the Golden Section Meeting at AIM, February, 2019

Artist: **Dan Bach** http://www.dansmath.com



I'm a former college mathematics teacher from California. I used Mathematica for over 25 years in the classroom, for teacher workshops, and at conference talks. My students were known to create mathematical graphics, movies, and sounds; either as class assignments or purely for pleasure. I'm now a 3D math artist and interactive book author. The 3 polyhedral shapes shown here (an octahedron, a cuboctahedron, and a small rhombicuboctahedron) are composed of paths that visit all the edges once and only once, returning to its original vertex. A rainbow of line segments then tracks its progress along this Eulerian circuit! (Viewable in 3D at this link: bit.ly/2AalWlb)

Artist: **Stacy Speyer** www.cubesandthings.net

I have a Masters in Fine Arts, with a focus in Textiles, and I am working on a degree in Mathematics. About ten years ago I started making and studying polyhedra. Using a range of materials from laser cut metal, acrylic, wood, and paper to yarn, beads, handspun wool, and basketry reed, I make pieces that accentuate different symmetries of the shapes. Combining math with art gives me the visual power, accessibility, and playful nature of art to get people interested in math. Pictured here are five paper forms I had at the show. The patterns come from book #4 of my series of 3D coloring books "Cubes and Things - Woven Twists."

Photos provided by the artists

Call for Student Posters

Who, When and Where

All undergraduate and graduate math students, Saturday, February 29, 2020, at the annual meeting of the MAA Golden Section at Mills College, Oakland, CA.

What

Poster presentations of research, new approaches to old problems, solutions to problems from mathematics journals, results of class projects or mathematical modeling contests, historical investigations in pure and applied mathematics, mathematical topics outside the standard curriculum, or mathematical investigations arising from internship experiences

Why

The meeting provides a great opportunity to learn about interesting and entertaining areas of mathematics, as well as to network with other students and professors. Student presenters receive **complimentary registration** and **Saturday luncheon**, plus a **free one-year membership to the MAA** or (for those who are already MAA members) a **free book**.

Details

If you have any questions (e.g., whether your idea is appropriate for presentation or what size font to use on your poster), contact Professor Kristen Beck (see contact information below). Participants must have an email address, possibly through a faculty mentor, where they can be contacted. To submit an abstract, go to https://forms.gle/QLtag4DpWkhftiff9 or scan the QR code to the right.

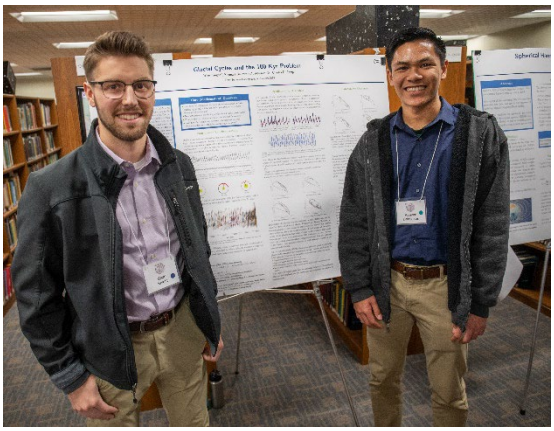
Deadline to submit an abstract: Saturday, February 15, 2020

All student posters should be typeset, illustrated, and displayed in landscape orientation on a foam poster board that measures roughly 36 inches × 48 inches. Posters will be on display throughout the meeting, including during a scheduled poster session. For more information about the 2020 Golden Section Meeting, visit http://sections.maa.org/golden/MAAMILLS2020.htm.

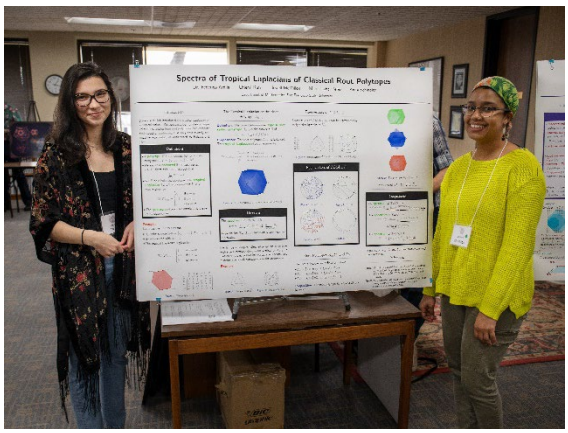
Contact

Professor Kristen Beck, Department of Mathematics & Computer Science, Saint Mary's College of California, Moraga CA 94575 Office Phone: (925) 631-6298 E-mail: kab24@stmarys-ca.edu

Poster Session at the American Institute of Mathematics, February 2019



Brian Knight and Raymart Ballesteros, Cal Poly San Luis Obispo



Maria I. Perez and Jewell McMillon, San Francisco State Univ.

Photos: Jon Shapiro