

THE

N.C. STATE UNIVERSITY

<http://www.math.ncsu.edu/undergrad/>

## MATHEMATICS NEWSLETTER



## Meet Star-Lena Quintana

Star-Lena is a sophomore pursuing her B.S in Mathematics and minor in Logic & Methodology. She is a proud Mexican-American from Hagerstown, Maryland. Star-Lena loves being an out-of-state student at NC State because she can always say she's from somewhere different than most of the students here. Star-Lena came here ready to immerse herself into, the plentiful opportunities at NCSU. She became an active member on the PAMS Council (which everyone should be a part of!) and helped to begin the reshaping of the council. As the publicity chair her freshman year on the council, Star-Lena made the flyers for PAMS events and chalked the sidewalks to encourage students to attend the Career Fair. Star-Lena also entered and won the PAMS t-shirt contest; that PAMS t-shirt our students now proudly wear "makes me smile every time I see one." Star-Lena feels that as a Math major and being part of PAMS, it is her duty to be involved within the PAMS college and community. She took over as President of the Society for Undergraduate

Mathematics (SUM club), thanks to the support of Dr. Scroggs, and is beginning to re-expand the Society as a club for Math majors and also other interested students. If you're interested, go to [OrgSync.com](http://OrgSync.com) and join the SUM Club. Outside of her math activities, Star-Lena is involved in DanceVisions, a dance company that allows for creative expression through body movement demonstrating passion. Star-Lena plays an active role through the Multicultural Student Affairs office and is an active member of the Peer Mentor Program, helping freshman feel comfortable here at State. She is part of the University Scholars Program and the National Society of Collegiate Scholars. Star-Lena plans to attend graduate school and hold a career with the federal government. Star-Lena is a very approachable person, so introduce yourself to her! Ask how you can become involved or any other questions you may have. If she doesn't know the answer, she can most likely direct you to someone who does. In Star-Lena's words, "Be active!"

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# COURSE HIGHLIGHTS

## **MA 493/591: The Mathematics of Ranking and Clustering**

**Prerequisites:** Linear Algebra (MA 305, MA 405 or equivalent), programming experience (MATLAB will be used in class lectures)

The results of ranking algorithms can have far-reaching consequences, from the bowl game a college football qualifies for to the placement of a web page on a search engine's result page. Data clustering, that is finding patterns in large, multi-dimensional data sets, can be the key to identifying genes associated with a disease, diagnosing cancer patients, finding patterns in different voting districts, or determining when your credit card is being used fraudulently. This course will cover the mathematics behind these two fast-growing areas. In examining ranking, we will survey many of the methods that have been developed in the last century and examine how each can be tailored to specific applications. In the clustering portion of the class, we will again survey the history of the discipline, before concentrating on more recent developments in the field including nonnegative matrix factorization and consensus techniques

## **MA 555 : Introduction to Manifold Theory**

**Prerequisite:** MA 426

In advanced calculus class (e.g. MA 426) students learn how to define and to perform differentiation and integration on  $\mathbb{R}^n$ . We will extend this to manifolds (shapes like sphere, torus, etc). The main difference is that on  $\mathbb{R}^n$  one can define addition of points (by adding the corresponding vectors), but on a general manifold points cannot be added in a meaningful way. We will learn how to go around this issue and define differentiation and integration on manifolds. We will start, of course, by giving a precise definition of a manifold.

## **MA 537: NONLINEAR DYNAMICS AND CHAOS**

**Prerequisites:** MA 341 and MA 405

In recent years there has been an explosion of interest in nonlinear behavior, chaos, and fractals in the physical and biological sciences. Chaotic behavior has been observed in

disciplines as diverse as meteorology, medicine, and economics. These phenomena may be introduced at an elementary level because often they are described by nonlinear difference equations, which are discrete dynamical systems and are analyzed by studying iteration of functions. The course will introduce appropriate mathematical concepts, e.g., equilibrium, stability, bifurcation, and fractals. Software will be available so that students can perform computer experiments and discover for themselves the fascinating behavior of nonlinear dynamical systems.

## **MA 587: Numerical Solution of Partial Differential Equations**

**Prerequisites:** A reasonable background in linear algebra, numerical analysis, and partial differential equations.

The Finite Element Method is a MUST for applied mathematicians, engineers, or anyone who uses computers to solve problems that involve partial differential equations. In this course, we use one-dimensional problems to introduce the finite element method, including the algorithm implementations, the theoretical backgrounds, and applications. Then we will carry over the essential tools to two dimensions. We will discuss some common used finite element spaces, error analysis, and other related topics. Efforts will also be made on the issues of implementation and related softwares. Using the data from the Matlab mesh generator, the students will be able to implement finite element method using their favorite computer languages for complicated geometries in two dimensions. <http://www4.ncsu.edu/~zhilin/>

## **MA 792 Advanced Programming for Mathematicians**

Instructor: Erich Kaltofen

The course teaches anyone with some programming experience how to program in the three most used programming languages, C, C++ and Java. The course is open for both undergraduate and graduate students. If you are interested, please visit the homepage of my 2008 course [www4.ncsu.edu/~kaltofen/courses/Languages/Spring08/index.html](http://www4.ncsu.edu/~kaltofen/courses/Languages/Spring08/index.html). If you have any questions, please contact Prof. Kaltofen for further information.

### **Newsletter Quote:**

Pure mathematics is, in its way, the poetry of logical ideas. ~Albert Einstein

### **Did you know????????????????**

The Math Department has an Undergraduate Lounge. It is located in SAS 2102. If you have any questions or need access, see Di Bucklad in room 2108.

### Advanced Mathematics Courses

**These classes may be used as Advance Math Elective in the Spring 2011**

**MA 325:** Introduction to Applied Mathematics  
**MA 401:** Introduction to Applied Math  
**MA 408:** Foundations of Euclidean Geometry  
**MA 410:** Theory of Numbers  
**MA 412:** Long-Term Acturial Models  
**MA 416:** Introduction to Combinatorics  
**MA 421:** Introduction to Probability  
**MA 426:** Mathematical Analysis II  
**MA 428:** Intro. To Numerical Analysis II  
**MA 432:** Mathematical Models in the Physical Sciences  
**MA 437:** Applications of Algebra

**MA 502:** Advanced Mathematics for Engineers and Scientists II  
**MA 513:** Introduction to Complex Variables  
**MA 537:** Nonlinear Dynamics ad Chaos  
**MA 555:** Introduction to Manifold Theory  
**MA 587:** Numerical Solution of Partial Differential Equations  
**MA 792:** Advanced Programming for Mathematicians  
**MA 793:** Nonlinear Waves: Asymptotics and Applications

## Math Honors Programs

### News from the Math Honors Program

Eleven students, Evan Adamek, Brittany Boudreaux, Joseph Briggs, Chelsey Cooley, Rachael Gordon-Wright, Kelsey Hawkins, James Holbert, Mark Hunnell, David Pate, William Wheeless and Nick Yelle completed the Math Honors Program last spring. Graduate schools these students will be attending include NYU, Indiana University, Georgia Tech, U of California, Riverside and NC State. New students joining the program last semester include Yeou Chiou, James, Choi, Jeff Gory, Jennifer Jackson, Nic Kiely, Robert Pearce, Sean Plummer, Tim Pluta, Tyler Reece, Ryan Walker and Chong Wang.

Twenty-seven students are currently participating in the Math Honors Program and invitations to join the program will be extended sometime during pre-registration. Every year approximately 20-25% of math graduates complete the Math Honors Program and about 80% of those students go on to graduate school. Schools they have attended include Berkeley, Princeton, Stanford, MIT,

Cornell, NYU and UCLA. Moreover, math honors students have received 13 NSF Fellowships and 4 DoD Fellowships for graduate school as well as many other honors including 6 Goldwater Scholarships and 2 Gates Fellowships. Besides taking more challenging courses to complete their math degrees, math honors program members also do research either at NC State or in a summer REU (Research Experience for Undergraduates). More than thirty students have also done a study abroad program focusing on mathematics, either at the Budapest Semesters in Mathematics or the Math in Moscow Program. Participation in those programs has played a big role in the success of our students in getting into excellent graduate schools. Dr. Paur is happy to talk to any student interested in participating in the Math Honors Program – either stop by her office in SAS 3134 or email her at [sopaur@math.ncsu.edu](mailto:sopaur@math.ncsu.edu) for an appointment. More information about the program can be found on the Math Honors website at <http://www.math.ncsu.edu/honors>.



## News for Undergraduates

### Celebrating 50 Years of PAMS

N.C. State University Libraries and PAMS have launched a new exhibit called “A Legacy of Discovery: Celebrating 50 years of the College of Physical and Mathematical Sciences”. The exhibit details the long and rich history of PAMS as well as a few interesting artifacts for individuals to look at. There is a cast of a Tyrannosaurus Rex femur and the first all-electric guitar. This exhibit is located in D.H. Hill Library and will be there through December 18.

### REU/REU+

This summer the NC State Math Department hosted 44 undergraduate students during its ten-week long Research Experience for Undergraduates (REU) program. The program also included an additional week of mentoring for under-represented students, the REU+ program. The department’s REU program in Modeling and Industrial Applied Mathematics supported twelve research projects led by faculty and industry partners in areas ranging from biomathematics and financial mathematics to quantum computing and data mining and the impact of environmental toxins. In addition to doing research on new and exciting problems in a variety of mathematical areas, the students participated in many social activities such as game nights, picnics, group dinners, and a beach trip. The summer long research experience for each project group culminated in a poster presentation at NC State’s annual Undergraduate Research Summer Symposium. Directors Dr. Loek Helminck and Dr. Hien Tran are looking forward to another successful REU program during the summer of 2011, math undergraduate students who want a taste of research are encouraged to apply.

**National Science Foundation sponsors many REUs on many topics. Visit [nsf.gov/crssprgm/reu/](http://nsf.gov/crssprgm/reu/)**

### Recruiters Love N.C. State

N. C State University was ranked 19<sup>th</sup> for recruitment in a poll that was recently conducted by the Wall Street Journal. N.C. State is so highly ranked because of its large student body as well as their focus on teaching students the practical skills they need when entering the job market. **CONGRATULATIONS N.C. STATE!!!!**

### SUM Series

#### Math and Pizza!

The SUM Series features informal talks on mathematical topics. The talks are held Wednesdays from 4:00 to 4:50, in 2102 SAS Hall. Get to know others as you enjoy pizza before the talk. For upcoming topics, check out the SUM Series website: [www4.ncsu.edu/~nreadin/sum](http://www4.ncsu.edu/~nreadin/sum)



## News for Undergraduates

### **Research Opportunities**

Undergraduates can get involved in research experiences during the academic year or during the summer. Being involved in research as an undergraduate can be an incredibly valuable experience. For help in finding a research mentor during the academic year, interested students can contact Dr. Molly Fenn at [mafenn2@ncsu.edu](mailto:mafenn2@ncsu.edu). During the summer, many colleges and universities (including NC State) sponsor Research Experience for Undergraduates (REU) programs. You can find listings of these programs at the following websites:

<http://ams.org/programs/students/undergrad/emp-reu>  
[http://www.nsf.gov/crssprgm/reu/list\\_result.cfm?unitid=5044](http://www.nsf.gov/crssprgm/reu/list_result.cfm?unitid=5044)

Undergraduates already working with a research mentor are highly encouraged to apply for funding through the NCSU Undergraduate Research Office. They provide grants of \$500 to \$1,000 to cover supplies, travel to conferences, or expenses. For more information and the application which is due by October 13<sup>th</sup>, see <http://www.ncsu.edu/undergrad-research/docs/Call-for-Proposals.html>. Additionally, all students engaged in research should be aware of the State of North Carolina Undergraduate Research and Creativity Symposium which will take place on November 20<sup>th</sup> at Meredith College. This symposium will be a great venue to present a short talk or a poster about your project.

### **ARTISTS/WRITERS WANTED!!!!**

The Math Undergraduate Newsletter is looking for creative students to draw/write original material to be included in upcoming newsletters. It can be anything you want from pictures, comics, jokes, poems etc. It just has to be appropriate for an academic setting.

Please send all submissions to Julia Reynolds at [joreynol@ncsu.edu](mailto:joreynol@ncsu.edu)



## Math Riddle:

What number comes next in the sequence  
61, 691, 163, 487, 4201, ?

For the Answer Visit:  
[www.math.ncsu.edu/undergrad/newsletter/](http://www.math.ncsu.edu/undergrad/newsletter/)

# Congratulations

## Students Honored:

Two of the three students who received the Chambliss Student Achievement award, from the American Astronomical Society, this summer were N.C. State students. The students, physics majors Blake Sharrits and Mary Burkley were honored for their noteworthy research.

## Thank You

The Math Department would like to send out a big thank you to Dr. Charlton for his 44 years of service. Dr. Charlton retired on October 1, 2010.



SAS HALL

## Undergraduate Program

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