



MATH IN THE TIME OF COVID

The Math Department had very eventful Spring and Summer 2020 semester terms, with challenges both big and small. The semester began as normal, but with the excitement of two tenure track job searches at the level of assistant professor immediately engaging the entire faculty. One position in logic and foundations was to replace a number of losses the department has had going back more than a decade. The job search was successful and Dr. Ilya Shapirovsky will be joining the department in the Fall. The other tenure track faculty line to support initiatives in data science and statistics was also very successful and Dr. Adina Oprisan will be joining the probability and statistics group in the Fall. Shortly after all the efforts involved in filling open lines were accomplished, the COVID pandemic began to make its impact felt, both nationally and locally.

A week after the hiring request had been sent up the administrative chain, it was becoming apparent to Dr. Harding that the department needed to plan for any eventuality. What started March 7th, initially as



ordering extra cleaning supplies and telling students to stay home if sick, quickly changed to an extended Spring Break from March 16-30 where faculty were tasked with putting their courses online. iPads and white boards were quickly purchased and the department members generously

shared resources about best practices, lockdown browsers, OBS Studio and more. Zooming took on a whole new meaning as important committee work needed to be accomplished over the Spring Break as well. There was still a hope that by finals at the beginning of May, NMSU would reopen. But as time moved forward, it became clear this was a pandemic. Student evaluations were put online for the first time and all in all, with the leadership of Dr. Harding, Dr. DeBlassie, Dr. Ballyk and the always fantastic office staff, the department managed to successfully perform its mission.

The Summer 2020 sessions saw a continuation of the COVID pandemic with everything going online, including the Math Success Center. The department took this as an opportunity for community outreach and opened

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MATH IN THE TIME OF COVID CONTINUED.

the online MSC to the world. The Fall 2020 semester is looking to be completely online as the Mathematics Department is being cautious about exposing students, faculty and staff while the number of cases in Dona Ana County continues to climb.

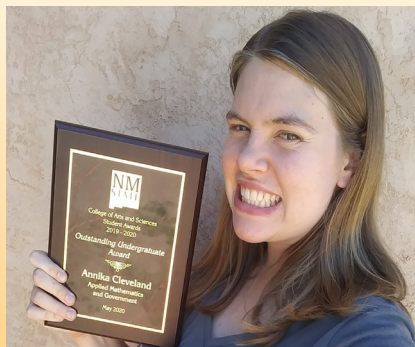
A pair of college track faculty were added over the summer. Dr. Jonathan O'Rourke and Dr. Kevin Meek will join the faculty in the Fall, teaching a variety of courses and helping in the Math Success Center. Dr. Tiziana Giorgi was offered, and took, an appointment as a "rotator" division head at the NSF. She

will be on leave from NMSU next year, with an option of one more year. There were two notable retirements and a promotion. Jerry Lodder and Alyne Fulte are leaving the department after decades of service. Both have been strong supporters of students and educational initiatives, including the teaching academy, and historical resources.

Paloma Pavao joined the department in the Spring and immediately put her many gifts to work in assisting with the onlining of the department. Together with Maria Sanchez and Dawn Rafferty, the department is truly blessed to have a competent, caring staff during these chaotic times.

UNDERGRAD SUCCESS

GETTING TO KNOW ANNIKA



In May 2020, Annika received her B.S. in Mathematics with a concentration in Applied Math as well as a B.A. in Government. She will be attending the School of Law at the University of New Mexico this fall, where she was offered the Daniel A. Sisk Scholarship in Legal Ethics, their most prestigious award.

Before college, Annika was largely indifferent to math, unimpressed by what seemed to be an arcane subject. This changed after she took Calculus II honors at NMSU. She decided to take more math classes the following semester and continued to be inspired and challenged by all her math professors. At the beginning of her sophomore year, Annika decided she had no choice but to major in math. While at times studying math was difficult and frustrating, she never regretted her decision. She even briefly considered pursuing a graduate degree in mathematics and spent a summer studying nonlinear dimension reduction at the Georgia Institute of

Technology.

Despite her love for math and the NMSU math department, Annika has decided to pursue her lifelong dream of attending law school. With her passion for working with vulnerable people she plans to study either family or immigration law. Studying math has taught Annika how to think and persevere through difficult problems, a skill she will carry into law school and the rest of her life. She will always be grateful for all her amazing professors at NMSU and their constant help.

KIST ENDOWMENT IS FINALIZED

Joseph E. Kist, known to us as Joe Kist, came to the Math Department in 1966 during a period of explosive growth. Joe received his Ph.D. from Purdue in 1957 from Meyer Jerison of “Rings of Continuous Functions” fame, and held positions at Wayne State, and Penn State before coming to NMSU. Joe had 7 Ph.D. students at NMSU and enjoyed a long career studying rings of continuous functions and operator algebras. After his retirement in the 1990’s he remained an active participant in department seminars, including the algebra and lattice theory seminar, until a few years before his death in October 2018.

Joe grew up in Buffalo, NY as one of three children



of parents who immigrated from Germany. His love of mathematics began in a vocational program for electricians he took as an undergraduate in high school. Joe lived his life in a modest unassuming way, devoted to academics ranging from his work in mathematics, to deep interests in literature, history, and science. Throughout his life, Joe was a quiet humanitarian, supporting the Salvation Army, local symphony and instigating a scholarship fund for graduate students, among many other causes.

Upon his death, the department found out that Joe donated a large sum to support graduate education in our department.



This endowment will affect the lives of students far into the future. The income from the Kist money will provide annual funds for the department in perpetuity. This year the amount was a bit over \$60,000. This will provide direct support through the Kist Fellowships we are introducing, support for conference travel, hosting conferences, visitors to our department, and many other uses. What Joe did not use for himself will greatly improve the lives of many, many others.

On January 7, 2020 we gathered to celebrate the gift, and thank Joe’s memory through his representative Pat Johnson. Pat worked tirelessly for many years to help this gift become a reality, and our department has deep appreciation for her efforts. Pat and Don Johnson (a longtime friend, colleague and coauthor of Joe’s) were present at the ceremony with many current and former members of the department, as well as Deans Pontelli and Lakey.

RESEARCH SPOTLIGHT

A NEW FOCUS ON RESEARCH IS BEARING FRUIT

Dr. Tiziana Giorgi was awarded a collaborative grant from the Applied Mathematics Division of the NSF in the amount of \$259,953. Her proposed research deals with the analysis and modeling of soft matter systems. Together with Dr. Sookyung Joo of Old Dominion University, Dr. Giorgi will consider the response of a liquid crystal to applied fields, and interfacial conditions. Their emphasis will be placed on the study of bent-core molecule liquid crystals in the so-called smectic A phases. Using the geometry of generalized director vectors and a set of order parameters, they will use physically relevant energy models to mathematically describe and analyze topics including ferroelectric properties of bent-core (BC) molecule materials, the influence of weak boundary conditions on Smectic A (SmA) and ferroelectric SmA (SmAPF), as well as twist-bent nematic (NTB) order in achiral molecule liquid crystals.



Tiziana and Sookyung take a well needed break.

The grant also included support for a graduate student for three years. Laura Chavez-Gutierrez will be studying under Tiziana in the field of partial differential equations through the grant and has already done a good deal of coursework related to filling in background material.



Dr. Xuemei Chen was recently awarded an NSF grant in the amount of \$123,544 to conduct research in the field of harmonic analysis. Her background in compressed sensing and her strong computational abilities played a big part in her successful submission last year. Compressed sensing aims to accurately and stably recover sparse signals from drastically undersampled measurements. Her project performs theoretical analysis for recovering signals that are sparsely synthesized in a frame or dictionary from very few measurements, and conducts numerical experiments on imaging applications where subsampled Fourier or convolution measurements are used. The expected outcomes of this project are building a framework of this synthesis-sparse sensing problem, and improving image restoration quality with provable guarantees. This is motivated by (a) numerous practical applications of CS in MRI, MIMO radar, tomography, remote sensing, etc., where sparsity is exploited; (b) the benefit of robust signal representation in redundant frames; and (c) the lack of theoretical work on the synthesis-sparse sensing problem. Xuemei has worked on relevant problems since her dissertation, and is well qualified to conduct this project, as demonstrated by her publications.

In May 2020, Dr. Jonathan Montano Martinez, assistant professor, was awarded an NSF grant in the amount of \$139,794 to study asymptotic growth of symbolic powers, mixed multiplicities, and convex bodies. He will investigate the asymptotic behavior of symbolic powers by studying the growth of three important sequences: the number of generators, the Castelnuovo-Mumford regularity, and the projective dimension. For the number of

generators, he plans to show that the sequence has polynomial complexity. This result would have important consequences on the arithmetic rank, Frobenius complexity, and Kodaira dimension of divisors. He plans to achieve this by using the theory of cohomological degrees, a generalization of the Hilbert-Samuel multiplicity. For the other two sequences, regularity and projective dimension, Jonathan plans to focus on regular rings of positive

characteristic. In such rings, a new class of ideals is defined for which he has previously shown the limit of these sequences exist; this class includes several types of determinantal ideals, as well as the square-free monomial ideals. He has two projects in mind, the first of which proposes a conjecture that establishes conditions for the non-vanishing of mixed multiplicities of multigraded algebras. A positive answer for this conjecture would unify results in the literature coming from several different contexts. The second to study a notion of mixed multiplicities for filtrations of not necessarily zero dimensional ideals.



WORKING IN GROUPS



In addition to the numerous NSF awards the faculty recently received, there is a continued tradition of collaboration going on. Support for faculty travel has been doubled this year and many other sources have taken an interest in the outstanding research done by our faculty.

Associate Professor, Dr. Louiza Fouli along with 6 other female researchers, was selected for the Summer Research

in Mathematics at MSRI for Summer 2020. The group was to be in residence for two weeks in June 2020. The same group was also selected for the Summer Collaborators program at the Institute for Advanced Study as well as for the Research in Groups program at ICMS, UK.

Dr. Robert Smits received an appointment as a Fellow in the 2020 Air Force Research Lab Summer Faculty Fellowship Program at United States Air Force Academy. His work centers on using machine learning to analyze problems in game theory which arise from the interaction of probability with nonlinear partial differential equations.

The collaborative effort with members at the Air Force Academy has potential applications in cybersecurity problems which can be modelled as multiplayer games. A graduate student was also awarded to study in Colorado Springs but needed to decline participation due to other commitments.



WE KNOW OUTREACH

THE DEPARTMENT INCREASED ITS OUTREACH



EFFORTS THIS YEAR TO HIGH SCHOOLS AND THE COMMUNITY AT LARGE



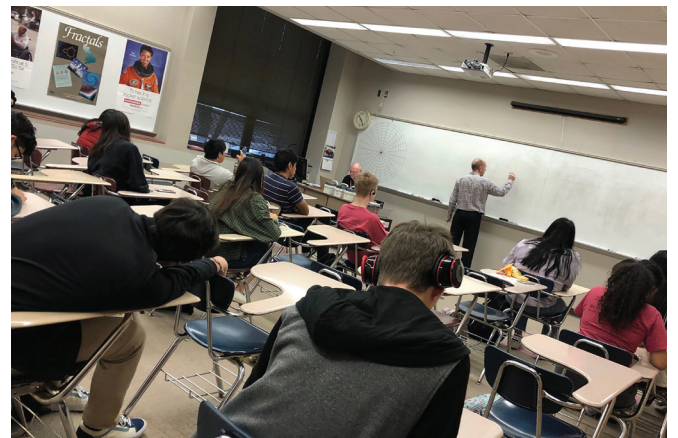
The department increased its visibility on the local and national stage with an aggressive outreach program conceived by Drs. Harding and Ballyk. At the beginning of the year, the Chair, Dr. Harding, stressed to the faculty the need to have more engagement with high schools and recruiting specifically to our undergraduate mathematics program. He set aside funds for recruiting statewide and out of state. One of the most enthusiastic people about student outreach is Dr. Robert Smits, who is the Dr. John A. and Margy Papen Endowed Professor of Actuarial Science.

Dr. Smits has made contact with many students from across the state of New Mexico and was invited by Principal Ruben Cano, an NMSU Alum, to talk to students at Omaha South High School where Dr. Smits was a student in the 1980s. South High is a Magnet School serving a majority Hispanic student body which meshes well with NMSU's longstanding tradition as an Hispanic Serving Institution. In addition to giving outreach presentations discussing NMSU, the College of Arts and Sciences, the Mathematics Department and the Actuarial Emphasis, Dr. Smits was able to teach 4 different classes as an emergency substitute due to a winter storm that had left some of the South High faculty stranded.

Through the Herculean efforts of Dr. Mary Ballyk, the Math Success Center was not only placed online during the COVID pandemic, but was additionally made available to the larger community. This outreach received good press coverage even in Albuquerque! <https://www.krqe.com/news/new-mexico/nmsu-offering-free-online-math-tutoring/>

“Math can be one of those challenges, and parents don’t always have the tools to help a child solve a tough problem – which could leave students or parents feeling stuck. That’s why New Mexico State University’s Math Department is opening up its online tutoring center to the community this summer.

The center’s tutors are graduate students in the Math Department with a wide knowledge of mathematics and statistics and will provide guidance to anyone in search of a little help.



Department chair, John Harding also mentioned that if an adult wishing to return to university wanted to refresh their math skills, they would be very welcome, as would a recent high school graduate who wanted to spend some of our shut-in summer getting a head start on classes in the fall.

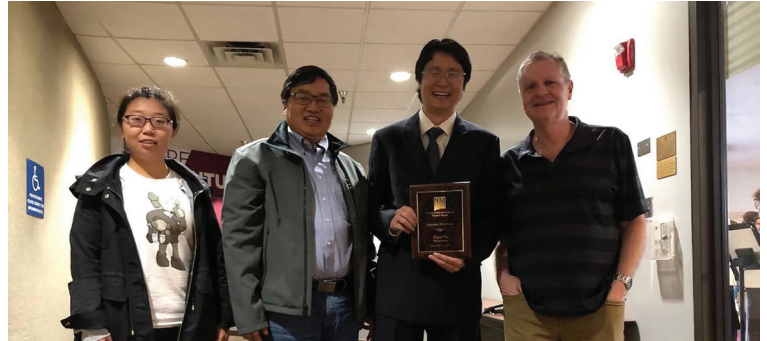
The online service was free and open from 10 a.m. to 2 p.m. and 6 pm to 8 p.m. Monday to Thursday, until June 30.

GRADUATE STUDENT

SUCCESS AND A BIG PROMOTION

One of the truly outstanding students in recent years is our Spring 2020 graduate, Dr. Ziwei Ma. Ziwei finished his thesis under the direction of Dr. Tony Wang with numerous publications on record and has accepted a tenure track position at the University of Tennessee at Chattanooga. He was awarded the Dean's graduate Award for Excellence in February based on an outstanding GPA, publishing a wide variety of research articles in statistics related to problems in economics and health related fields, participating in local, regional, and national conferences in his area as well as collaboration with scholars from all around the globe.

Ziwei is also an outstanding teacher, with experience from pre-calculus through intermediate statistics. He ran a innovative version of Statistics 251 in the Spring 2020 term and his materials will be used in the future for instructors teaching the course.



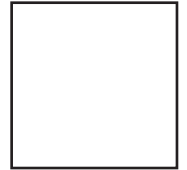
DR. VILLAVERDE PROMOTED TO COLLEGE ASSOCIATE PROFESSOR



Dr. Karen Villaverde was recently promoted to College Associate Professor based on a strong balance of teaching, service, and research. Karen is an extremely active member of the Teaching Academy, participates in an ongoing teaching seminar in the math department and earns high marks on evaluations. She has been a co-organizer of the NMSU/UTEP workshop in Mathematics and Computer Science, where she took her degree. She is also instrumental on the social committee, planning events including math nights with food in the Hotel, Tourism and Restaurant Management dining hall. With all of this energy, Karen still finds time to continue her scholarship and published a book with Springer in 2018 with Olga Kosheleva, *How Interval and Fuzzy Techniques Can Improve Teaching*.



MATHEMATICAL SCIENCES DEPARTMENT



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The department has been very fortunate in the recent past to have strong support, and would like to point out two special gifts:

There was a charitable addition to the **Anna Schrufer Kist Endowed Scholarship**, and **Dr. Charles Swartz** generously established the **Charles Swartz Endowed Scholarship**, which is matched in part by Giving Tuesday Challenge Funds.



RECOGNIZING ADMINISTRATIVE EXCELLENCE

NEWS HIGHLIGHTS



Our very own administrative assistant, Maria Sanchez, was properly recognized for her decades of love and commitment to students, staff and especially faculty in the Spring, receiving the Arts and Sciences award for Staff Excellence.



Fiscal Assistant, Dawn Rafferty, who makes the books balance and foresees short and long term budget risks for the department chair, was our representative at Starry Night.