COMPONENTS

CENTER FOR COMPUTATION & TECHNOLOGY

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LSU

LSU CENTER FOR COMPUTATION & TECHNOLOGY

Components
Volume 7

LSU Center for Computation & Technology is an interdisciplinary research center that advances the University's Flagship Agenda and promotes economic development for the state by using computational science applications to aid research and develop solutions that benefit academia and industry. CCT is an innovative research environment, advancing computational sciences, technologies, and the disciplines they touch. Researchers at the CCT use the advanced cyberinfrastructure – high-speed networks, high-performance computing, data storage and analysis, and hardware and software development – available on campus to enable research in many different fields. By uniting researchers from diverse disciplines, ideas and expertise are disseminated across LSU departments to foster knowledge and invention.

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MESSAGE FROM CCT DIRECTOR

CCT celebrates its 10-Year Anniversary this year. The stories you will read in this volume of *Components* illustrate areas of research in which the CCT has developed recognized excellence and also highlight the integration of students in all aspects of the center's research activities. A recurring theme is the effective utilization of modern cyber-infrastructure to solve complex problems and to explore new channels of creativity. Another is the timely engagement of students of all ages in rapidly advancing elements of the information technology arena.

Twenty-five faculty members at LSU presently hold joint appointments between the CCT and a home academic department where tenure resides. These appointments span ten departments and five separate colleges. In addition, our growth continues to abound as the number of faculty, staff, and students affiliated with the center reaches nearly 200.

Being nationally and internationally recognized experts in their respective fields, the CCT's faculty and research staff lead collaborative projects that cut across the University's traditional disciplinary boundaries and extend to faculty and research groups from many universities across Louisiana. Because of CCT's uniqueness, we expect to generate many more exciting projects, connecting IT and interdisciplinary applications to academia, government, and industry in areas such as materials science, biology, chemistry, astrophysics, game design, and high performance computing.

The CCT has become an important component of Louisiana's economic development engine, especially as it relates to the digital media industry. Through a new undergraduate digital media minor, students have an opportunity to incorporate their artistic or technical talents into their major area of study, no matter what it might be, and to hone their collaborative skills in an environment similar to game-design studios. The center's collaborative interactions with the video-game development industry are certain to expand when we move into the Louisiana Digital Media Center—the new building we broke ground on this summer—and share its space with Electronic Arts' North American Test Center.

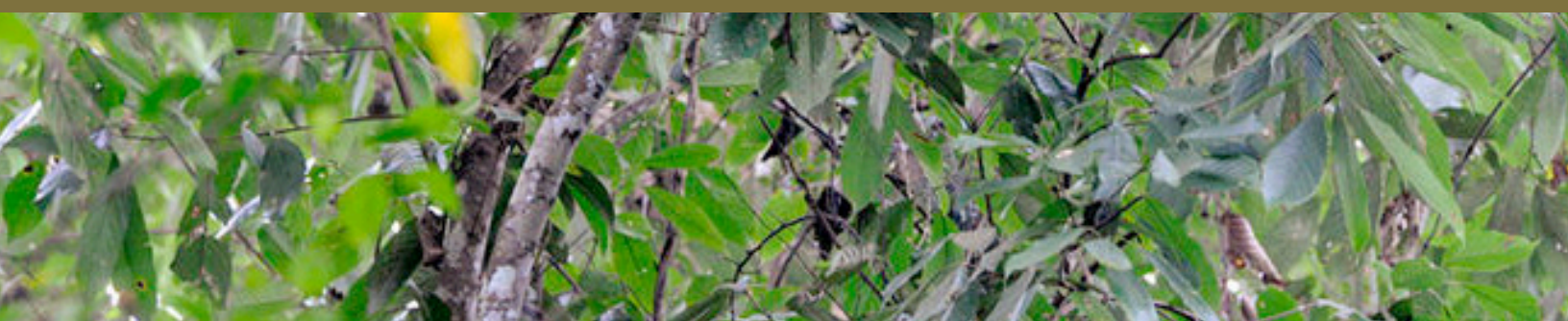
The CCT's mission and activities continue to draw the attention of, and visible support from, local and state leadership. We are especially appreciative of the strong backing that we continue to receive from LSU's administration as the University strives to maintain excellence during tough budget years. The future is even brighter than the present.

As the new director of this vibrant and innovative center, it is my privilege to be leading CCT into the next exciting era.

Joel E. Tohline, Ph.D.
Director

Photo Credit: Eddy Perez, LSU

Research



A Material World:

LSU Materials Group Lands Major Grant

With technology driving the global economy, the workforce and our day-to-day lives, many believe that materials science – the study and design of custom materials with task-specific properties – is the key to our future. In light of this, LSU has made materials science a focus of interdisciplinary study on campus for several years, and, recently, researchers' efforts were paid back by the millions.

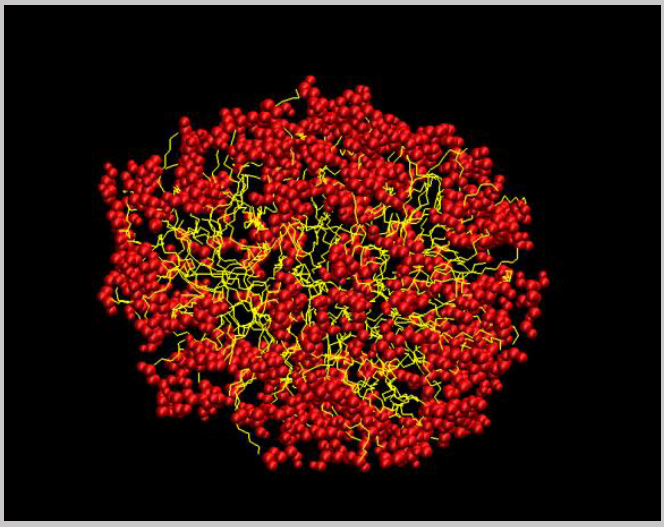
Faculty at LSU, together with scientists at universities across Louisiana, received one of the state's largest ever grants from the National Science Foundation, or NSF, to form the Louisiana Alliance for Simulation-Guided Materials Applications, or LA-SiGMA. Participants include more than 23 faculty members at LSU, spanning the Departments of Physics & Astronomy, Chemistry, Mathematics, Mechanical Engineering, Biological and Agricultural Engineering and the Center for Computation & Technology, or CCT. Led by LSU Professors Mark Jarrell of the Department of Physics & Astronomy and Randall Hall of the Department of Chemistry, along with Louisiana Tech University Chemistry Professor Ramu Ramachandran and Tulane Chemical and Biomolecular Engineering Professor Lawrence Pratt, the Alliance includes researchers from LSU, Louisiana Tech University, UNO, Tulane, Xavier, Southern University, and Grambling State University to combine experimental, theoretical, and computational approaches to studying three designated "science driver" areas: electronic, energy, and biomolecular materials.

"Individual Louisiana institutions do not have a critical mass of researchers to address the challenges described in the proposal," said Hall. "LA-SiGMA will build this critical mass by supporting collaborations between scientists and engineers at different institutions through shared graduate students and courses. A confluence of experimental and computational facilities, together with directed intellectual collaboration, will allow LA-SiGMA to have a transformational effect on materials science in Louisiana."

LA-SiGMA capitalizes on the state's cyber-infrastructure such as LONI, or the Louisiana Optical Network Initiative, a state-of-the-art fiber optics network connecting Louisiana and Mississippi universities to each other as well as to the National Lambda Rail and Internet2. Computational scientists will play an integral role by developing new computational tools and helping researchers migrate existing computer programs to the next generation of computers.

"The formation of LA-SiGMA through the support of this NSF EPSCoR grant will enable Louisiana to position itself to transform research and education in computational materials science, a relatively young field," says Michael Khonsari, LSU Dow Chemical Endowed Chair and Professor of Mechanical Engineering and director of Louisiana's EPSCoR program. "The alliance, which will include more than 100 faculty, postdoctoral researchers, and students, will be sustained by collaborations involving shared students and postdoctoral researchers, interdisciplinary programs in computational materials, and shared courses taught via HD video."

Program objectives include building the next generation of experimentally validated formalisms, algorithms, and codes for multi-scale materials simulations; implementation on present and next generation supercomputers; and



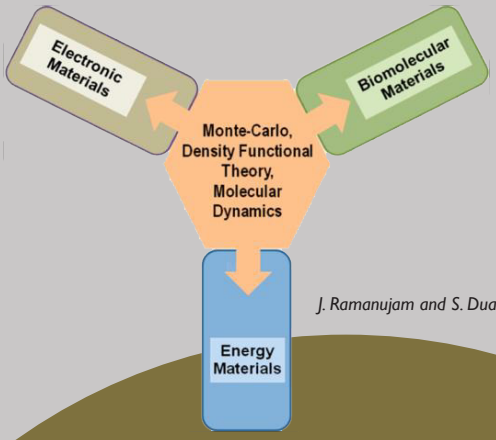
Self-assembly of Span 80 into a single micelle.
J. Lin, K. Xia, R. Kumuditha, B. Thakur, B. Novak, D. Moldovan, C. Sabliov, H. Ashbaugh

educating the next generation of a highly skilled workforce of materials scientists and engineers. The group has made significant progress toward these objectives. In fact, during the summer of 2011, LA-SiGMA and CCT hosted more than 20 undergraduate and high school students at LSU in a Research Experience for Undergraduates, or REU, program, offering the opportunity for a cutting-edge research experience with LSU faculty.

The REU student teams worked on projects focusing on everything from enhancing drug delivery systems to developing better methods of hydrogen storage. The Alliance funded three teachers from the Louisiana School for Math, Science, and the Arts to learn about high performance computing and to develop computing modules for their courses. LA-SiGMA also supported three high school teachers participating in LSU's LAMSTI program, a three-year program bringing high school teachers to study at LSU, enrich their teaching skills, and earn a Master's of Natural Science degree. These teachers worked with faculty to develop stronger methodology for incorporating high-performance computing into high school math, science, engineering, and technology classes.

"Together, LONI Institute and LA-SiGMA form an incredibly powerful and perhaps unique support network for computational materials and biological sciences. The LONI Institute provided funds to hire 12 faculty throughout the state in computational materials and biological sciences as well as a support staff of computational scientists," said Jarrell. "LA-SiGMA builds upon this structure with $20 million in funding to support these scientists and others and build a critical mass of researchers in these areas. Together, these resources will establish Louisiana as an internationally recognized leader in computational materials and biology and allow us to pursue resources needed to establish the first federally funded center of excellence in the state."

To learn more about LA-SiGMA, visit http://lasigma.loni.org



J. Ramanujam and S. Dua

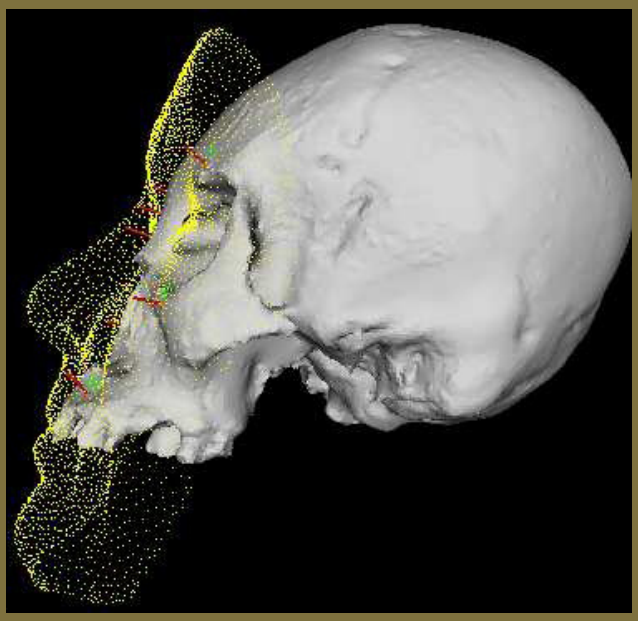
Elements of LA-SIGMA Include:

- An education plan that includes new materials science graduate courses delivered across the state;
- Well-developed relationships between research universities, two-year colleges, and the K-12 community through ongoing outreach efforts;
- Strong partnerships between Historically Black Colleges and Universities, or HBCUs, two-year colleges, and other universities in the state;
- Involvement of predominantly undergraduate institutions as partners in research;
- A team focused on training students and researchers to fully utilize the next generation cyberinfrastructure;
- Multifaceted diversity, workforce development, and external engagement plans including relationships with industries through researchers, industry liaisons, and the state EPSCoR committee; and
- Rigorous evaluation and assessment by an external evaluator and feed back through an external review board to ensure that goals and objectives of the project are met.

LA-SiGMA

Louisiana Alliance for Simulation-Guided Materials Applications

Computer-Aided Forensic Facial Reconstruction



For forensic law enforcement, facial reconstruction from skeletal remains plays an important role in identification of the dead where post-mortem deterioration makes it difficult.

Xin Li, assistant professor of the LSU Department of Electrical & Computer Engineering and Center for Computation & Technology, has received $10,000 from the Louisiana Board of Regents to develop new methods for computer-aided facial modeling and reconstruction, in collaboration with Mary Manhein and her group from the LSU FACES Lab (Forensic Anthropology & Computer Enhancement Services), and Warren Waggenspack, associate professor of the LSU Department of Mechanical Engineering. Li's proposal is titled "Surface and volumetric matching for forensic facial reconstruction from incomplete skulls."

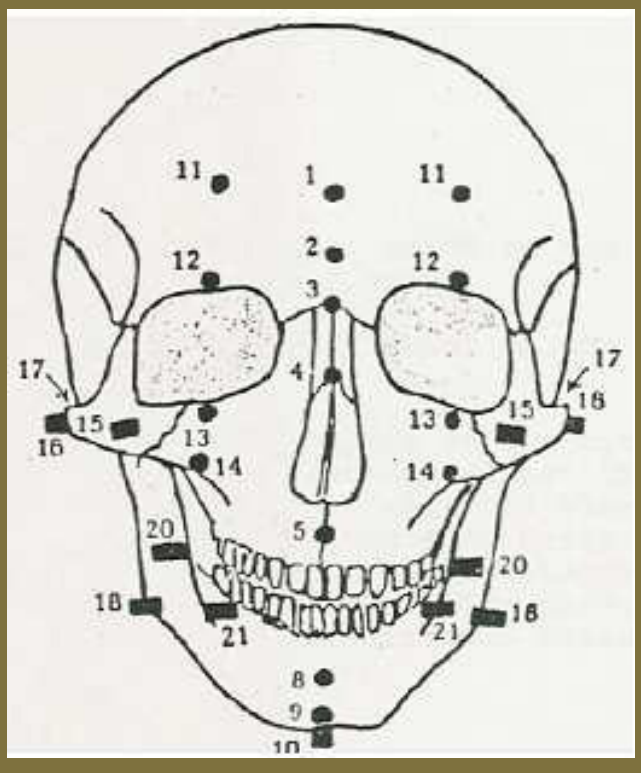
As a nationally renowned center for facial reconstruction, the LSU FACES Lab has reported that currently one skull reconstruction usually takes an experienced and skillful specialist on average two weeks to finish. The-state-of-the art facial reconstruction is conducted on skulls manually using clay.

Furthermore, when the input skull data are incomplete, direct manual reconstruction becomes much harder. While manual methods remain of great interest for forensic identification, it is imperative to develop new computerized digital methods, which are also well justified by their rapidity and the decrease in subjectivity.

"New 3D data acquisition hardware allows precious models to be digitized accurately," said Xin Li. "Our plan is to develop novel data modeling and processing algorithms so that shapes can be analyzed, edited, and synthesized for various scientific tasks within the digital environment, while reducing manual labor, time, and costs tremendously."

"By creating a unified digital forensic craniofacial reconstruction framework that integrates domain knowledge from specialists such as anthropologists, pathologists, and odontologists, three challenging problems can be solved – automation of skull assembly from fragile fragments, repair of damaged and incomplete skull models while preserving substrate details, and muscle/skin placement based on tissue depths," said Li.

Computer scientists and experienced forensic anthropologists will closely collaborate in this project to evaluate the effectiveness of this data modeling paradigm in completing facial reconstructions and advocate the smooth transition from current manual reconstruction approaches to digital methodologies.



Coast-to-Cosmos

(C2C) Receives $1.35 Million to Develop the Coastal Hazards Collaboratory in the Northern Gulf Coast

Researchers in Louisiana, Mississippi, and Alabama are leveraging their unique partnerships, proximity, and significant prior investments in cyberinfrastructure to advance science and engineering of coastal hazards of the northern coast of the Gulf of Mexico.

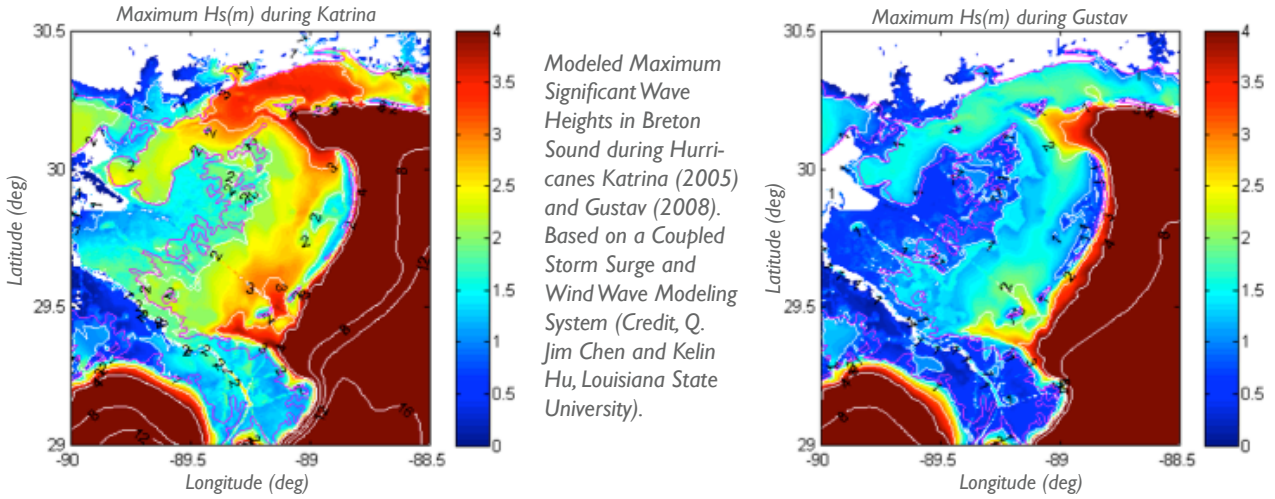
Funded by the National Science Foundation, or NSF, this consortium, called the Northern Gulf Coastal Hazards Collaboratory, or NG-CHC, has recently formed to advance economic opportunities for citizens by reducing risks to coastal vulnerabilities; catalyze collaborative research via enhanced cyberinfrastructure that will potentially address problems such as engineering design, coastal system response, and risk management of coastal hazards; and enhance the research competitiveness of the Gulf region.

The LSU co-principal investigators of the NG-CHC are Q. Jim Chen, head of the focus area, Coast to Cosmos (C2C), at LSU's Center for Computation & Technology (CCT) and professor of LSU's Department of Civil and Environmental Engineering (CEE); Honggao Liu, deputy director of CCT; Steven Brandt, IT consultant at CCT and adjunct professor of computer science; and Patrick Hesp, professor of geography and anthropology. The LSU research team also includes Jian Tao, IT consultant and research scientist in CCT; Kelin Hu and Haihong Zhao, post-doctoral researchers in the CEE department; Carola Kaiser, IT analyst and GIS specialist in the School of the Coast & Environment and CCT; and graduate students.

The northern Gulf Coast is essential to the sustainability of economically important coastal fisheries, marine transportation, energy development, and national defense. The NG-CHC has the opportunity to capitalize on strong cyberinfrastructure and current coastal hazards research infrastructure to address issues of national importance regarding the sustainability of the Gulf Coast. The challenge is to develop a framework and strategies for organizing the region's resources in a manner that transcends state line boundaries.

Current investments include high-bandwidth optical networks, HPC systems, large data storage, data archives, middleware, visualization resources, and connections to national research networks including the National LambdaRail and Internet2. The NG-CHC will broaden and strengthen these cyberinfrastructure resources to include training for the next generation of researchers.

More specifically, cyberinfrastructure tools and services need to work with computationally demanding models and vast observational data sets. The new collaboratory



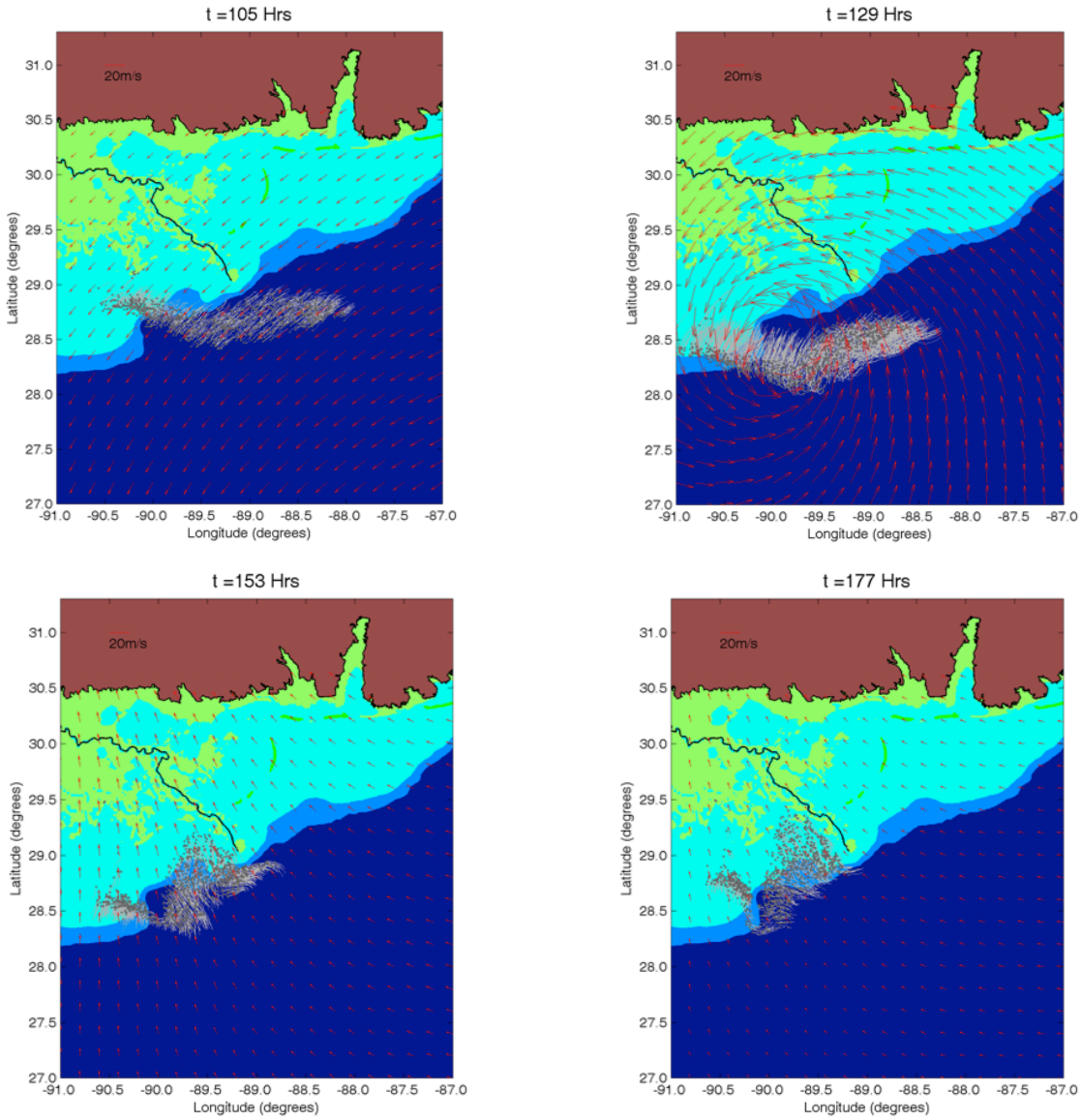
Modeled Maximum Significant Wave Heights in Breton Sound during Hurricanes Katrina (2005) and Gustav (2008). Based on a Coupled Storm Surge and Wind Wave Modeling System (Credit, Q. Jim Chen and Kelin Hu, Louisiana State University).

will create cyberinfrastructure tools and services and demonstrate three modeling environments that allow scientists to access and use data from observational data systems located at universities, government agencies, and private industries in the northern Gulf Coast.

For example, one of the grand challenges for earth system science is to characterize dynamic environmental processes at appropriate space and time scales with integrated observation networks and models. Even with the current high-capacity cyberinfrastructure, this region lacks a system to integrate these data inventories into information and knowledge that will reduce risks to coastal hazards. The challenge includes the ability to couple models, invoke dynamic algorithms based on streams of sensor and satellite data, locate appropriate data and computational resources, create necessary workflows associated with different simulation demands, and provide visualization tools for analysis of results.

"LSU has made significant progress in the development of this Coastal Hazards Collaboratory, a consortium of 10 universities in the Gulf region," said Chen. "Robert Twilley, a former LSU professor of oceanography and coastal sciences, has chaired the executive council for this three-state consortium. Close collaborations among coastal engineers, earth system scientists, and computer scientists are key to the success of this project."

One of the NG-CHC research highlights is the Advanced Surge Guidance System (ASGS), a multi-state coastal modeling research and development effort providing operational advisory services related to impending hurricane events. Based on the Advanced Circulation and Storm Surge model (ADCIRC) coupled with the SWAN wave model, the ASGS is a sophisticated software package that ties up software programming, numerical analysis, coastal engineering, high performance computing, and a dynamic Web interface to generate storm surge guidance for ap-



Snapshots of modeled oil transport driven by a hypothetical land falling hurricane near the Mississippi River delta. Gray: oils from the BP Deepwater Horizon oil spill; red arrows: hurricane wind field; dark blue: deep water; light blue: shallow water; black line: Mississippi River (Credit, Q. Jim Chen Haihong Zhao and Jian Tao, Louisiana State University).

proaching hurricanes. During Hurricane Irene (2011) that impacted the East Coast from North Carolina to Vermont, ASGS received tremendous attention from federal and state agencies and residents of those impacted states.

"During the last days before landfall of Hurricane Irene, there were more than 3,000 visits to the ASGS Website each day" said Kaiser. Kaiser is the key developer of the CERA (Coastal Emergency Risks Assessment) Google Maps-based interactive Web interface (http://nc-cera.renci.org) for the ASGS. She works in close collaboration with the University of Louisiana at Lafayette and the University of North Carolina at Chapel Hill. Next year, the ASGS effort will be extended to Mississippi and Alabama, in addition to south Louisiana.

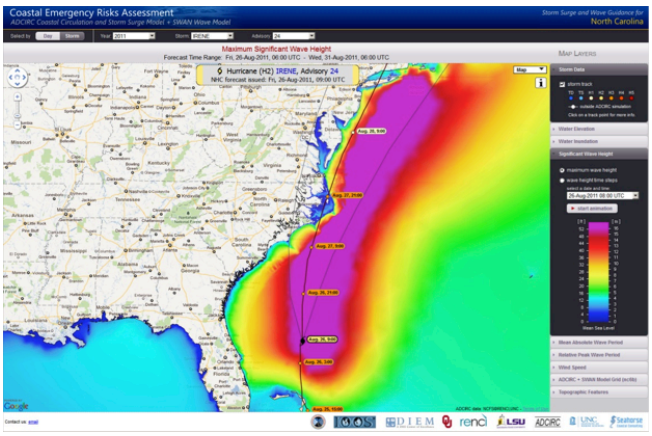
Other significant progress at LSU includes the implementation of a state-of-the-art computer model with an improved asymmetric hurricane surface wind module.

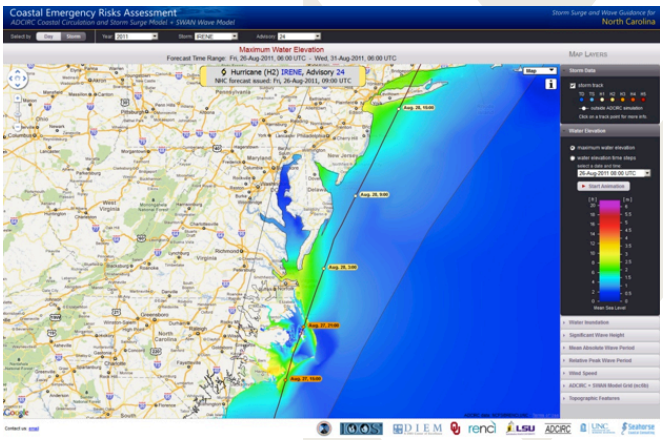
It is used for simulations of nonlinear waves and storm surges in the HPC computational framework, Cactus, and was developed in collaboration with the University of Delaware. A prototype of Coastal Data Factory for storm surge data archival, retrieval, and analysis is also in development.

"With these NSF investments, the existing computational and research capabilities of Louisiana will significantly improve, and the ability to collaborate with other researchers in the northern Gulf Coast region will be enhanced," said Liu. "It's so vitally important for our state – protecting the coast means protecting Louisiana's economy and national economic output."

Q. Jim Chen

LSU co-Principal Investigator of the Northern Gulf Coastal Hazards Collaboratory





Forecasts of maximum significant wave height (left) and maximum water level (right) based on NHC Advisory 24 of Hurricane Irene (2011) and the ASGS output (Credit, Carola Kaiser, Louisiana State University, and Robert Twilley, University of Louisiana at Lafayette).

Kinect Virtual Reality

One Step Closer to the Real Thing

Since the introduction of high-definition LCD televisions, large high-resolution displays have become reasonably inexpensive, and TVs with over two million pixels and sizes of 50 inches and larger are common in the home. But despite these devices' large sizes and sharp images, the realness of the image shown on a TV falls far short of even the simple experience of looking out a window.

Why? First, we have two eyes, which normally receive slightly different images, allowing us to judge distances and perceive depth. Second, our ability to move about near a window allows us to "look around." We move close to the window to see more, and we move side-to-side to get a better view. This first capability, stereoscopic 3D, is now commonplace in the movie theater and an increasingly inexpensive option on new TVs. This second capability is more interesting.

At the LSU Center for Computation & Technology (CCT), Assistant Professor Robert Kooima and his group have produced this effect by combining common, inexpensive, off-the-shelf technologies. A Panasonic 58-inch 3D plasma TV provides the stereoscopy. A Microsoft Kinect, disconnected from its X-Box 360 and connected instead to an ordinary workstation computer, provides the "look around." The Kinect is a depth camera. It records high-resolution distance measurements rather than colors. Given these distances, a software package called OpenNI extracts images of the people in the room and analyzes these images to determine the positions of their bodies, arms, legs, hands, and heads. Results from this analysis are used to compute the positions of the users' eyes, and an interactive 3D stereoscopic image from that perspective can then be rendered.

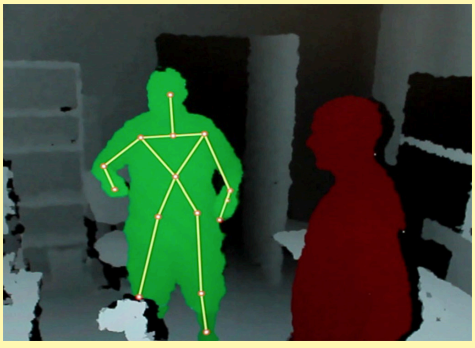


Image (left) shows the depth and functionality of the Kinect VR.

The combination of 3D imaging and user-centered perspective is greater than the sum of its parts, and the experience of using this system is surprising.

"The applications of this technique are extremely broad," said Kooima. "Interactive scientific visualization at the LSU CCT benefits directly from the improved realness of the rendered image, and these benefits apply regardless of field or subject matter. We've applied it to astrophysical simulation visualization and X-ray tomography, and we've even used stereo rendering in our video game design and computer graphics courses."

Of course, despite this work, there are many ways in which viewing a display screen falls short of normal vision. The contrast and brightness of modern TVs cannot approach the range of light intensities that we perceive. Also, the varying focus of our eyes, which gives our brains subtle clues as to distances and sizes, is not exercised when our eyes are focused only upon the plane of the TV. These issues, and others, will be addressed in the future as display technology improves, and researchers at CCT will be taking the lead in applying these advances to scientific research and education.

1 2

3 4

Images (above) show examples of the Kinect Virtual Reality research. The image on the display appears to be attached to the room rather than to the TV. As you move about, you perceive that you are moving around the displayed scene. The image becomes an extension of the room in which you stand, connected at the rectangular frame of the screen, rather than being a separate scene detached from reality by the display plane. This effect enhances the illusion that the displayed objects are 3D, solid, and separate from the display. Their presence and realness are astonishing.

Biological Sciences, Computer Science, and CCT Collaboration Reaches Nature Cover

To view the full article which appeared in Nature, *visit: http://www.nature.com/nature/journal/v469/n7331/full/nature09687html?sf1012566=1*

The cover article for the January 2011 issue of the prestigious journal *Nature* featured research by LSU Boyd Professor Mark Batzer, Research Asst. Prof. Miriam Konkel, Jerilyn Walker (all from LSU's Department of Biological Sciences); Assoc. Prof. Brygg Ullmer (of the Department of Computer Science and the Center for Computation & Technology, or CCT); and 97 co-authors from across the globe. Following earlier *Science* cover articles by the LSU team and collaborators in 2007, the *Nature* article reported the results of analyses of data gathered during a four-year project that investigated the orangutan genome.

Orangutans are the only great apes that are arboreal and solely endemic to Southeast Asia. Their habitat is currently restricted to Sumatra and Borneo. Primarily due to habitat loss, Bornean orangutans are considered endangered species, and Sumatran orangutans are even considered a critically endangered species. Orangutans are the world's largest tree-dwelling animal, yet, amidst their leafy activities, their bodies consume proportionally less energy than almost any other mammal (and far less so than humans).

Of interest to the LSU team were the mobile element content and composition of the orangutan's genome and the comparison of this composition to the genomes of humans and other primates.

Unfamiliar with mobile elements? Perhaps surprisingly, little more than one percent of human DNA actually codes for our proteins. About half of our DNA is still considered dark matter, whose nature is poorly understood. Most of the remaining half is composed of mobile elements. The comparative study of how these mobile elements have accumulated and evolved over many millions of years has proved crucially significant toward helping scientists understand both our own genomes and those of our extended relations spanning the kingdom of life.

After earlier experiences with both wet-bench and supercomputing analyses of the rhesus macaque and other genomes, the LSU team initially anticipated the orangutan genome analysis could be a relatively straightforward task. After all, the overall repeat content and mobilization rates were shown to be remarkably similar among the three previously sequenced and analyzed primate genomes. But after a promising start, the team found themselves in an unforgiving jungle.

"We kept combing through orangutan genomes for Alu elements (a particular kind of mobile element) specific to orangutans, and we just couldn't find anywhere near as many as expected," said Ullmer. "Initially, we were sure there must be a problem in our code, but – Miriam and I just couldn't find the bug." So it was a relief when a collaborating team came up with very similar results. As reported in the *Nature* publication, "Surprisingly, Alu elements were relatively quiescent, with only 250 recent insertions identified by computational and laboratory approaches, where thousands were initially expected. It is tempting to propose a correlation between reduced Alu retroposition and the greater structural stability of the orangutan genome."

Analysis of the tremendous amount of data generated by this study would have been impossible without the supercomputers and associated expertise provided by LSU CCT and LONI (Louisiana Optical Network Initiative). For example, the orangutan effort was the first primate genome project that also included second-generation sequencing technology. Using tools such as LSU's Illumina sequencer, a single several-day sequencing analysis can identify tens of millions of short (e.g., 50-letter) DNA sequences. Making sense of these vast tangles is a profound challenge that is only beginning to be tackled by LSU and global scientists. Ullmer, Konkel, Batzer, and their colleagues hope new interactive computational tools will increasingly provide crucial support in untangling these Gordian knots, weaving new tapestries of meaning. For, whether their owners engage trees and rivers with hands or tails, every genome tells a unique tale.

Outreach

LSU CCT iOS Training

for Growing Mobile Application Market Spurs Student Company

As smartphone functionality continues to develop, it's safe to say that the demand for qualified app programmers will create the newest, hottest job market for college graduates.

The LSU Center for Computation & Technology (CCT), in an effort to introduce students to this exciting new IT profession, hosted a two-week summer camp to train LSU students in iOS application development, entrepreneurial tips, and hands-on mobile computing knowledge. Fifty-eight students representing 28 different LSU degree majors attended the camp.

A first of its kind at LSU, the bootcamp targeted the transition from portable, medium-scale computing to mobile computing, a change that is inevitable with new technology development. Instruction for the camp was engineered by both GeniusPort, an App training company, and CCT personnel.

"Students need awareness and education in the mobile computing arena so they can be prepared for this transformation," said Ravi Paruchuri, organizer of the camp and LSU CCT assistant director of research and advanced computing.

Participants of the camp were very enthusiastic and by the end of the camp produced some great projects. A few students built on the knowledge gained at the bootcamp to form their own company.

"iOS Boot Camp was great because it provided us with a practical working knowledge of the concepts that we went on to use for No App.ologies, LLC," said Rebecca Pearson. "Our company was especially inspired by the effectiveness of small teams in enhancing creativity and developing apps."

No App.ologies, LLC, created by Timmy Meighan (CEO) and Rebecca Pearson (COO), both students in the LSU College of Humanities and Social Sciences, was designed to create original iPhone apps that will allow students central accessibility to the knowledge and resources they want, whether it be through a textbook or hands-on instruction. Other members of the company are James Ramsey IV, LSU student in the College of Engineering, and Derrick Hoenig, a graduate of the University of Central Florida, with experience in graphic design, who will provide an artistic vision.

No App.ologies is currently developing two apps. One is for a local high school's National Honor Society to help in the development of a tourism app. For the second app, they are teaming up with an LSU organization to create a positive economic impact on the lives of those living on and around campus. They aim to have these completed by December, with a third one underway.

To continue with the excitement of the camp's instruction, CCT has created the Mobile App | Art | Action Group, or MAG, led by Jesse Allison, camp co-organizer and LSU assistant professor of experimental music and digital media in the School of Music and CCT. This group is not limited by mobile platform, application area, or area of interest. Participants of MAG come together to share their progress, receive feedback and help, connect with others, and get inspired to try innovative things with mobile computing.

"Attending the iOS Bootcamp served as the first source of formal training for our primary team members," said Pearson. "We look forward to maintaining our relationship with the iOS Boot Camp organizers and continuing our education by attending the Mobile Apps Group Meetings at LSU."

"Development for this computing platform engages business people; graphic, interaction, and game designers; musicians; engineers; social media practitioners; marketing and advertising specialists; and even a few programmers," said Allison. "I'm excited about the future of this endeavor—exploring new modes of engagement in mobile programming and mobile environments, as the platform reaches an incredible variety of students,

potential fields of application, and relevance in a changing digital landscape."

The MAG encourages participation from students, faculty, and professionals, as well as industry representatives. More information about MAG can be received by joining the mag-announce and mag-discuss mailing lists; just email anything to mag-announce-join@cct.lsu.edu and mag-discuss-join@cct.lsu.edu. Mag-announce is used to distribute information on upcoming meetings and relevant campus and community events while mag-discuss is a more informal place for the community to ask questions, post interesting developments, and find collaborators.

"CCT faculty, staff, and student research assistants have developed novel applications of mobile computing—and even new mobile computing hardware platforms—for a number of years within research labs and LSU classrooms," said Brygg Ullmer, associate professor of the LSU Department of Computer Science and CCT, and also a camp co-organizer. "Many of these efforts have been under the umbrella of LSU's Arts, Visualization, Advanced Technologies, and Research program, or AVATAR/ digital media efforts, with support from both state and federal research grants."

With MAG, CCT intends to empower students, staff, and faculty to become part of this technology shift. MAG focuses on all the available platforms to deliver mobile computing and also is exploring ways of introducing its participants to multiple platforms and providing training in how to use them.

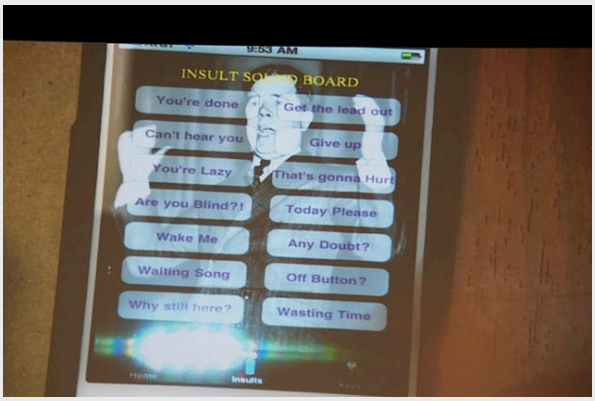
The iOS applications bootcamp is one way CCT is engaging broader audiences, cultivating enthusiasm, engagement, and economic and workforce development across the full landscape of academic and professional disciplines.

"App development has a huge growth potential," said Joel E. Tohline, director of the LSU CCT. "Imagine how courses across the University might be transformed and the entrepreneurial spirit of students enhanced if every LSU freshman arrived on campus with the ability to develop their own iOS app."

Ubiquitous computing is here, and now is an exciting time for exploring and creating new ways to use mobile applications.

More information on No App.ologies can be viewed at: noapp-ologies.com.

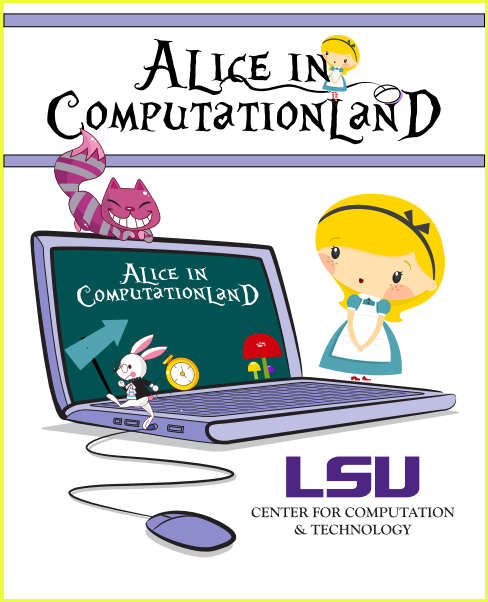
Images (above and below) are examples of group app projects created during the camp.



(Image): iOS camp attendees included 58 LSU students, representing 28 different LSU degree majors

Alice in Computation Land

Camp Launched to Address STEM Demand



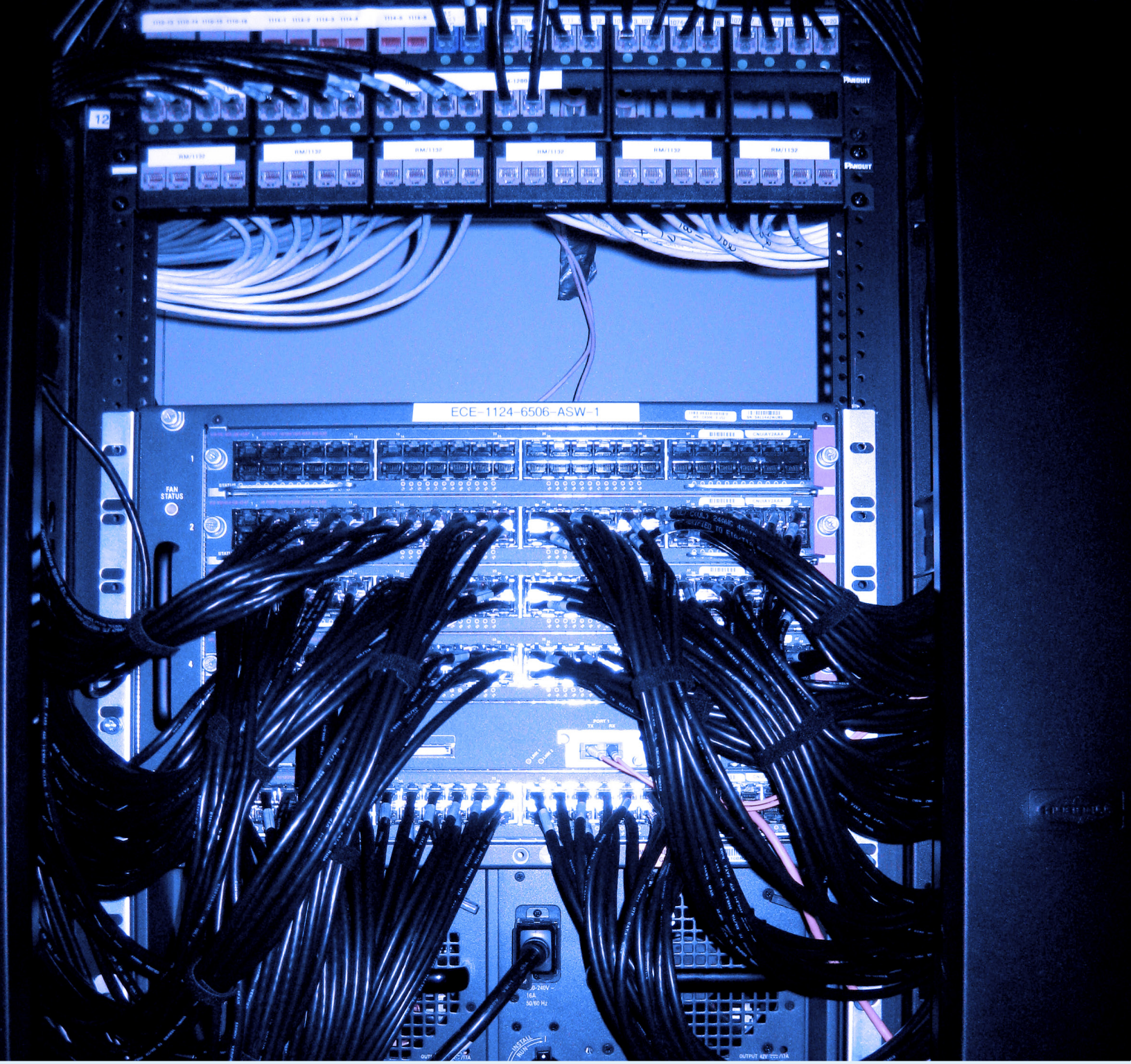
The Center for Computation & Technology, or CCT, launched a new summer camp titled "Alice in Computation Land," to motivate and engage girls in grades six through eight in Baton Rouge and the surrounding area in STEM (science, technology, engineering, and mathematics) programs. The camp received such an overwhelming response that two sessions were created.

The two groups of camp participants learned how to use a computer and various applications in their everyday lives. Students were introduced to computational science techniques such as modeling and simulations. They also received training in Webpage design and iMovie and Flash software. Camp participants simulated forest fires, modeled populations of frogs and nutria, and discussed how animated games and videos were created. In addition, training and career opportunities were highlighted to encourage these young women to explore a career in one of the STEM disciplines.

"I am excited to be working with so many young women," said Kathy Traxler, camp instructor and CCT's education and outreach specialist. "One goal of this workshop is to interest these young ladies in the sciences and technology so they will consider a STEM discipline for their careers. But the main objectives of the workshop are to have fun while learning in a college atmosphere and to promote higher education."

The Alice in Computation Land camp was sponsored by the LSU CCT and is listed as a program of the National Girls Collaborative Project, a consortium for advancing the agenda in gender equity for science, technology, engineering, and mathematics. In addition, the camp is included in the Computer Science Collaboration Project, which specifically focuses on outreach to women and minorities.

"Computational skills that are acquired at a young age will serve students well as they prepare for the challenges of high school, college, and real-world careers," said Joel E. Tohline, CCT's director. "While developing solid computational skills, students will necessarily also hone their skills in mathematics and logic. Providing an opportunity for young women to master such skills in a creative and fun environment will make it more likely that they will pursue careers in technical fields such as science and engineering. This is particularly important because, in the U.S., women are traditionally underrepresented in these areas of the workforce."



Cyberinfrastructure

LSU Receives $2 Million Grant for Campus Network Advancing Discovery

A nearly $2 million grant from the National Science Foundation, or NSF, will take LSU's research-enabling network infrastructure to a level of capability available only at the most elite research labs and institutions in the world.

The grant, titled BIPAS, or Bifurcated Infrastructure Promoting the Advance of Science: Revitalizing LSU's Data Network Infrastructure, will enhance LSU's high-speed data communication network, better enabling it to handle very large amounts of data flow critical to researchers across a variety of disciplines. The grant comes to LSU as part of the NSF's Academic Research Infrastructure Program: Recovery & Reinvestment.

With the NSF funding, LSU will be able to extend the benefits of its very high-speed research connectivity from the Louisiana Optical Network Initiative, or LONI, and national cyber-backbones – like Internet2 – deep into the campus infrastructure that serves research labs and classrooms. Additionally, LSU will be able to provide on-demand increases in connectivity in response to future classroom and research needs.

With significant investments in upgrading the core campus network infrastructure through its Network 2010 initiative, LSU already provides an infrastructure matching that of its national flagship research university peers. "With this funding, we're installing 10 Gbps fiber links to our campus research buildings," explained the grant's principal investigator Ric Simmons, executive director of University networking and infrastructure. "We'll have 1 Gbps to the desktop within these builings, and where needed, 10 Gbps to the desktop." According to Simmons, the grant will be spent on the research network that is separate and distinct from the main Internet traffic on campus. "We are committed to making sure that our researchers have the fastest access to Internet2 and the LONI network so they can connect via those advanced networks to other resources and collaborators," he said.

To advance discovery in the sciences and arts, LSU already utilizes a rich array of cyberinfrastructure resources such as LSU supercomputers, LONI networking and computational systems, and, via LONI, the resources of TeraGrid, the backbone of national cyberinfrastructure. The new grant-funded network enhancements will better enable the use of these resources by all, but especially non-traditional areas of computational research including music and theatrical and visual arts.

"More and more research groups across campus are routinely demanding access to huge data files that are either generated or archived at national research labs, observatories, or supercomputing centers," said Joel E. Tohline, director of LSU's Center for Computation & Technology and co-PI on this grant.

"In recent years, LSU's connections to LONI and Internet2 have facilitated the efficient transport of such files to the edge of campus. The BIPAS project now provides network avenues by which these huge data sets can be efficiently transferred from the edge of campus to individual laboratories and offices for analysis. A wide array of research and instructional activities will significantly benefit from this upgrade of the University's network infrastructure."

LSU researchers should begin to enjoy the benefits of BIPAS in 2012.

•Additional Information

The Louisiana Optical Network Initiative, or LONI, is a state-of-the-art fiber optics network that runs throughout Louisiana and connects Louisiana and Mississippi research universities to one another as well as to national advanced networks (such as Internet2). LONI connects Louisiana's major research universities – LSU, Louisiana Tech University, LSU Health Sciences Center in New Orleans, LSU Health Sciences Center in Shreveport, Southern University, Tulane University, University of Louisiana at Lafayette, University of New Orleans and Xavier University – allowing greater collaboration on research that produces results faster and with greater accuracy. LONI provides Louisiana researchers with one of the most advanced optical networks in the country and the most powerful distributed supercomputer resources available to any academic community with more than 85 teraflops of computational capacity. Additional information about LONI can be found at http://loni.org/.

Economic Development

Louisiana Economic Development (LED) Statistics

Electronic Arts Inc.'s North American Test Center and LSU's CCT to Share LSU's New Louisiana Digital Media Center

During the July 27, 2011, ground breaking ceremony of the new Louisiana Digital Media Center located on LSU's main campus, Governor Bobby Jindal announced Electronic Arts Inc. plans to significantly expand employment at its North American Test Center, or NATC.

Electronic Arts Inc., or EA, a leading global interactive entertainment software company, develops, publishes, and distributes interactive software worldwide for video game systems, personal computers, wireless devices, and the Internet.

EA is close to maximum employment capacity at its current LSU South Campus location, which it occupied in 2008. Once EA shifts operations to the new 94,000 sq. ft. Digital Media Center sometime in 2012, employment is expected to quickly increase from approximately 400 jobs today to more than 600 positions, including on-site contractors. Originally NATC was anticipated to create 20 full-time jobs and 200 part-time jobs. Already the direct employment at the facility has increased to about 200 full-time positions, including direct EA positions and full-time contractor positions, and 200 part-time positions.

The new Digital Media Center will house not only EA's NATC (~30,000 sq. ft.), but also LSU's Center for Computation & Technology, or CCT (~50,000 sq. ft.), and it will include instructional space with cutting-edge audio/visual capabilities that will support LSU's academic research efforts related to digital media and software development. The $28.2 million project is being financed with funding from the state capital outlay budget, Louisiana Economic Development (LED), and U.S. Economic Development Administration.

CCT, marking its 10th anniversary July 2011, had long sought a contemporary, permanent home for its programs that drive academic and business research with high-performance computing. One such program of the LSU CCT is the new AVATAR initiative (Arts, Visualization, Advanced Technologies and Research), which unites faculty from many disciplines and enables students to conduct research and to complete projects in virtual environments, digital art, electro-acoustic music, animation, video game design, scientific visualization, and more.

"This partnership shows that LSU can be a key player in the state's economic development future," said LSU Chancellor Michael Martin. "We are breaking ground on a new facility and on a strong partnership that supports our academic mission. This public-private partnership allows students to couple their studies with experience from the world's leader in electronic game development and will allow our faculty to interact with leaders from the private sector."

Gov. Jindal has worked closely with EA since taking office, originally announcing the NATC with local partners in August 2008. EA's presence in Baton Rouge represents one of Louisiana's most significant digital media industry wins to date and has enabled LED to gain access to leading digital media and software companies around the world. EA committed to assist Louisiana FastStart™ and LSU in their curriculum development efforts, as well as to assist LED in the cultivation of a vibrant video-game development industry in Louisiana.

EA is among dozens of companies that have taken advantage of Louisiana's Digital Interactive Media & Software Tax Credit.

The initial recruitment of EA and the continued growth and development of the NATC are the result of a special partnership including EA, LED, LSU, the Baton Rouge Mayor-President's Office, the Baton Rouge Area Chamber, and the Baton Rouge Area Foundation.

View from West-Parker Coliseum showing future position of building at right.

Lagniappe

Highlights

• Susanne Brenner, CCT and LSU Department of Mathematics professor, was named the Michael F. and Roberta Nesbit McDonald Professor in Mathematics at LSU.

• Jorge Pullin, CCT and LSU Department of Physics professor, was invited by the Topical Group on Gravitation of the American Physical Society to present a talk at the Principal Investigator Symposium on Gravity at the NSF. The symposium, which featured four principal investigators of NSF grants in gravitational physics, conveyed the excitement of recent developments in gravitational physics to NSF authorities.

• Thomas Sterling, CCT and LSU Department of Computer Science, was invited to attend the Kickoff Meeting of the DARPA UHPC Program in Washington, DC. This by-invitation-only meeting featured perhaps the most important new program in a decade to advance HPC and among the first to drive the U.S. toward effective Exascale performance.

• Sumanta Acharya , CCT and Department of Mechanical Engineering professor, was awarded the ASME Heat Transfer Memorial Award in Science. The Memorial Award is one of two highest recognitions given by the American Society of Mechanical Engineers for significant accomplishments in the field of heat transfer.

• Susanne Brenner was a plenary speaker at the 30th Southeastern-Atlantic Regional Conference on Differential Equations (SEARCDE 2010) at Virginia Tech. Her talk was titled "Finite Element Methods for the Monge-Ampere Equation."

• Bijaya Karki , CCT and LSU Department of Computer Science associate professor, received the 2010 Rainmakers Mid-Career Scholar Award. This award recognizes a faculty member at the associate professor level or recently promoted to full professor who exhibits a sustained program of excellence as measured by the criteria set forth in the emerging scholar category.

• Jorge Pullin has been appointed editor for the space-time and gravity section of Scholarpedia, a wiki-based encyclopedia using the same software as Wikipedia, but with articles written by experts and peer reviewed.

• Juana Moreno, CCT and LSU Department of Physics & Astronomy assistant professor, received the Phi Kappa Phi, LSU Chapter, 2011 Non-Tenured Faculty Award.

• Susanne Brenner was appointed to the National Advisory Committee for the Statistical and Applied Mathematical Sciences Institute (SAMSI).

• Thomas Sterling was invited to participate in the by-invitation-only Sixth International Exascale Software Project workshop conducted in Maui. Participants included scientists from the U.S., European Union, Japan, China, and Russia.

• Randall Hall, CCT and LSU Department of Chemistry professor, received the LSU Webster Parish Chapter Alumni Professorship Award.

• Jorge Pullin was appointed founding editor of Physical Review X. Physical Review is the most important set of journals in physics, published by the American Physical Society. The brand goes back to 1893. Physical Review X is their new, open access, all-electronic journal, to be financed by author fees.

• Steve Brandt, Oleg Korobkin, Frank Löffler, Jian Tao, and Erik Schnetter, all CCT researchers, participated in the Elsevier Executable Paper Grand Challenge and were selected to present their Prickly Pear Archive at the ICCS 2011 conference in Singapore.

• Thomas Sterling delivered the keynote address at the International SuperComputing Conference in Hamburg, Germany, titled "HPC Achievement & Impact 2011."

• Susanne Brenner presented the 2011 Sonia Kovalevsky Lecture at the 7th International Congress on Industrial and Applied Mathematics in Vancouver, British Columbia.

• The CCT scientific visualization group's image titled "3-D visualization of Hurricane Katrina making landfall on the Louisiana coast" was published on the back cover of the State of Louisiana Comprehensive Annual Financial Report, for the Fiscal Year Ending June 30, 2010. The group members are: Werner Benger, Shalini Venkataraman, Amanda Long, Ana Buleu, and Stephen D. Beck.

• Thomas Sterling gave the keynote address at the 2nd International Supercomputing Conference in Mexico, titled "Enabling Exascale Computing through the ParalleX Execution Model."

• Susanne Brenner was a keynote speaker at the 2010 South Eastern Mathematical Science (SEAMS) Workshop at the College of Charleston. Her talk was on "C0 Interior Penalty Methods for Fourth Order Problems."

Events

CCT-Sponsored Conferences and Events (Fall 2010-Summer 2011)

Animation Collaboration
Dates: *September 13-16, 2010*
Attendees: *25*
Location: *Shaw Center for the Arts, Baton Rouge*

UHPC X-Caliber Workshop
Dates: *October 5-7, 2010*
Attendees: *36*
Location: *LSU campus*

Cinema for the Ears Concert
Date: *October 18, 2010*
Attendees: *60*
Location: *LSU campus*

ACM Regional Programming Contest
Dates: *October 28-29, 2010*
Attendees: *71 teams across four sites*
Locations: *LSU, Baylor University, LeTourneau University, East Central University*

Princess Ball, Red Stick International Animation Festival
Date: *November 7, 2010*
Attendees: *250*
Location: *Louisiana Old State Capitol*

6th Red Stick International Animation Festival & "Best of the Fest" Competition
Dates: *November 10-13, 2010*
Attendees: *5000; 437 submissions received*
Location: *Shaw Center for the Arts, Baton Rouge*

NanoDays
Dates: *March 26; March 30, 2011*
Attendees: *180*
Location: *BREC Highland Road Park Observatory; Louisiana Art & Science Museum*

Research Experience for Undergraduates 9-week program
Dates: *May 30-July 29, 2011*
Attendees: *9 selected; 152 applicants*
Location: *LSU campus*

LA-SiGMA REU and RET
Dates: *May 30-July 29, 2011*
Attendees: *14*
Location: *LSU campus*

Beowulf Boot Camp for High School Students & Teachers
Dates: *June 6-10, 2011*
Attendees: *39*
Location: *LSU campus*

Alice in Computation Land Summer Camp for Middle School Girls
Dates: *June 13-17; July 18-22, 2011*
Attendees: *29; 19*
Location: *LSU campus*

Stop Motion Animation Summer Camp for High School Students
Dates: *July 11-15, 2011*
Attendees: *10*
Location: *Shaw Center for the Arts*

Density Functional Theory Workshop
Dates: *July 23-27, 2011*
Attendees: *43*
Location: *LSU campus*

Computational Thinking from a Parallel Perspective Workshop
Dates: *July 31-August 6, 2011*
Attendees: *18*
Location: *LSU campus*

iOS Application Boot Camp for LSU Undergraduates
Dates: *August 1-12, 2011*
Attendees: *54*
Location: *LSU campus*

Lectures 2010-2011

Sponsored by CCT and held on LSU Campus
Speakers Fall 2010 through Summer 2011: 20 total

Lectures by Category:
- Special Guest Lectures: *16*
- Computational Mathematics Seminar Series: *2*
- AVATAR (Arts, Visualization, Advanced Technologies and Research) Lecture Series: *1*
- Frontiers of Scientific Computing: *1*

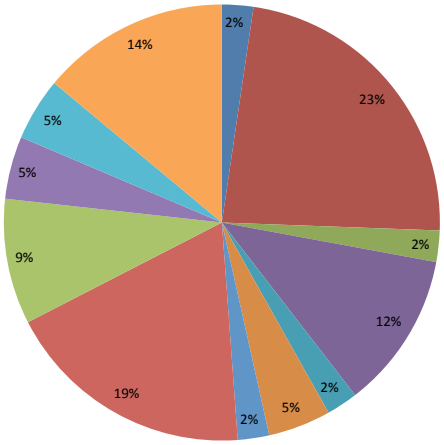
High-Performance Computing Tutorials 2010-2011

Hosted on the LSU campus
Organized by CCT and HPC @ LSU

Fall 2010: *11 tutorials*
Spring 2011: *7 tutorials*
Summer 2011: *8 tutorials*

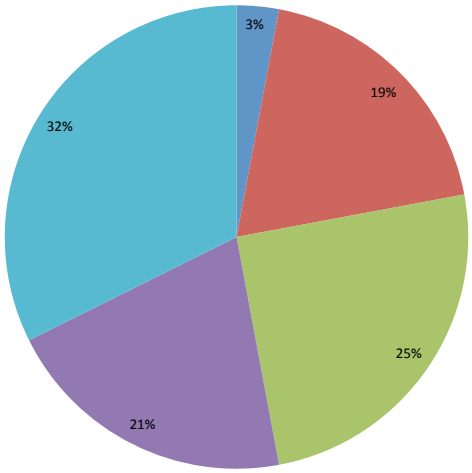
Business Reports

CCT Faculty by Department for 2011



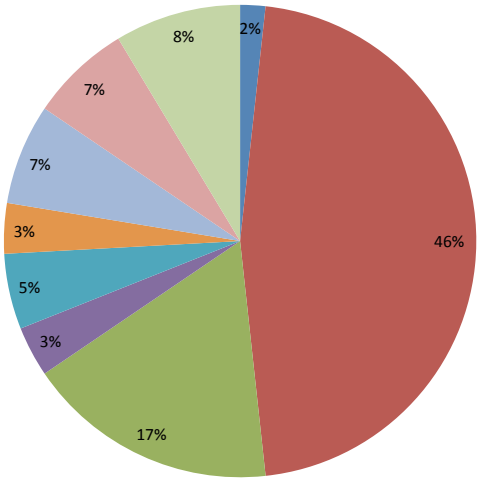
- Art & Design 2%
- Computer Science 23%
- Chemistry 2%
- Electrical & Computer Engineering 12%
- Environmental Engineering 2%
- Information System and Decision Science 5%
- Mass Communication 2%
- Mathematics 19%
- Mechanical Engineering 9%
- Music 5%
- Petroleum Engineering 5%
- Physics & Astronomy 14%

CCT Professional Staff for 2011



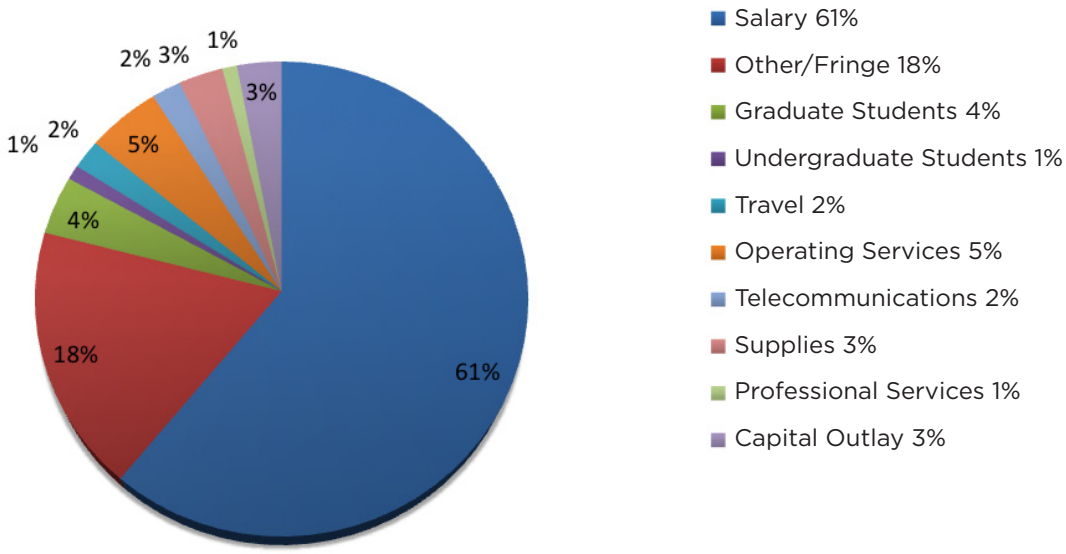
- Economic Development & Digital Media Staff 3%
- Executive & Administrative Staff 19%
- Technical Staff 25%
- Postdoctoral Researchers 21%
- Research Scientist 32%

CCT Graduate Assistants by Department for 2011

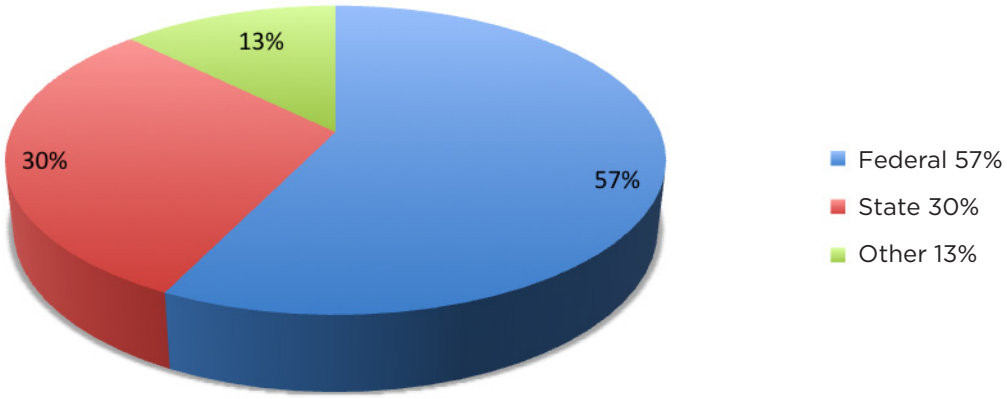


- Chemistry 2%
- Computer Science 46%
- Electrical & Computer Engineering 17%
- Geology & Geophysics 3%
- Information Systems & Decision Sciences 5%
- Mathematics 3%
- Music 7%
- Petroleum Engineering 7%
- Physics 8%
- Mechanical Engineering 2%

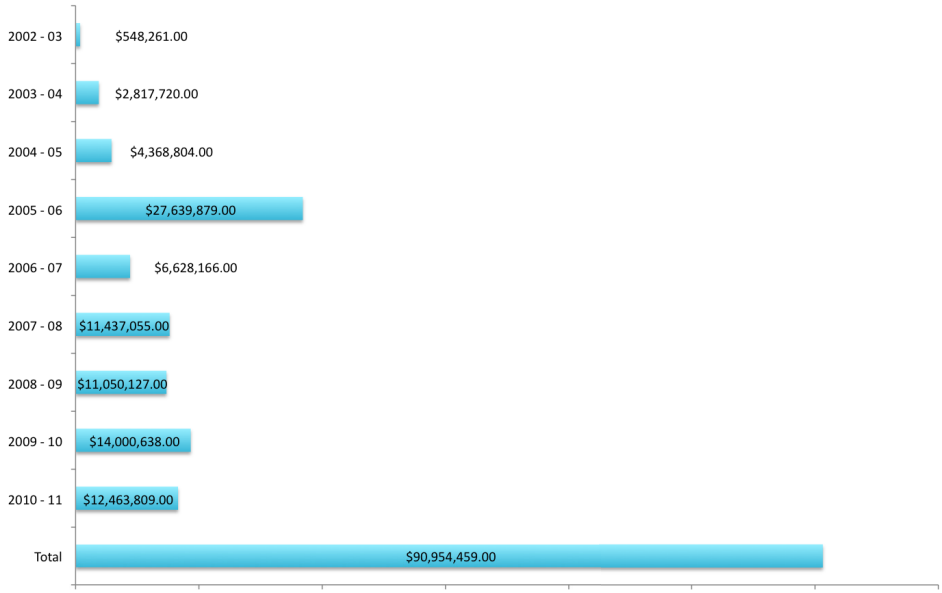
CCT Investment Summary 2010-2011



Cumulative External Funding by Source FY 2003-2011



External Funding FY 2003-2011



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