Inside CCT

LSU's Center for Computation & Technology

August 31, 2013, Issue 5

PATS ON THE BACK

The NSF awarded $3,924,181 for "MRI: Acquisition of Super-MIC–A Heterogeneous Computing Environment to Enable Transformation of Computational Research and Education in the State of Louisiana." The project is directed by **Honggao Liu, Q. Jim Chen, Mark Jarrell, Joel Tohline, and Ram Ramanujam**.

Xin Li, Mary Manhein, and Warren Waggenspack received $447,611 from NSF for "RI: CGV: Small: Digital Forensic Facial Reconstruction from Incomplete Datasets."

Q. Jim Chen received $74,463 from The Water Institute of the Gulf and the Coastal Protection and Restoration Authority for "Optimizing the Design of Shoreline Protection to Reduce Marsh Edge Erosion for Louisiana Coastal Protection and Restoration."

The NSF awarded $169,999 to LSU for "EAGER: Collaborative Research: Using PDE Descriptions To Generate Code Precisely Tailored To Energy-Constrained Systems Including Large GPU Accelerated Clusters." The project is directed by **Steven Brandt, Peter Diener, Frank Löffler and David Koppelman**.

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WHAT WE DO

In the early years of digital computing, virtually all computation was performed in batch. Today, most computing is highly interactive, with the notable exemption of supercomputing.

Over the next decade, multi-hundred core machines may become the norm for personal devices, and multi-million core for research systems. These prospects demand progress in interactive engagement with large parallel systems for research, training, and educational uses.

Researchers at LSU's Center for Computation & Technology have developed and begun implementing plans to bring such capabilities into production. In 2011, CCT's Brygg Ullmer led a team of some 40 investigators in receiving about $1 million grant from the National Science Foundation for the "MRI: Development of Melete" project.

To learn more about Melete, *Inside CCT's* correspondent talked to the project's team.

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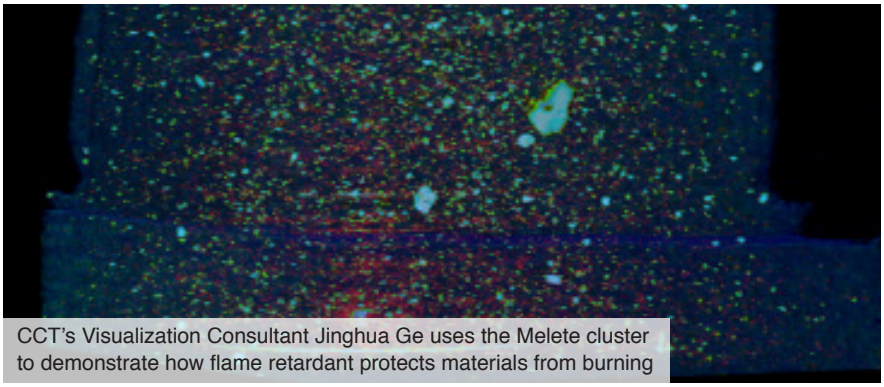

CCT's Visualization Consultant Jinghua Ge uses the Melete cluster to demonstrate how flame retardant protects materials from burning

WE MOVED

Congratulations to all CCT for finally moving to our new home, the Louisiana Digital Media Center! The process took almost three weeks, but we are all finally here.

In order to learn more about the different components of this multi-purpose facility, *Inside CCT's* correspondent spoke with Bill Schuermann, senior associate design consultant at Houston-based HFP Acoustical Consultants.

Since May 2010, which was his first exposure to the drawings of the building, Mr. Schuermann's main responsibility has been to envision what technology LSU was going to want when the doors opened in 2013.

In our conversation, he stressed that this facility is not just advanced classrooms, not simply a theater with a voice lift Constellation system, and not merely a recording studio. It's all of these in one, and this is what makes the building so special.

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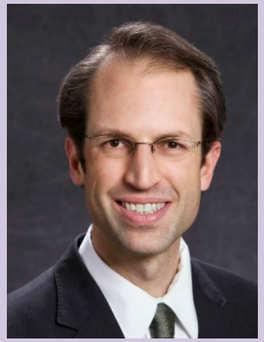


Brygg Ullmer
LSU Assistant Professor of Computer Science
Cultural Computing Focus Area Lead at CCT
Principal Investigator Development of "Melete" Project

What is a Melete?

Melete is a new kind of research instrument that integrates an interaction-oriented, software-rich compute cluster with tangible interfaces to support collaborative research and the classroom. In Greek mythology, Melete is the muse of practice.

The system is a heterogeneous compute cluster of roughly 15 nodes and 360 cores, some with GPUs, some with large RAM. Multi-core versions of Mathematica, Matlab, Maya, and other software will be installed both for interactive and batch use.

The project's development activities center upon new interaction devices and systems for live use of the compute cluster. In addition to traditional textual and graphical interfaces, the system will be fronted in several meeting rooms and classrooms with tangibles interface devices integrated with tablet computers, linked with pre-existing computers and projection facilities.

Who is working with you?

Melete will be tasked with servicing five domains – computational biology, materials, mathematics, engineering, and arts.

Co-PI Mark Batzer, who is LSU Boyd Professor of biological sciences, and I coordinate computational biology aspects of the project. Co-PI Susanne Brenner, LSU professor of mathematics and faculty at CCT, leads the computational mathematics initiative. Co-PI Les Butler, LSU professor of chemistry, oversees the computational materials aspect. Co-PI Rod Parker, director of the LSU School of Art, is responsible for computational arts.

CCT's IT Consultant Chris Branton has been very active with coordinating all aspects of the project, including software and tangible interface development. He is also coordinating user application needs and functioning as liaison to the HPC staff.

Jinghua Ge
Visualization Consultant at CCT

How have you used the Melete cluster?

The scientific dataset we visualize everyday is easily at Gigabytes level. The old-fashioned visualization software are not keeping up with the data growth, and personal computers are just not powerful enough to provide large-scale interactive data exploration. We use the VisIt parallel visualization software to visualize large-scale scientific data on Melete.

By setting up a Melete host profile for remote parallel computation, VisIt's GUI interface runs locally at the user's desktop, while the computation is distributed seamlessly to Melete. VisIt running on Melete enables large-scale data exploration as an investigation process through high performance and event-driven computation.

How has it helped your visualization work?

Melete helps with prototyping visualization routines for a group of datasets. When launching an interactive visualization session on Melete, I explore different ways to analyze a typical dataset, finalize an effective visualization routine, and write a batch script for this routine. Then I submit the batch job to a normal supercomputer to use many more nodes to process many more datasets.

The backbone web service support by Melete helps us engage more versatile user groups and attract students and new users.

Melete integrates an interaction-oriented, software-rich compute cluster with tangible interfaces.

Landon Rogge
Undegraduate student at LSU
Senior in Computer Science and Mathematics

What has been your role on your project?

I have been supporting Melete users for big science and researching new interaction methods to allow simpler access to the system for scientists who are unfamiliar with command-line interfaces.

How has working on this project helped you develop professionally?

Working on the Melete project has helped me gain a better understanding of cluster management techniques, as well as research practices for making compute clusters available for big science.

Learning how to approach the expectations of users and suit the software to their needs has been an invaluable experience for me.

This project has given me opportunities to utilize a number of tools and techniques to which I would otherwise not have been exposed.

What do you want to do when you graduate?

After graduation in May 2014, I plan to apply to the FBI to pursue a career in fighting cyber-crime, which frequently involves the use of HPC systems and other tools I learned on this project.

Les Butler
LSU Department of Chemistry
Co-PI leading the Computational Materials Aspect

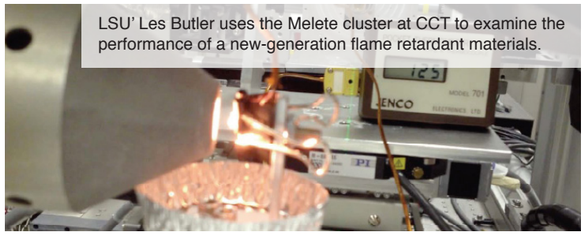
Why is Melete significant to researchers?

How do you look inside a burning sample and examine the performance of a new-generation flame retardant? We are using X-ray interferometry at the Advanced Photon Source, and soon, at the LSU Center for Advanced Microstructures & Devices synchrotron.

Do you recall how a straw appears to bend in a glass of water? Inside the flame, the polymer and flame retardant bend the X-rays and reveal the formation of a protective char layer over the polymer object.

The X-ray interferometer is the instrument that detects the small X-ray refractions, on the order of microradians.

We have made movies of the burning polymer and then done 3D imaging of the burnt sample. We use Melete to convert the raw images into human visible data sets.



LSU' Les Butler uses the Melete cluster at CCT to examine the performance of a new-generation flame retardant materials.

X-ray interferometry for materials science is just a few years old. Our software is under rapid development and it is a tremendous advantage to use Melete with our new Mathematica codes.

And by the way, X-ray interferometry may soon appear in clinical applications as low-radiation dose imaging; researchers at the National Institute of Health are exploring this new X-ray method for applications such as mammography.

How has Melete improved your research?

The data rate of X-ray imaging is huge. A couple of days yields roughly one TB of data. How can we present these results to our collaborators? Melete helps us extract the "good stuff," which we store on an iPad.

RENDER FARM FOR ART STUDENTS

This summer, CCT's cultural Computing focus group member and assistant professor of digital art Derick Ostrenko was a pioneer in encouraging art students to utilize LSU High Performance Computing facilities.

Students using 3D animation software offloaded rendering jobs to SuperMike-II.

With the help of Marshall Roy, information technology analyst at the College of Art + Design, Ostrenko worked with Lisa Giaime, manager of HPC systems at LSU, and Eric Wiggins and Michael Bryant of CCT to make the render farm accessible to School of Art students.

"Students can render most jobs on their laptops, but this can take a very long time for high quality graphics. By offloading to another rendering source, they can go through numerous iterations without having to wait 20 to 30 minutes between changes," Ostrenko said.

Wiggins and Bryant demonstrated the rendering process in Maya, using a student video of molten lava as an example.

"Working with Derick's students helped us work out the kinks in the rendering process with SuperMike-II," said Giaime. "Finding the sweet spot in the middle of functionality and security was an interesting challenge."

"Our main mission at CCT is education and research, but we also want to use our technology as an economic development engine in Louisiana," said CCT's Director Joel Tohline. "The fact that the art students were able to successfully use SuperMike-II as a render farm shows that we can do it, so we invite visual effects companies to partner with us."

By Angela T Harwood
LSU College of Art + Design

NEW HIRES (AUGUST 2013)

On August 15, 2013, CCT hired a new Assistant Director for Economic Development, Randy Dannenberg, who has 12 years of experience in the business aspect of the entertainment industry in Los Angeles where his main responsibility was to bridge the "creatives" with the investors. Our correspondent spoke with Randy to find out how his previous experience in Hollywood will benefit CCT.

Randy Dannenberg
Assistant Director for Economic Development

What is your background?
I was born in New York, but I can't get away with calling myself a New Yorker because my parents moved to Georgia when I was two. I grew up in a small town, then we moved to the suburbs of Atlanta during high school. I obtained my bachelor's degree in business from the University of Georgia in Athens. A few years later, I discovered an interest in film and television production, and enrolled in the Film School at Florida State University. Upon graduation, several of my friends and I got into a car and drove to Los Angeles.

Getting into the entertainment industry is almost like getting into a fraternity. I first started as an assistant for Handprint Entertainment's production division developing projects for clients who included Jennifer Lopez, Nicole Kidman, Michelle Williams and Julia Stiles. After that, I worked for Media 8 on numerous film projects including "Monster," for which Charlize Theron won an Academy Award™, and "Upside of Anger" starring Joan Allen and Kevin Costner.

How will your previous experience benefit CCT?
In many ways, what CCT wants me to do is what I've been doing for the past 12 years: building partnerships between the creative people who write screen plays and business people who want to invest in production. I think the process is very similar and the same skills sets will be useful at CCT when I am building partnerships between academia and business.

What are the skills necessary for this job?
Certainly, networking is the biggest. Meeting people and figuring out how you can help address their needs. It may not be immediate. In other words, I may meet somebody in business who does not have direct correlation to what we are doing at CCT at the time, but years down the road, maybe there is an intersection and an opportunity. So, it's about always looking for the opportunity and keeping people in the back of your mind. When something new comes up on the CCT side, remembering about that company and putting the two together is the key.

Also, negotiating deals is important. Anybody can sit down and say that there is an opportunity for you and I to work together. But there is a difference in recognizing the opportunity and what they call "closing a deal."

From building bridges between "creatives" and financiers in Hollywood to creating connections between CCT and the industry in Baton Rouge.

Why did you decide to shift from the film industry?
Part of it was a personal reason—I wanted to get back to the South: this is where I grew up and lived most of my life. My family is here, and I want to be closer to them. They are in Georgia and Florida, so it will be easier to see them at holidays.

What attracted me at CCT specifically is the breadth of what the center is doing. From Coast to Cosmos, the Material World to digital media. Even though I am not a scientist, I feel like I will be a part of the science and of the knowledge expansion process.

What do you hope to achieve?
I want to make the business community aware of CCT. Once we have a number of deals, success breeds success, and it will be much easier to go to the wider business community to tell our story.

What are your hobbies?
I like playing with computers. I built my own digital media center that hooks to my TV, and it can play music and movies. I like biking. I am very excited about kayaking or canoeing here at the LSU lakes.

How have you transitioned to Louisiana?
Showing up in mid August was a big shock from California weather. The humidity is incredible. I have not lived in the South for 12 years now and got used to the climate in Los Angeles. What I do love about Louisiana already is the food, and if I'm not careful I probably will get fat here. I like the openness of the people. Everybody at CCT has been great at welcoming me.

Jianwei Wang
Geology & Geophysics

Dr. Wang comes from the University of Michigan. His research interests are high performance computer modeling and simulations, applications of quantum chemistry and molecular dynamics in Earth materials. He received a Ph.D. in geochemistry from the University of Illinois at Urbana-Champaign.

Kenneth Lopata
Chemistry

Dr. Lopata's research focuses on plasmon near-field waves and molecule-mediated plasmon transfer. In 2010, he received the first William Wiley Distinguished Postdoctoral Fellowship at the Department of Energy's Environmental Molecular Sciences Laboratory. He received his Ph.D in physical chemistry from UCLA.

R. Clint Whaley
Computer Science

He received his Ph.D from Florida State University in the area of optimizing compilers, and worked at the University of Texas at San Antonio. His research interests include empirical optimization, optimizing compilers, high performance computing, computer architecture and parallel computing.

Revati Kumar
Chemistry

Dr. Kumar comes to LSU from the University of Chicago. Her interests lie in the field of material science, specifically in modeling chemical systems that are relevant to the energy storage sector. She was involved in the study of Li-ion transport in rechargeable batteries to understand the structure and dynamics of Li-ion in the electrolyte. Her Ph.D is in theoretical chemistry from the University of Wisconsin-Madison.

In August 2013, eight new faculty joined LSU in seven different departments because they recognize that the CCT offers a unique and fertile environment in which to nurture their research and creative activities. Some have already secured accounts on SuperMike-II, and all are excited to join us in the Louisiana Digital Media Center.

Edgar Berdahl
Music

Prior to LSU, Dr. Berdahl served as a postdoctoral fellow at the Technical University of Berlin and a lecturer at the Center for Computer Research in Music and Acoustics at Stanford University where he received his Ph.D in Electrical Engineering. He studies the design of embedded media with a particular focus on making digital interactions seem more "analog." He is the first person to teach designers and artists how to prototype using embedded Linux.

William Shelton
Chemical Engineering

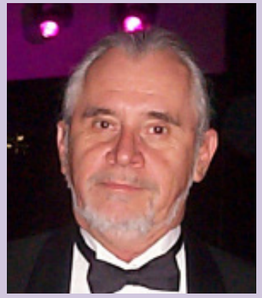
Prior to LSU, Dr. Shelton was the Associate Director of the Environmental Molecular Sciences Laboratory at Pacific Northwest National Laboratory, a U.S. Department of Energy government research laboratory in Richland, WA. He received his Ph.D in theoretical condensed matter physics from the University of Cincinnati. The main body of his work is in the general area of disordered systems, alloy theory and surface science where he has worked on incorporating magnetic and chemical disorder including point defects, such as vacancies and antisites in both materials and chemistry.

Cameron Thrash
Biology

Cameron's primary interests are in investigating the biogeochemical roles of microorganisms in marine systems, using a combination of cultivation-based techniques and high-througput sequencing for a variety of "omics" based approaches. Before joining LSU he had a NSF Postdoctoral Fellowship in Biology researching the genomics and evolution of SAR11 bacterioplankton. His Ph.D. is from UC Berkeley, where his dissertation focused on bioelectrochemical reduction of perchlorate, a major contaminant of groundwater in the United States, isolation of novel perchlorate reducing microorganisms, and side projects involving anaerobic oxidation of iron and uranium.

Mark Wilde
Physics

Before LSU, Dr. Wilde worked at McGill University in Canada. His research interests are in quantum information theory, quantum error correction, quantum computational complexity theory and quantum optics with applications to quantum communication. He is the author of *Quantum Information Theory* published by Cambridge University Press. He received his Ph.D in electrical engineering from the University of Southern California, Los Angeles.



Bill Schuermann
Senior Associate Design Consultant
HFP Acoustical Consultants

How is this facility unique?
It is as state of the art as a theater could possibly be today. I am unaware of any other rooms in North America that have both Meyer Sound full cinema system and Constellation for musical performance and voice lift in one. I don't think there are any.

As far as voice lift, in the United States there are about eight to ten facilities that have a similar system. Stanford and LSU are the only two universities on this list. University of California at San Diego also has a Constellation system, but they don't use it for voice lift, mostly for a music performance.

Steve Ellison, Meyer Sound's applications director for digital products, who is one of the founding fathers of technology upon which Constellation is built, spoke very highly about this building at the annual trade show for the audio/video industry last year. Talking about the Constellation voice lift systems the company did in the past year, he gave three examples: in a concert hall in Moscow, Russia, at a military installation in Hawaii and the third one—at LSU. By the way, he spent the most time talking about the one at LSU as it is not just a Constellation voice lift, but also a cinema and a class room.

What is the significance of the voice lift Constellation system?
It gives the students and the professors the ability to interact better. The theater can seat 200 people, but you can talk as if you were in a small room without a microphone. You don't notice the system when it's on, but you notice it when it we turn it off.

The audio processing required to do the Constellation voice lift is equivalent to a super computer for audio. By the standards of LSU researchers, it's not a supercomputer, but the computation that it's doing within the audio business is as state-of-the-art as you can possibly get.

If you look at a commercial theater, they have standards to adhere to in terms of loud speakers and amplifiers, but the performance of the theater at LSU is on a totally different level. It is above IMAX, which is considered an advanced system.

There are 82 loud speakers and 26 microphones. The theater meets the SIPTY standards and has 7.1 surround sound capability. Not a 5.1, which is the average today, but 7.1. When 9.1 or 32.1 comes around, since we are digitally based, we can reconfigure the system to meet the new standards.

What is special about the theater's 4K system?
Having a 4K theater is not rare any more, and many universities have it. But what is different about the theater here is that most others have a Sony SRX video projector. This is what we were going to have at LSU, but I saw Kristi Digital projector at an expo in Las Vegas two years ago, and realized it was much better. It makes the picture brighter and sharper.

Did you design the recording studio?
cont. on p.7

The wooden pockets in the recording studio's walls and ceiling make the sound warmer. By Robert Kooima.

Stephen Beck
Director of LSU School of Music

Why is this building important to you?
The reason why it is so unique to the music school is because it provides us with some physical spaces we'd never had before for doing experimental work in music and audio.

There are three spaces that are important to us. First, it is the auditorium with its Constellation sound system and more than 80 speakers. We are one of the leading institutes in the world that's experimenting with control systems for large speakers. In order to actually hear the work that we are doing, we need to have a place where we physically bring in all of the speakers to a single space. This costs money and takes time.

In the auditorium, because everything is already built in, we are simply plugging in our control software and are able to have the concert almost immediately. The ability to have that in a controlled space is very unique, and we will be one of the few universities with that kind of theater, which we will use for our research.

The second is the recording studio itself. Part of the first floor has three labs that are connected to one another and are acoustically isolated from anywhere else. Quiet is very important for making high-quality recordings, and we've never had that type of space anywhere on campus.

We currently have recording rooms at the music building, but there is always background noise from ventilation and the elevator. We just did not have the facility that could meet these kinds of specifications. Having a real recording studio complex raises the level of what we can do musically and scientifically.

Third, we now have some lab space where we can build new musical instruments and new musical interfaces. It's right next door to Brygg Ullmer's labs.

The combination of the fabrication lab and the media interaction lab will take us to a higher level of research and creativity. This can be anything from embedded loud speakers to speakers that have computers imbedded inside of them, to programming iOS apps, anything that gives us the opportunity to connect physical gesture, physical manipulation in some type of tangible way to the process of music making. Which is essentially what a musical instrument is, it is a mechanical device that translates physical energy into sound. This part of our research is something that is relatively new to LSU, and it's a growth area in the field of computer music. We are very excited to have these spaces available to us.

cont. from p.6

My specialty is technology, so Coleman Architects worked with Ashton Taylor, HFP's lead acoustician. Dr. Stephen Beck defined the acoustical space he envisioned, and the design team created the studio.

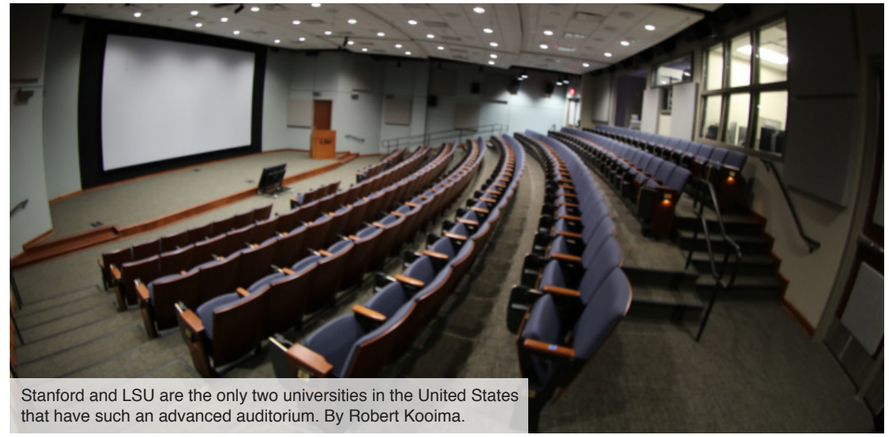
What are the wooden pockets on the walls?
A dead room has no personality. The boxes add natural sounding reflections that give each room its unique sound. They are all different depths. So, when you shoot sound at them, it comes back at different times. It's within milliseconds, but it's still different times. This makes the sound warmer and it does not seem like a small room anymore.

Opposite of those panels is an absorptive panel, which makes sure there is no flutter or echo.

HFP also worked closely with Coleman Architects and MEP Engineering designing the heating, ventilation and air-conditioning system to keep the temperature and humidity in the recording studio quiet and comfortable. We used several tricks, such as using special materials and running the pipes in a certain way, so the air coming through would not add noise.

What about the technology in the classrooms?
We have talked about individual elements, but this place is a system. A flexible system. Take the classroom: you can bring audio and video from anywhere to anywhere. You can record, view, see and share information, do video and teleconferencing, add a secondary location, and all these things are network-based and all shared.

No system is ever complete. Technology changes, and we incorporate the newest trends. I built the platform and now it's the input from CCT's faculty, the staff and students in terms of how they actually will be using it. I will incorporate their suggestions to make the system even better and more useful. I spent three years of my life designing the system, and I will be in touch. What we are doing right now is just a start.



Stanford and LSU are the only two universities in the United States that have such an advanced auditorium. By Robert Kooima.

DID YOU KNOW?

Constellation is a complete solution of equipment and services provided exclusively by Meyer Sound. This groundbreaking technology enables the acoustical properties of a room to be altered to suit the nature of the event taking place. Combining the company's patented algorithm, advanced digital processing, and miniature transducer technology with decades of research into the acoustical attributes of exceptional listening spaces, Constellation provides flexibility unattainable with traditional mechanical methods of variable acoustics, such as movable walls, draperies, orchestra shells, or secondary chambers.

OUR HOBBIES

Gravlaks, one of Stephen Beck's favorite dishes, requires almost a week to make.

In this section, we continue featuring our colleagues, focusing on what they do in their free time. Stephen Beck, CCT's Cultural Computing focus area member and director of the School of Music at LSU, is passionate about cooking. It is a way to get him thinking about something other than work.

How did you develop a special interest in cooking?
When I was in graduate school at UCLA, my composition teacher suggested that I learn how to cook because it would be easier to get musicians to play my music. I really took that to heart. Being able to bring a group of musicians together, feed them, tell them what we are going to play is part of building a community around music making.

What cuisines do you prefer?
When I cook for fun, I revert to Louisiana, French, and Italian dishes. I lived in Paris for a year and enjoy French food, but I also like the whole philosophy of Italian food when you take the freshest ingredients and concentrate the flavors.

Did you cook much in France?
I had a Fulbright grant in Paris for a year studying computer music while working on my PhD, but I did not have time to prepare meals, nor did I have a kitchen. What I learned there is the value of cooking. Paris was a transformative place for me musically, scientifically, computationally and culturally.

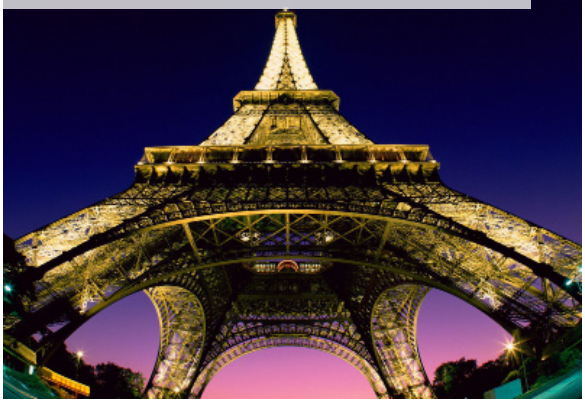
What do you like about Louisiana food?
It just tastes great. It's about building flavors by bringing ingredients together and letting them simmer. It's also about sharing with others, which I like. You can not make a small amount of red beans, jambalaya or gumbo, it's just impossible.

Do you feed Louisiana food to your family in other parts of the country?
I am originally from California and still have family there, while my wife's family is on the East Coast, so we live a tri-coastal life. I once made the mistake of proposing to my wife's family that you could make a cocktail sauce that you might have in Louisiana with shrimp and have it with lobster. In Massachusetts, the only thing you eat lobster with is lemon. So, I was considered a lobster heretic for a while.

What dish takes the longest to prepare?
Gravlaks requires almost a week. You get a fresh piece of salmon, skin it, clean it and bone it. Then get a mixture of salt, sugar and spices, rub it into the fish, wrap it up and put in the refrigerator for three days under weight. Pull it out, flip it over and put it back in the fridge for another three days. Then you slice the fish very thin, and it is great on bread or toast.

Where do you shop for groceries?
While living in Paris, I learned that you go to the place where you can get the freshest ingredients. I often go to the farmer's market and get inspired by what I see there. That's probably my biggest downfall is that I shop for food too much. I don't buy a lot, but I go often.

Paris is the place Steve learned the value of cooking.



Did you pass along your passion to your children?
I have a daughter and a son. My daughter is starting to do her own cooking, and for my birthday, she made blintzes from scratch, which I don't even think I've ever done. She definitely surprised me.

Your advice to a beginner cook?
You need good knives, good pans and patience.

PATS ON THE BACK

cont. from p.1

Robert Kooima received $10,000 from Adler Planetarium for "LROC: Lunar Reconnaissance Orbiter Camera."

Peter Diener and **Frank Löffler** received $125,997 from NSF for "Self-Consistent Evolution of Extreme Mass Ratio Inspirals."

Jorge Pullin received $360,000 from NSF for "The dynamics of quantum gravity: symmetry reduced models."

Graduate student Madhavi Divakar Rajathadripura, who works under the supervision of Theda Daniels-Race, presented a poster entitled "Characterization of surface morphology of biopolymer coated substrates using non-contact atomic force microscopy" at the 16th International Conference on Non-Contact Atomic Force Microscopy held in Maryland this year.

Congratulations to all!

Louisiana State University
Center for Computation & Technology

Inside CCT

Monthly newsletter for internal use

Comments?
Story ideas?
Contact CCT's Communication Manager Tatiana Johnson at tjohnson@cct.lsu.edu

LOVE PURPLE
LIVE GOLD