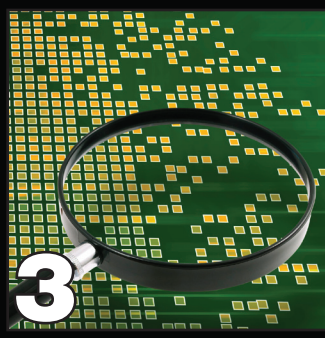

Volume 6
COMPONENTS
Center for Computation & Technology
LSU



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LSU Center for Computation & Technology

Components
Volume 6

Research

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Economic Development

The 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, advanced 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.

Anual reports Components 2010

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Research

Seeing is Believing: Visualization Gives Scientists a Good Look at Data

"The main goal of data visualization is to communicate information clearly and effectively through graphical means. It doesn't mean that data visualization needs to look boring to be functional or extremely sophisticated to look beautiful. To convey ideas effectively, both aesthetic form and functionality need to go hand in hand, providing insights into a rather sparse and complex data set by communicating its key aspects in a more intuitive way. Yet designers often fail to achieve a balance between design and function, creating gorgeous data visualizations that fail to serve their main purpose — to communicate information." (Friedman, 2008) from "Data Visualization: Taking the Presentation of Methods and Results to the Next Level," publication of the Data Visualization Workshop, November 2009.

As the saying goes, "A picture is worth a thousand words." But the worth might increase if the pictures provide more information about astrophysical activities, diseases and medical conditions, paths and damage potential for hurricanes, and other scientific phenomena researchers only recently have gained the tools and technologies to explore.

On the other hand, a bad picture is worth a thousand bad words -- a picture should not just look good and colorful; it also needs to be scientifically accurate and communicate the right content. Scientific accuracy coexisting with a pleasing image is extremely important in scientific visualization as compared to paintings, drawings, computer graphics, and other art forms.

Scientific visualization, also called visual data analysis, is an interdisciplinary process that examines three-dimensional phenomena with geometric qualities, in which researchers create visual, possibly interactive, exploration of their data. According to Friendly (2008), visual data analysis emphasizes "realistic renderings of volumes, surfaces, illumination sources, and so forth." This technique is advancing understanding in many disciplines, and is becoming more widely used.

Scientists often need a way to visually explore their data rather than just reading charts and figures. To be as scientifically accurate as possible, researchers produce large data sets, but then face the problem of how to study the resulting data, since looking at raw numbers for data sets that can be up to a terabyte in size is impossible for a researcher to analyze alone. Often, application scientists don't know all that is possible to see through their data.

At this level, further examination requires a visualization researcher to go beyond traditional solutions and interact directly with the data, applying multiple options and methods, color schemes, post-processing algorithms, analysis routines and more, proposing new ways of studying data sets where it is simply impossible to see anything by just inspecting the numbers.

But, as with any image, there is more taking place than meets the eye. Behind the glossy, beautifully colored image lie several days or even weeks of work, with visualization researchers combing through complex algorithms and reconciling differences, sometimes piece by piece, in large data sets to ultimately produce a picture of what the data is showing.

Werner Benger, Ph.D., a visual data analysis specialist at the LSU Center for Computation & Technology, explains that because people only see the end result of visualization, the picture or video, they lose sight of what it takes to produce that image.

"Often, people will bring the visualization scientist a big set of data, and expect him or her to just pop that in the computer, hit a few buttons, and instantly show them a picture or video," Benger said. "Unfortunately, the process is not that simple, and there are lots of issues the visualization scientist must work through to get to the point of actually producing these."

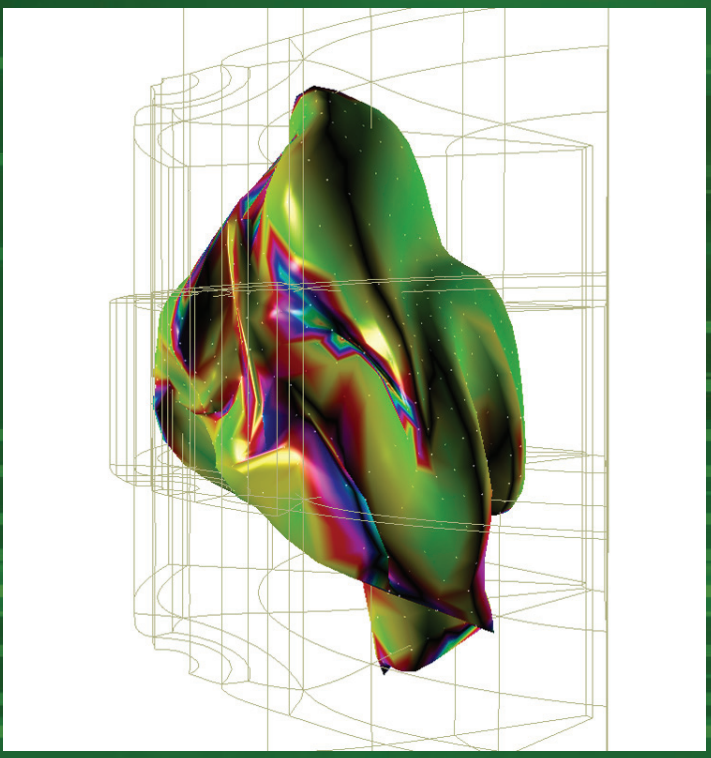
Benger recalls one occasion where he showed a researcher a 30-second animation of his data, which had taken Benger three weeks to produce (a relatively short turnaround for visualization, Benger notes), and the researcher could not understand what took so long, being unaware that a major part of the work was to understand his data and implement appropriate software

tools and algorithms to transform the information into something visually attractive.

Visual analysis, Benger explains, begins with the raw data, which often is a collection of mathematical expressions the researcher must go through bit by bit to make sure it is correct, as one miscalculation can derail the whole process. A first -- usually severely underestimated! -- hurdle is just the file format of the provided data.

Because the data contain so much information, it often comes in different formats and file programs that do not necessarily work well together. The researcher must go through the information and reconcile any differences so he or she can pull all data into the finished product.

After working for several years on these projects, and often being asked why he can't "just visualize" the data instantly, Benger served as the lead creator of a new software program he designed specifically to ease scientific visualization. Called VISH, this program operates as a "visualization shell," meaning it is an environment that can incorporate multiple elements of the visualization process while implementing newly developed algorithms and deploying them to researchers easily. Compared to the ad-hoc approach that exists in many visualization software programs,



VISH operates on a systematic approach to process large data sets, and is based on proven mathematical codes that make it easier and more efficient to process data.

Benger developed VISH based on eight years of prior experience working with commercial visualization software, namely Amira, where he was part of the core developer team in Germany at Zuse Institute Berlin.

"I developed VISH after several years of writing software codes for visualization, which gave me insight into what would work effectively," Benger said. "Also, because visualization is interdisciplinary and many researchers use it for different purposes, I wanted to create something that could be easily accessed and shared across networks to suit a diverse set of needs."

VISH, which Benger created and made available in 2005, is available at http://sciviz.cct.lsu.edu/projects/vish/Vish@LSU.html. Benger has incorporated this into many of his projects. LSU researchers have widely used VISH since 2008, including toward work on the National Science Foundation-funded CyberTools project, which aims to create tools and applications that allow scientists to use cyberinfrastructure more effectively.

What Are We Looking At?

The main projects Benger examines through scientific visualization are astrophysics issues due to his original interest (he got his master's degree in astronomy), and computational fluid dynamics. Several of his recent works are modeling the collision of two black holes, which causes emissions of gravitational waves across the universe. Because these collisions take place in galaxies far, far away, scientists have no way to literally observe them.

Benger, using data researchers generate numerically based on Einstein's equation for general relativity, can create visualizations that illustrate the structure of gravitational waves emitted during those violent astrophysical processes, depicting properties of the propagating curvature of space/time, and possibly involving temperature and density if matter is involved in such an event.

In a related area, Benger has created visualizations to illustrate galaxy formation. The process in one visualization involves 16 million particles, each representing dust, dark matter, or newly formed stars, and Benger shows the velocity for each particle, using a variety of colors and light with tactics that allow him to indicate the vector track for each particle.

While astrophysics is his main research area, Benger also conducts visualizations of other processes. Recently, he and a research team comprised of CCT researchers Marcel Ritter (University of Innsbruck), Feng Jijao, Sumanta Acharya (LSU Department of Mechanical Engineering), Nathan Brener (LSU Department of Computer Science), and Somnath Roy created a series of visualizations based on computational fluid dynamics, using fluid flow data. This area is studied in many disciplines, and has implications for oil movement, floodwater movement during a hurricane, chemical processes, and more.

For their visualization, Benger and the research team examined fluid movement taking place within a stirred-tank, which is a common mixing and testing device used in the chemical industry. Because the chemicals and fluids used are often clear or light-colored, visualization allows the researchers to see how the liquid moves within the tank, indicating seed points, streamlines and how changes in velocity affect movement during mixing, with the final objective to assess the quality of the mixing and thus providing tools to optimize the design of stirred tanks.

Medical imaging is another research area benefitting from advances in scientific visualization. Benger created a series of visualizations for brain tumor analysis that show in multiple dimensions how the tumor spreads through the brain and to which parts, providing information a doctor couldn't see from a traditional MRI or other scan.

Recent Collaborations

As mentioned, the variety of data formats involved in a visualization can complicate and slow down the process. Benger addresses this problem by using a comprehensive file format called HDF5, and a software package he calls F5, to incorporate and integrate the complex information requirements of a visualization in one place.

Mike Folk and Quincey Koziol of The HDF Group, which develops and supports HDF5, collaborate regularly with Benger to ensure that HDF5 meets the requirements of F5.

"One of Werner's most impressive contributions has been how his F5 data model organizes information during the visualization process," Folk said. "A typical data file for visualization contains pretty much raw data. To that, F5 adds information about the mathematical space of the phenomenon being visualized. This approach enables Benger to integrate data from a variety of sources far more quickly and accurately than traditional visualization approaches can. We expect Werner's approach eventually to revolutionize how data is organized for visualization, and are very pleased that HDF5 can play a role in this process."

"Overall, the key to a successful visualization project requires investment of time and effort by both the data provider and the visualizer, with both having a clear understanding of the research priorities," Benger said. "While doing this process right takes time and often moves slower than either one would prefer, this approach will ultimately result in a clear, easy-to-see image that helps advance understanding in that particular domain."

Sabine Schindler, director of an interdisciplinary consortium working on scientific computing at the University of Innsbruck, noted that visualization is becoming a more integral part of research.

"Visualization is an important factor in our research, not only to present our results to colleagues at conferences and to the public, but also for us," she said. "In our fields of research, which include physics, civil engineering, mathematics and computer science, we produce huge amounts of data by simulations, often 3-dimensional data of several quantities and time series of all these quantities. In order to see what is happening in the models, we cannot look at the output numbers, but we need to have the output visualized. Different quantities often have to be visualized in different ways. When an interesting feature is found, we need to dig

deeper into the data and display it in various ways. We found that often we can use the same visualization methods for completely different models, e.g. galaxies, plasma in a fusion experiment, or Earth's atmosphere."

Seen in Print:
Several images Benger and his colleagues created have been used in publications worldwide, including textbooks, posters, presentations, banners, and more. Some recent uses of scientific visualization images that Benger helped produce include:

- Hurricane Katrina visualization project used in DISCOVER magazine

- An astrophysical visualization image was featured on the Web site for Einstein's Messengers, at http://www.einsteinsmessengers.org. This group documents work being done nationally through the Laser Interferometer Gravitational Wave Observatory, or LIGO, project.

- An image from the Numerical Relativity research group at CCT, of which Benger is a part, was used on the front cover of Science Highlights 2009, the annual magazine of the TeraGrid.

Visit us at LSU
http://sciviz.cct.lsu.edu/projects/vish/Vish@LSU.html

To see some of Dr. Benger's scientific visualization images:
http://sciviz.cct.lsu.edu/gallery/

http://jean-luc.aei.mpg.de/Images/

CCT Researchers Leading National Grant-Funded Research at LSU

During the past academic year, CCT faculty and staff brought in more than $10 million in new grant funding with an overall fiscal year total of $14 million in external funding, almost $3 million more than what was brought in during the previous fiscal year. Through these grants, CCT has been able to hire additional staff and advance research in many areas, including digital media, astrophysics, computer architecture, biological sciences and nanoscience.

Some of the major research grants CCT faculty and staff were awarded this year include:

- Professor Thomas Sterling's group received a grant award through the Defense Advanced Research Projects Agency's Ubiquitous High Performance Computing program, which brings together researchers and scientists from universities, industries, and national laboratories to develop new systems and architecture to prototype these next-generation supercomputers. Sterling and his research group at the CCT are partnering with Sandia National Laboratory to develop new execution models and improve runtimes for the first part of the project. They also are partnered with Georgia Institute of Technology to test emerging systems and ensure the components developed at each partner site are compatible.

- Susanne Brenner and Li-yeng Sung, both professors with CCT and the LSU Department of Mathematics, received a more than $300,000 award from the National Science Foundation titled "Fast Interior Penalty Methods" for a three-year research project.

- Blaise Bourdin, an associate professor with the LSU Department of Mathematics and CCT, received National Science Foundation funds stemming from the American Recovery and Reinvestment Act of 2009 for his proposal, "Applications of Variational Fracture: Enhanced Geothermal Systems." Enhanced geothermal systems are an alternative energy source in which heat is created when water circulates through artificially simulated fractures in rocks. Bourdin's research in this proposal will examine the mechanisms scientists can use to create these artificial fractures and expand the use of geothermal systems, creating a clean, renewable, affordable and widely available energy source.

- LSU Professor Tevfik Kosar received a grant from the National Science Foundation to support his work on Stork Data Scheduler, an innovative computing tool that helps researchers access and transfer large data sets easily and efficiently.

- A research group led by Professors Mark Jarrell and Randall Hall received funding from the Experimental Program to Stimulate Competitive Research (EPSCoR) through the Louisiana Board of Regents to create a comprehensive research, education and outreach program in materials science. The program, Louisiana Alliance for Simulation-Guided Materials (LA-SIGMA) will use the resources of the Louisiana Optical Network Initiative to conduct computational modeling and create new materials that would improve technology for items such as computer memory, batteries, controlled drug delivery, and more.

- TeraGrid, the backbone of national cyberinfrastructure, received $30.2 million in extension funding from the National Science Foundation to continue providing an integrated, persistent computational resource for the national research community. Included in the extension is $1.14 million for the Louisiana Optical Network Initiative, or LONI, to extend the support and network connections through March 2011. Honggao Liu, Ph.D., LSU's High-Performance Computing Director, and Daniel S. Katz, senior computational scientist with the University of Chicago and Argonne National Laboratory who also is an adjunct associate professor in the LSU Department of Electrical and Computer Engineering and CCT, developed and led LONI's extension proposal for TeraGrid.

- A research team led by Robert Twilley was recommended for a nearly $6 million grant from the National Science Foundation Experimental Program to Stimulate Competitive Research (EPSCoR) Research Infrastructure Improvement Track-2 Program for "Research and Education Cyberinfrastructure Investments to Develop the Coastal Hazards Collaboratory in the Northern Gulf Coast." The grant funds work for three years. Twilley and professors Jim Chen, Gabrielle Allen and Honggao Liu will contribute research toward this project.

- LSU Professor Seung-Jong "Jay" Park received a National Science Foundation grant for two projects he is leading at the University to make research across high-speed networks, which can transport 10 Giga bits of data per second (Gbps), more efficient and available to more users.

- Gabrielle Allen and Erik Schnetter received National Science Foundation funding through four different awards to investigate and understand gamma-ray bursts, thought to occur when a massive star collapses, creating a black hole and exploding bright flashes of gamma rays radiating across the universe, in a project they call PetaCactus.

- A research team led by LSU Department of Physics & Astronomy Professor Mark Jarrell, received a 2010 Innovative and Novel Computational Impact on Theory and Experiment, or INCITE, award from the U.S. Department of Energy's Office of Science. Jarrell and his team received 17,000,000 user hours on the Cray XT supercomputer at Oak Ridge National Laboratory in Tennessee to advance materials science research on a more powerful machine.

- LSU received a National Science Foundation grant to upgrade and advance the campus network to make it stronger, faster and more efficient. CCT Interim Director Stephen David Beck and CCT Director of Cyberinfrastructure Shantenu Jha were co-principal investigators on this project, called BIPAS – Bifurcated Infrastructure Promoting the Advance of Science: Revitalizing LSU's Data Network Infrastructure.

- Hongchao Zhang received an award from the National Science Foundation for "The Analysis and Design of Gradient Methods for Large-Scale Nonlinear Optimization and Applications."

- Bijaya Karki received an award from the Louisiana Optical Network Initiative (LONI) for "Visualization of Oil Spill Related Data."

- Gabrielle Allen received an award from the Louisiana Optical Network Initiative (LONI) for "Modeling and Visualizing the Effect of Severe Storms on Oil Spill Trajectories with the Cactus Framework and LONI."

Education

AVATAR

Initiative Launches Digital Media Undergraduate Minor at LSU

"Students regularly express to us an interest in working as a video game developer, animator, or other profession involving interactive digital media. We crafted the AVATAR minor to address the needs of these students as well as the needs of the digital media industry."

Faculty with the University's Arts, Visualization, Advanced Technologies and Research, or AVATAR, Initiative have developed a new academic program that will allow students to obtain an interdisciplinary minor in digital media, preparing them for careers in emerging fields such as animation, video games, electronic music and digital art.

The University approved the AVATAR Initiative in Spring 2008 as one of its multidisciplinary hiring initiatives, bringing together faculty, researchers and professionals to create a concentrated academic research program in digital media. The initiative is housed within the LSU Center for Computation & Technology, which has led these efforts.

AVATAR faculty members have spent the past two years developing a program that would allow students to minor in digital media. The University approved this academic program in Fall 2009, and students were able to declare the minor and begin taking classes toward the degree in the Fall 2010 semester.

"Students regularly express to us an interest in working as a video game developer, animator, or other profession involving interactive digital media. We crafted the AVATAR minor to address the needs of these students as well as the needs of the digital media industry," said Stephen David Beck, Derryl & Helen Haymon Professor in the LSU School of Music and AVATAR Initiative director. "The faculty who are part of the AVATAR Initiative have developed an interdisciplinary curricula that we feel prepares students to work in these fields and provides them with an enriching educational experience during their time at LSU."

Undergraduate students can enroll in one of two digital media minor programs, each with a focus on different thematic cores. The DMART minor is an arts-oriented program, offered through the LSU College of Art & Design, and the DMTEC minor is a technology-oriented program, offered through the LSU College of Engineering.

Students in both programs will take foundation courses in the arts and computer programming, and three elective courses in digital media within their core focus (arts or technology). Students also must take one course from the other core focus. Elective courses are offered in different departments across campus, including computer science, electrical and computer engineering, music, art, English and mass communication. As a final course toward the digital media minor, students from both cores take a capstone course together, which will engage both arts and technology applications in collaborative, interdisciplinary projects.

To officially kick off the minor, AVATAR Initiative began hosting a lecture series that brings distinguished leaders from the field of digital media to campus, who discuss the latest developments and help students understand the skills they need for careers in these disciplines.

AVATAR Lecture Series speakers who visited LSU this year include Daryl Holt, the chief operating officer of EA Sports Tiburon Studios in Orlando, Florida; John Worthington of Worthington Designz, a pioneer of digital music and video effects; and Calit2 researcher Tom DeFanti, Ph.D., an internationally recognized pioneer in visualization and virtual reality technologies.

AVATAR faculty also are leading several digital media research projects at LSU, including:

Laptop Orchestra of Louisiana (The LOLs): The LOLs are a group of musicians who compose, conduct and play music using ordinary office laptop computers. The ensemble performs with up to five laptops at a time, and some of the pieces involve Nintendo "Wii Mote" controllers as virtual musical instruments. The LOLs debuted in April 2010, and have further performances scheduled in the upcoming year. LOL research is focused on developing new tools for managing orchestral software, time synchronization, tangible interactions and composing new works for laptop ensembles.

GRENDL: Short for Grid-Enabled Distribution and Control for Laptop Orchestras, this program uses SAGA, a software program for distributed computing environments developed at LSU, toward applications in the arts and humanities. Using SAGA, groups such as the LOLs treat similar orchestras as distributed computing environments to produce computer music, and can incorporate more people and play simultaneously with similar ensembles in different locations.

4K CineGrid: LSU researchers have been part of CineGrid, an interdisciplinary research group that focuses on networking and applications to enable advances in digital media, for several years. Now, AVATAR faculty are working with CineGrid to build supporting networks and applications for 4K video, which is four times the resolution of HD. Two new AVATAR-led courses through the LSU School of Art allow students to create short, stop-motion animation in 4K to share with CineGrid. AVATAR also plans to become part of CineGrid Exchange, a digital media depository, and researchers are developing portals to share, exchange and create video in 4K and beyond.

Participating in the AVATAR Initiative are the School of Art, Department of Computer Science, Department of Electrical & Computer Engineering, Department of English, Manship School of Mass Communication, School of Music, and the Center for Computation & Technology

For more information on the AVATAR Initiative and LSU's new minors in digital media, please visit avatar.lsu.edu.

New High-Performance Computing Cluster for Classroom Instruction, Student Use

The CCT is providing a new LSU high-performance computing cluster, Arete, exclusively for education, including classroom instruction, distance learning and undergraduate or graduate student projects. While LSU has other high-performance computing resources on campus available for faculty and students to conduct research, Arete is the most powerful cluster dedicated exclusively to student educational needs.

Arete is a 72-node cluster with a peak performance of 5.3 Teraflops, with high-speed networking connections and 24 Terabytes of shared storage space. This cluster is comparable in size and speed to the University's other high-performance computing resources. Arete was named for the Greek quality of excellence in fulfilling one's full potential and purpose. The first students to use Arete were those enrolled in Professor Thomas Sterling's "High Performance Computing: Models, Methods and Means" course, offered through the Department of Computer Science, in the Spring 2010 semester.

"The course provides students with a basic overview of how high-performance computing works, and we wanted to make this instruction applicable by giving them a resource to learn programming, develop basic applications and get hands-on experience operating a supercomputing cluster," Sterling said.

Although CCT acquired and installed Arete for Sterling's course, students in other disciplines or courses can use the cluster to get practice operating computational resources. Students at other institutions can access Arete remotely to work hands-on at high-performance computing exercises and experiments.

"Faculty and research staff are the primary users for LSU's existing supercomputing systems, and we realized it is important, as part of our academic mission, to also provide students with opportunities to use these machines," said CCT Interim Director Stephen David Beck. "With Arete, we are happy to provide a resource for the whole campus so students can take the skills they learn in the classroom and put them into practice, giving them a much deeper appreciation of how this technology is advancing research in many disciplines."

Bringing Stop Motion to Life!

The students in Digital Art 4050 over the summer 2010 semester had no idea what they were in for. The first course of its kind, the students would be responsible for bringing together a stop motion animation film, build everything from scratch, and finish the following semester with a short film.

Ten students were invited to participate in the experimental film. The only thing that they didn't decide on their own was the script itself. The film "Fenris and Tyr" is a Norse myth about the God of War (Tyr) and the wolf (Fenris) who is destined to destroy the world at Ragnorak.

The students have been working for over six months on the preproduction, and are set to conclude production at the end of the semester. The plan is to show at least part of the film, in uncompressed, native 4k at the Cinegrid conference in December 2010.

This course, taught by Stacey Simmons, Ph.D, is offered as an elective in the digital media AVATAR minor in digital media arts (DMART).

Outreach

CCT Hosts First Research Experience for Undergraduates Program

"Halfway through this summer, the thought smacked me upside the head, 'I am working with one of the handful of general relativity research groups in the world,'" said Linda Holyoke. "What an honor. What a privilege. Besides a great deal of physics and computer science, this summer taught me that I can realize my dream of being a research physicist."

The LSU Center for Computation & Technology hosted a nine-week summer program on "Interdisciplinary Research Experience in Computational Sciences." Similar Research Experience for Undergraduates, called REU, programs are hosted at most top-tier research universities, and CCT's was one of the first three such programs funded through the National Science Foundation's Office of Cyberinfrastructure.

The focus for this REU was Interdisciplinary Research Experience in Computational Sciences, which emphasized using the cutting-edge cyberinfrastructure on campus and in the state to investigate different scientific phenomena. During this program, 16 college students from Puerto Rico, Illinois, Ohio, New York, Florida, Arkansas, Missouri, Michigan, Pennsylvania and Louisiana collaborated with CCT faculty and staff on advanced computational research projects.

CCT faculty Juana Moreno, Department of Physics & Astronomy, and Gabrielle Allen, Department of Computer Science, served as principal investigator and co-principal investigator, working with CCT staff Bety Rodriguez-Milla and Kathy Traxler to secure funding from the National Science Foundation and the Louisiana Board of Regents for this summer program.

"The REU gave students a chance to collaborate on computational science research projects that are larger than anything they could do alone, emphasizing the importance of interdisciplinary scientific exploration," Moreno said. "Also, because many CCT research groups work regularly as part of international teams, the students at our REU had a unique opportunity to work alongside these groups and see how international research projects are conducted."

Throughout the program, students worked with faculty and research staff at CCT, examining various science phenomena. Their summer research encompassed a broad variety of computational science topics, including:

• Developing and implementing parallelization for graphics processor units, which can lead to faster codes. REU students Jitu Das, Jonathan Gluck, David Poliakoff, and Brittany Shannon, worked with faculty mentors Mark Jarrell and Juana Moreno, CCT and LSU Department of Physics & Astronomy, and Randall Hall, CCT and LSU Department of Chemistry, to create coding for these graphical processors.

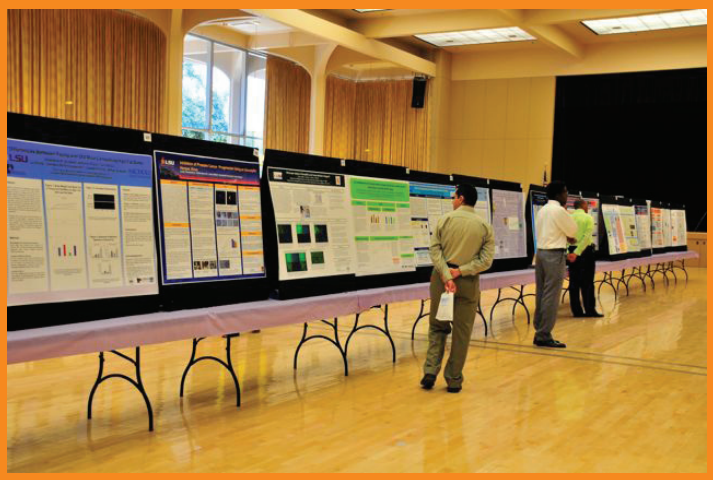
• Scientific Visualization using VISH, a software environment that allows researchers and students to create visual representations of scientific datasets using newly developed and experimental visualization methods. REU students Fernando Berrios and Edwin Matthews worked with CCT Research Scientist Werner Benger, who developed the VISH software, to analyze data and render images from state-of-the-art astrophysical simulations covering colliding galaxies (computed at the University of Innsbruck, Austria), merging neutron stars and black holes (from the numerical relativity research group at CCT), as well as computational fluid dynamics data from the LSU Department of Mechanical Engineering. The students quickly learned how to deal with data sets as large as 300GB on a daily basis, unthinkable only a couple of years ago, and added their own extensions to the software environment, which will continue being used in ongoing research.

• Molecular dynamics simulation of the ionic liquid 1,3 dimethyl imidazolium chloride confined inside multi-walled carbon nanotubes, which have implications for uses in energy storage in electric double layer capacitors, and in the synthesis of nanomaterials based on organic salts for biomedical applications. REU student Harsha Dissanayake worked in this project with faculty mentor Francisco Hung, a chemical engineering professor. They used high-performance computing resources from HPC-LSU for this project.

• Interactive devices that use radio frequency identification technology, called RFID, which allow users to directly touch and analyze data. REU students Landon Rogge and Rachel Bradford worked with CCT and LSU Department of Computer Science Professor Brygg Ullmer, whose research specialty is tangible interaction, to create some initial RFID cards that could work for both Apple and Microsoft platforms.

• Solar cell designs based on plasmonics, which can improve absorption in photovoltaic devices, permitting a considerable reduction in the physical thickness of solar photovoltaic absorber layers. REU student Ian Reynolds worked with faculty mentor Georgios Veronis, CCT and LSU Department of Electrical and Computer Engineering, to computationally explore and design highly efficient, thin-film, p lasmonic solar cells by performing electromagnetic simulations using the LSU high-performance computing resources.

• New techniques and libraries for multi-user, multi-touch input sensing, which allow researchers to use touch-display technology for interactive data analysis and visualization. REU student Chad Thompson worked with CCT mentors Robert Kooima, who is adjunct faculty with LSU Department of Computer Science, and Jinghua Ge, who directs the LSU Advanced Visualization Service Laboratory, to create new software that eases the process for researchers to adapt multi-touch interaction technology to existing data analysis applications.



• Examining the diffusion of flame retardants in glassy polystyrenes, a common material used for packaging and sealants. REU student Andrew Hamilton worked with faculty mentors Randall Hall, a professor with CCT and LSU Department of Chemistry, and Cheri McFerrin, a post-doctoral researcher, to use high-performance computing resources to study the diffusion process as a function of temperature, in particular the dynamics near the glass transition temperature.

• Working within frameworks for scientific simulation to design language that makes it easier for multiple researchers to share and manage data across networks. Students Eric Seidel and Michael Thomas worked with faculty mentors Gabrielle Allen and Steve Brandt, CCT and LSU Department of Computer Science, and Erik Schnetter and Frank Löffler, CCT and LSU Department of Physics & Astronomy, to use the Cactus Computational Toolkit, a popular open-source framework that LSU researchers helped develop, to test their language and work toward creation applications for iPhones or iPads.

• Examining data and creating simulations of astrophysical phenomena to gain a better understanding of the most fundamental laws of physics. REU student Megan Miller worked with Peter Diener, CCT and LSU Department of Physics & Astronomy, to examine binary black holes, which are thought to occur when two black holes spiral around each other and eventually collide together. REU student Linda Holyoke worked with Erik Schnetter, CCT and LSU Department of Physics & Astronomy, to examine gamma ray bursts, which are thought to occur when a massive star collapses, creating a black hole. The students worked with their faculty mentors to design, perform, and analyze numerical simulations to examine possible models for these scenarios.

The students agreed the REU was a wonderful opportunity to work with university researchers while using cutting-edge technology. "Halfway through this summer, the thought smacked me upside the head, 'I am working with one of the handful of general relativity research groups in the world,'" said Linda Holyoke. "What an honor. What a privilege. Besides a great deal of physics and computer science, this summer taught me that I can realize my dream of being a research physicist."

Several students said the experiences they had at the summer REU will help them in future course work and planned graduate school studies. "The first thing that comes to mind when I think of what I have gained is the ability to study, comprehend, implement, and summarize a new idea," said Landon Rogge. "This process is not often taught in classrooms, and is an extremely important process in the scientific community. The product of my research this summer will continue to benefit me both through my academic studies and into my career."And, the REU gave these students one of their first opportunities to conduct scholarly research and present their findings.

"The REU has been instrumental in exposing me to the world of research," Michael Thomas said. "Before this summer I had never been involved in research before. I had certainly never before been exposed to creating posters, writing scientific papers, and having research peer reviewed. The summer REU program has been invaluable at helping me decide where I want to take my future, and helped me narrow my interests so I can pursue that future with a razor-like focus."

At the conclusion of the REU, students had an opportunity to present their projects to CCT faculty and a representative of the National Science Foundation. Edward Seidel, LSU Floating Point Systems Professor of Physics and former CCT director, who is the National Science Foundation's assistant director for the Mathematical and Physical Sciences Directorate,

attended the research presentations to meet with students, provide feedback, and emphasize the importance of interdisciplinary research.

CCT Interim co-Director Jorge Pullin, a professor with LSU Department of Physics & Astronomy, also attended, along with CCT faculty members who served as mentors for the students throughout the summer.

"I am very impressed with the quality of work you all have been able to produce in a short amount of time," Seidel told the students, noting that the interdisciplinary emphasis of CCT's REU is what leading science organizations consider the ideal setup for research.

The CCT REU students also developed posters about their work, which they presented as part of the 17th annual LSU Summer Undergraduate Research Forum, where undergraduate students from across campus present their summer research projects to a panel of distinguished University faculty and researchers.

In addition to working on their research, the REU students attended seminars and presentations with various CCT faculty throughout the summer, learned more about the high-performance computing resources and networking connections available through the Louisiana Optical Network Initiative, and visited the nearby Laser Interferometer Gravitational-Wave Observatory in Livingston, Louisiana.

For more information on CCT's REU in Interdisciplinary Research Experience in Computational Sciences, visit **http://reu.cct.lsu.edu.**

CCT Inspires K-12 Students and Teachers through Outreach

In addition to conducting research activities at the university level, CCT researchers implement a variety of outreach activities to develop the knowledge, skill sets, and career interests of students and teachers at the K-12 education level.

Through these outreach programs, which include lecture series, major events, workshops, meetings, and bringing distinguished visitors to campus, faculty and staff introduce K-12 students to computational and analytical concepts in exciting ways that stimulate their interest in advancing their science, technology, engineering and mathematics education.

Some of CCT's major outreach initiatives for a K-12 audience this year include:

NanoDays: Faculty from CCT's Material World research focus area and the LSU Department of Physics & Astronomy hosted a day of fun, free, family friendly activities at Highland Road Park Observatory in Baton Rouge. Called NanoDays, this event was part of a national event of educational programs about nanoscale science and engineering, sponsored by the Nanoscale Informal Science Education Network. NanoDays featured several hands-on activities for children of all ages, such as seeing how big they are compared to nanoscale objects, understanding how a scanning probe microscope allows scientists to explore the nanoworld, experiencing the effect of reducing the size of regular objects by trying to pour water out of a nano-cup, learning about nanomaterials used in the manufacture

of stain-resistant clothes, building models of nanoscale structures, playing with liquid crystals, and making some fluids magically part in the middle by applying magnets to them. NanoDays also featured presentations from two prominent nanoscience researchers, Kristen Buchanan of Colorado State University and Jayne Garno, LSU, who provided an overview of the nanoscale world and the tools that allow researchers to "see" it.

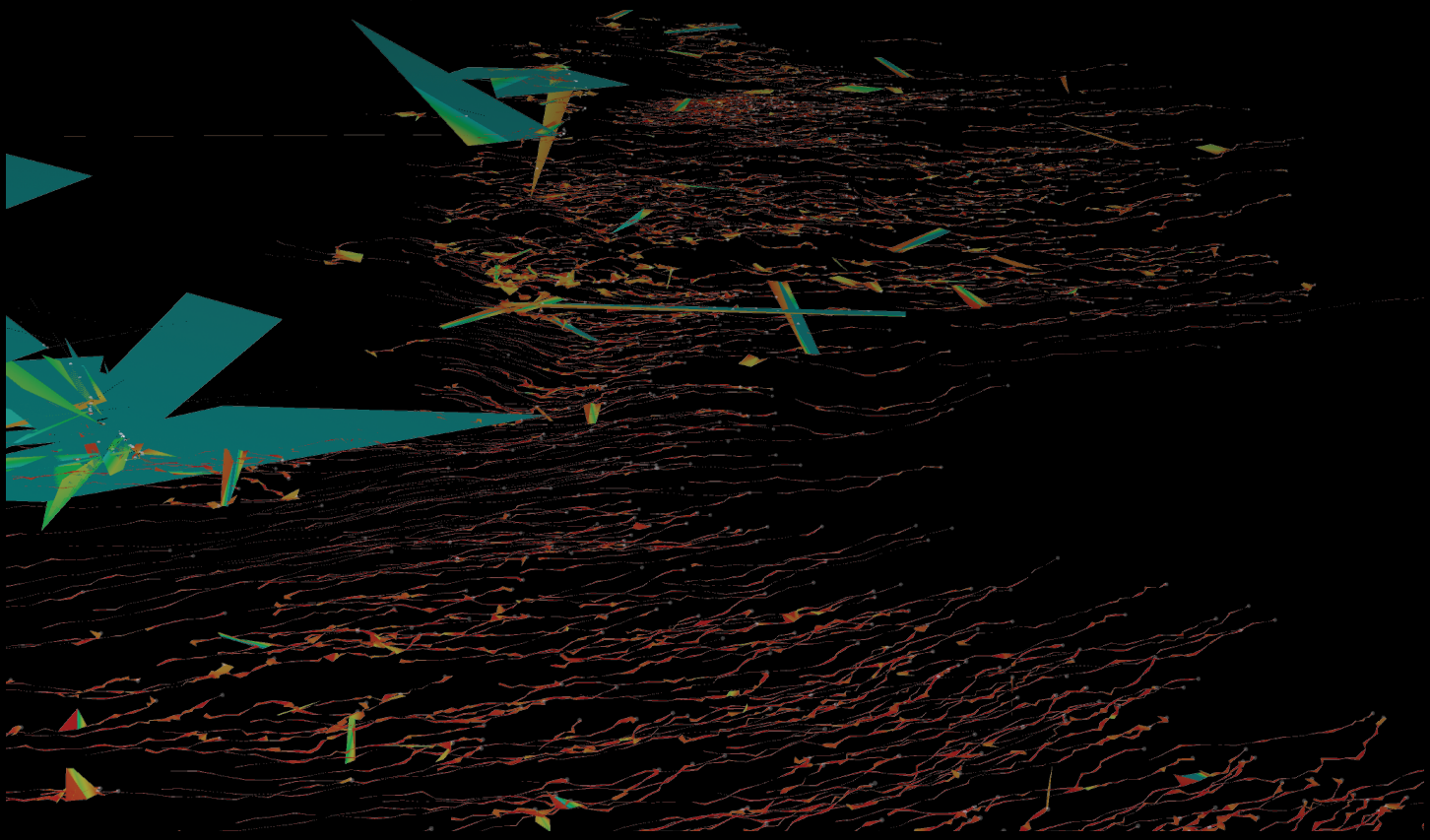
LSU Get Animated! Summer Camp: Nineteen students and one teacher from Baton Rouge-area middle and high schools spent a week learning basic techniques to develop storylines and create art for animation. During this camp, which took place at CCT's Laboratory for Creative Arts & Technologies, students worked with professionals to create original, short animated films. This camp took place through a partnership with AnimAction, a company that focuses on youth expression through animation and frequently participates in CCT's Red Stick International Animation Festival. The films students created during LSU Get Animated! Summer Camp can be viewed on CCT's YouTube channel, at www.youtube.com/LSUCCT, and these films were featured among the film screenings at the sixth annual Red Stick International Animation Festival in November 2010.

Beowulf Boot Camp: Professor Thomas Sterling, CCT and LSU Department of Computer Science, led the third annual Beowulf Boot Camp at CCT. Sterling developed this activity in 2007 with assistance from CCT faculty and staff to give high school students an introduction to high-performance computing research and technology, and offer them a chance to work hands-on with university researchers. The third camp was the largest and most successful Beowulf Boot Camp to date, doubling the student attendance to 40, and increasing the geographic reach, with students from high schools across the state attending. CCT offers this activity at no cost to the students, on a first-come, first-served signup basis. During Beowulf Boot Camp, the students built computer clusters from scratch, then connected their clusters together to form a mini supercomputer, which they used to develop and run basic applications. The students learned basic programming exercises, and conducted performance benchmark tests to see how the mini supercomputer they built compared to the world's largest and fastest machines.

Computational Science Workshop for Louisiana Educators: CCT hosted a no-cost, weeklong workshop for 25 Louisiana high school math, science or computer teachers to introduce them to computational science tools and techniques, giving them ideas for incorporating this technology into their lesson plans and curricula. Leading computational science educators from around the country traveled to LSU to teach the workshop, and LSU researchers on the CyberTools project, which aims to develop tools and applications that allow scientists to use high-performance computing more effectively, also worked with participants. CCT co-hosted this activity with the LONI Institute, a consortium created around the Louisiana Optical Network Initiative, or LONI. Computational scientists and faculty members who work with the LONI Institute attended the workshop to present their research. The 25 teachers who participated left with at least one lesson plan and homework assignment for their high school students, which included new computational science concepts and activities.

Cyberinfrastructure

CCT Professors Use Advanced Computing, Networking to Aid Gulf of Mexico Oil Spill Response



When the Deepwater Horizon oil rig exploded in the Gulf of Mexico April 20, 2010, it touched off the largest environmental disaster in U.S. history, leading to a full-scale response operation to stop the leak, understand and address damages, and minimize further harm.

At the university level, several CCT faculty members and researchers used their access to the advanced cyberinfrastructure available at LSU – high-performance computing, high-speed networking, software and hardware, and innovative data processing and management tools – to help inform the response and understand the oil spill's impact in various areas.

Networking Through New Orleans

As an immediate response to the oil spill, the Louisiana Optical Network Initiative, or LONI, assisted teams from the National Oceanic and Atmospheric Administration, or NOAA, as they arrived in New Orleans in late April to aid in the oil spill.

LONI, a high-speed, fiber optic network that connects supercomputing resources among six universities – LSU, Southern University, University of Louisiana-Lafayette, Louisiana Tech University, University of New Orleans and Tulane University, along with the two LSU health sciences centers in New Orleans and Shreveport, provided the NOAA team with access to high-speed, high-bandwidth networking connections so they could share and transfer critical data quickly.

Because there is no central NOAA office in Louisiana, the response teams would otherwise have been forced to rely on regular Internet connections available in hotels or on Wifi connections in public places to transfer data to NOAA's main office in Washington, D.C. This would be a long, slow process, especially since the NOAA teams must send large data files and coastal aerial imagery to coordinate response efforts at the federal level with on-site teams.

The LONI staff at LSU and Tulane University provided connections for NOAA staff arriving in New Orleans, who then used Tulane's high-performance computing resources, housed on campus, to upload their data and send it directly to federal response coordinators in the nation's capital. Because LONI connects Louisiana's network to the national Internet 2 high-speed network, data transfer occurred quickly, and federal teams were

able to respond faster than if relying on regular-speed network connections.

What Happens When An Oil Spill Encounters a Hurricane?

Hurricane season officially began June 1, and scientists with the National Oceanic and Atmospheric Administration predicted an active season, with more storms than average.

While a hurricane in any year is a dangerous threat to Louisiana and other coastal states, many worried how the oil spill in the Gulf of Mexico would worsen the potential impact of storm surge on the Louisiana coast.

LSU Professor Q. Jim Chen, with the Department of Civil and Environmental Engineering and CCT and Professor Robert Twilley, with the LSU Department of Oceanography and CCT, created a hurricane and storm-surge forecasting model that incorporates deposit and transport of oil into predictions.

Most hurricane and storm surge forecasting models are not designed to consider the three-dimensional transport of oil, but for more effective predictions and response, scientists need to combine models using different physics and examine multiple elements at one time, including the oil.

These more complex models often involve large data sets that are too big to run on a regular office computer. The Chen and Twilley-led research groups at LSU used the high-performance computing and advanced networking capabilities of LONI to develop and integrate multi-physics models and automate the data input to create visualizations rapidly.

In recent years, Chen's research group has used LONI computing resources to model hurricane winds, storm surges, wind waves, wetland erosion and sedimentation caused by Hurricanes Katrina (2005) and Gustav (2008). Chen and Twilley expanded these models to simulate how and where oil from the spill would move under hurricane-force winds and storm surge.
For an initial example, Chen and Twilley used data they had from Hurricane Gustav to predict what would happen if a similar storm on the same track entered the Gulf of Mexico this summer. Using LONI, Chen's exploratory model showed that if a Gustav-like storm hit, it would force oil and oil-contaminated sediment into the Barataria and Terrebonne bay marsh areas.

Chen presented these preliminary results at the Northern Gulf Institute Conference in Mobile, Ala., and is working with collaborators at LSU and other universities along the Gulf Coast to conduct further research varying storm tracks, intensities, sizes and speeds, along with changes in oil locations as recovery efforts continue.

Oil and Water

Mayank Tyagi, professor with CCT and LSU Department of Petroleum Engineering, is leading research to investigate how the spilled oil flows through water.

Tyagi's research in this area focuses mainly on computational fluid dynamics, the study of fluid flows in nature. Tyagi was part of a research group that created the Computational Fluid Dynamics Toolkit at CCT, which is a software program that allows scientists to model these processes more effectively using high-performance computing.
Using the toolkit, Tyagi and his team have built on their previous models created for examining oil flow through wells and pipelines to create new simulations that show how oil from the Deepwater Horizon leak moves through water in the Gulf of Mexico and then into ocean water.

Tyagi said these simulations could provide a better estimate on flow rate, pressure and properties of discharged oil at the leak location. Tyagi is planning to conduct further research to examine behavior and disbursement of discharged oil into seawater.

Overall, the research team is looking at their existing capabilities, near and long-term needs for a response system in terms of computational models, data management and experimental observations to see what could be used, adapted or changed to specifically address the Deepwater Horizon oil spill.

Wading Through the Data Deluge

One group in Louisiana aiding in oil spill response efforts is CLEAR, the Coastal Louisiana Ecosystem Assessment and Restoration group. The CLEAR

Program is a collaboration of state, federal, university and industry organizations that provide science-based solutions for coastal or environmental monitoring, preservation and sustaining.

LSU is a member of CLEAR, and the University research group is analyzing various data sets to advise on coastal recovery efforts. This presents a challenge because they are looking at very large files that must be efficiently stored, processed and analyzed.

Aiding in this process is PetaShare, a distributed data management system that Tevfik Kosar, a professor with CCT and the LSU Department of Computer Science, created through a grant from the National Science Foundation. PetaShare uses unique storage systems, schedulers and schemes that allow users to handle data more effectively with automated processes. This enables scientists to spend more time focusing on their research and less time dealing with data.

PetaShare is available at seven university test sites throughout Louisiana, connected to the Louisiana Optical Network Initiative, which allows data transfer at 40 gigabytes per second. Through PetaShare, there are 300 Terabytes of disk storage and 400 Terabytes of tape storage available in state. In comparison, large hard drives usually can hold up to one Terabyte of data, and most of the data sets the CLEAR group members are analyzing are too big to store on a single computer set or portable drive.

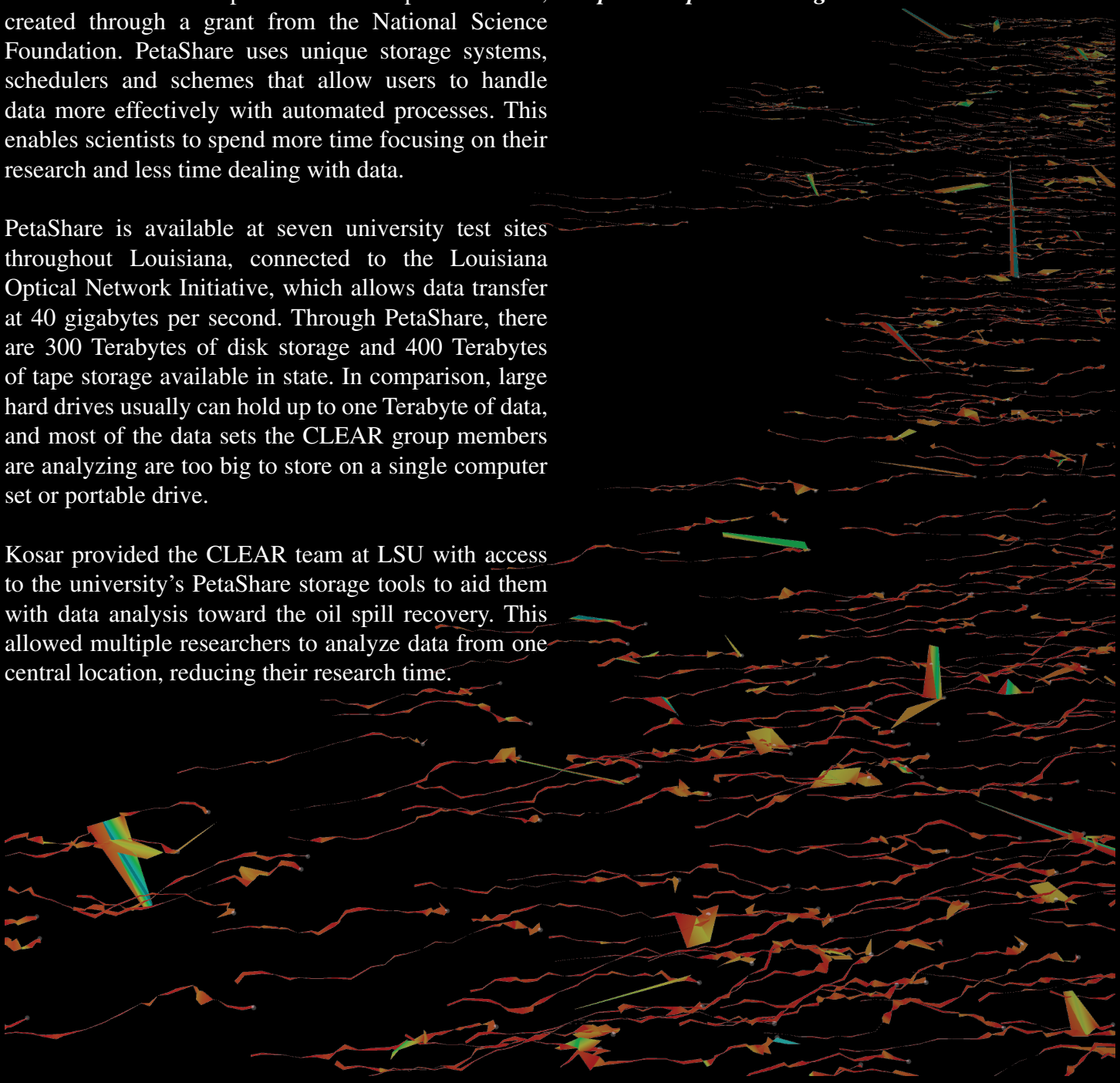
Kosar provided the CLEAR team at LSU with access to the university's PetaShare storage tools to aid them with data analysis toward the oil spill recovery. This allowed multiple researchers to analyze data from one central location, reducing their research time.

Related Links:
LSU Oil Spill Resources
http://www.lsu.edu/pa/mediacenter/tipsheets/oilspill.shtml

Coastal Louisiana Ecosystem Assessment and Restoration (CLEAR)
http://clear.lsu.edu/

Louisiana Optical Network Initiative
http://www.loni.org

PetaShare
http://www.petashare.org



ECONOMIC DEVELOPMENT

CCT Professors Receive $1 Million in Federal Funding To Advance Digital Media and Computational Science Research

LSU Professors Stephen David Beck and Thomas Sterling received $1 million as part of the appropriations in the United States Senate Omnibus Appropriations Bill for their "Center for Digital Innovation" proposal, which furthers research in next-generation digital media and supercomputer architecture.

Sen. Mary Landrieu (D-La.), who is part of the Senate Appropriations Committee, was instrumental in securing this and other funding for Louisiana.

Beck, Derryl & Helen Haymon Professor in the LSU School of Music, and Sterling, Arnaud & Edwards Professor in the LSU Department of Computer Science, both hold joint appointments with the LSU Center for Computation & Technology, or CCT. They jointly developed the Center for Digital Innovation proposal to expand research initiatives both are leading to advance components of 21st century computational science technology.

Beck, CCT interim director, is the University's lead on the Arts, Visualization, Advanced Technologies and Research, or AVATAR, Initiative. LSU approved the AVATAR Initiative in Spring 2008 to create a concentrated academic research program in digital media, including animation, video games, electronic music and digital art.

The AVATAR Initiative was a critical factor in leading video game company EA Sports' August 2008 decision to locate its North American Quality Control and Testing Facility in Baton Rouge, on LSU's south campus, and staff with the EA game testing center work closely with the AVATAR research group.

Faculty with the AVATAR Initiative spent the past two years developing a program that will allow students to obtain a minor in digital media through the LSU Colleges of Art & Design and Engineering, in which they will take courses in several departments, including computer science, electrical and computer engineering, music, art, English, and mass communication, to prepare them for careers in digital media. The University approved this academic program in Fall 2009, and students can formally declare the minor beginning this semester.

Sterling, a former NASA and Caltech scientist who invented the Beowulf cluster that is the building block of the world's supercomputing systems, leads the Systems Science and Engineering Focus Area within CCT. He and his research team have spent the past several years working on the ParalleX project to investigate how parallel computing environments can run effectively on large-scale machines.

He is part of the National Science Foundation's Exascale Point Design Study program, the NSF HPC Task Force, the DARPA Exascale Technology and Software Studies, and the International Exascale Software Project. He also is leading LSU's collaboration with Sandia National Laboratories on the recently announced DARPA Ubiquitous High Performance Computing Program to prototype next-generation supercomputers.

Sterling's research group is conducting research to determine the execution models, application programming interfaces, system software and hardware the scientific research community will need when supercomputers move from Petascale to Exascale and become capable of running a million trillion calculations per second.

"With the additional funding our proposal has received through federal appropriations, we're able to advance the research initiatives already taking place on campus and catalyze efforts within the digital media group and the supercomputer architecture group to expand work in both areas and create new opportunities," Beck said.

For more information:

Exascale Point Design Study: http://exascale.cct.lsu.edu

ParalleX: http://px.cct.lsu.edu

AVATAR: www.avatar.lsu.edu.

CCT Education and Research Highlights

The LSU Office of Research & Economic Development selected 100 University Rainmakers, honoring faculty who are nationally and internationally recognized for innovative research and creative scholarship, who compete for external funding at the highest levels, and who attract and mentor exceptional graduate students. Included among the Rainmakers are 13 CCT faculty members, who were named within their respective departments: Q. Jim Chen, Sitharama Iyengar, Brygg Ullmer, Gabrielle Allen, Tevfik Kosar, Thomas Sterling, Jagannathan "Ram" Ramanujam, Rudy Hirschheim, Susanne Brenner, Sumanta Acharya, Stephen David Beck, Chris White and Mark Jarrell.

Professor Jorge Pullin was invited to participate in a Joint Commission Meeting on Science and Technology Cooperation between the United States and Argentina, which included representatives of many federal agencies that fund science and technology projects from both countries.

Professor Susanne Brenner was named a Fellow of the Society for Industrial and Applied Mathematics, for "advances in finite element and multigrid methods for the numerical solution of partial differential equations." The members of the Class of 2010 Society for Industrial and Applied Mathematics (SIAM) Fellows, including Professor Susanne Brenner, were recognized at the Prizes and Awards Luncheon July 13 at the SIAM Annual Meeting in Pittsburgh, Pennsylvania.

Professor Gabrielle Allen was invited to be one of three keynote speakers at the TeraGrid 2010 conference (TG'10), discussing how computational modeling of complex systems (black holes and neutron stars) has enabled advanced breakthroughs. Honggao Liu, HPC Director at CCT, served as poster chair for TG'10.

Robert Lipton, a professor with LSU Department of Mathematics and CCT, was re-elected to the Board of Directors for the Society of Engineering Science for a second three-year term lasting from 2011 through 2013.

Professor Thomas Sterling was invited to attend the annual Conference on High Speed Computing in Oregon, which is the longest-running conference series in the field of supercomputing. This Department of Energy-sponsored meeting is by invitation only, and a limited number of guests are invited to participate.

Professor Brygg Ullmer won the ACM Symposium on User Interface Software and Technology conference's 2009 Lasting Impact award for his research into tangible and embedded interaction.

Zhifeng Yun, a doctoral student in the LSU Department of Electrical and Computer Engineering, was this year's recipient of CCT's dissertation fellowship to further graduate research in computational science.

Professor Thomas Sterling was honored during Supercomputing 2009 (SC 09) as one of five inaugural fellows of the International Supercomputing Conference, for his contributions to advance high-performance computing research and his contributions to the conference since its inception.

Professor Tevfik Kosar was selected as one of Baton Rouge Business Report's Forty Under 40 for 2009. These annual awards honor people doing innovative work in the capital region, and Kosar was honored for his research into advanced data storage and management systems at LSU, and for his efforts with the Pelican Foundation to establish science and technology-focused charter schools throughout Louisiana.

The International Society on General Relativity and Gravitation, a worldwide scholarly organization that promotes study and collaboration in relativity and astrophysics, asked CCT Interim Director Jorge Pullin to run for president of the organization. The society nominates only two candidates worldwide to run for this international position.

Victor Taveras, a postdoctoral researcher in LSU Department of Physics & Astronomy and CCT, won the Bergmann-Wheeler prize of the International Society of General Relativity and Gravitation "for contributions to loop quantum cosmology and the development of a novel extension of loop quantum gravity." This prize is for Ph.D. candidates who demonstrate research that brings novel approaches to quantum gravity.

CCT Associate Director for Economic Development Stacey Simmons was named Louisiana's Technology Leader of the Year at the Governor's Technology Awards. She was recognized for her tireless efforts to promote technology-based economic development in the capital region.

Professor Rudy Hirschheim, CCT and Information Systems and Decision Sciences, was ranked at the top of his field in two international studies of information science researchers: Lin & Gregor, and Truex et. al.

Professor Susan Ryan, LSU College of Art & Design and CCT, received the Tiger Athletic Foundation President's Award for teaching.

Robert Lipton, a professor in the LSU Department of Mathematics and CCT, was invited to present the keynote lecture "On Local-Global Approximation Error For Generalized Finite Element Methods" at the 9th World Congress on Computational Mechanics in Sydney, Australia, July 19-23.

Professor Susanne Brenner was a keynote speaker at the 6th Singular Dayson Asymptotic Methods for PDEs conference at the Weierstrass Institute for Applied Analysis and Stochastics in Berlin, Germany.

Professor Tevfik Kosar was invited to the Editorial Board of the ICST Transactions on Network Computing.

Professor Thomas Sterling was invited to give a presentation and participate on an open panel at the 24th Annual National HPCC Conference in Newport, Rhode Island.

Professor Sumanta Acharya, CCT and mechanical engineering, was selected as an LSU Distinguished Research Master of Engineering, Science and Technology. This honor, administered through LSU's Office of Research & Economic Development, has been presented annually since 1972 by the University Council on Research to acknowledge faculty who have made remarkable contributions through research and teaching. The University also awards a Distinguished Research Master of Arts, Humanities and Social Science.

Professor Thomas Sterling was invited to give one of the formal presentations of the first meeting of the new High Performance Computing Task Force of the National Science Foundation, which took place in Chicago, and was invited to give the opening presentation at the final technical meeting informing the DARPA UHPC Program management team at Stanford University in Palo Alto, California.

Professor Susanne Brenner was a keynote speaker at the sixth Southeast Asia Society for Industrial and Applied Mathematics (SIAM) Conference, which took place in Kuala Lumpur, Malaysia.

The paper "Critical Perspectives on Large-Scale Distributed Applications and Production Grids," authored by Shantenu Jha, Daniel S. Katz and co-authors Manish Parashar, Omer Rana and Jon Weissman, was declared Best Paper in the closing session of the 10th IEEE/ACM International Conference on Grid Computing (Grid 2009).

Susanne Brenner spent a month as Overseas Visiting Professor at the State Key Laboratory of Scientific and Engineering Computing (LSEC) at the Chinese Academy of Sciences in Beijing, China. During her visit, she taught a short course on Discontinuous Galerkin Methods. She also spent a month as Professeur Invité at the Laboratoire Jacques-Louis Lions at the Université Pierre et Marie Curie in Paris.

Professor Thomas Sterling gave talks at the IDC HPC User Forum at the Stuttgart High Performance Computing Center in Stuttgart, Germany; the University of Maryland Center of Scientific Computation and Mathematical Modeling in College Park, Maryland; and at the 22nd International Workshop on Languages and Compilers for Parallel Computing at the Trabant University Center at University of Delaware in Newark, Delaware.

Professor Jorge Pullin was appointed to the advisory panel of the journal Classical and Quantum Gravity of the Institute of Physics (UK). The advisory panel is composed of 20 high-caliber researchers from around the world, and panel members provide advice to the journal on fast-track communications and other high-priority research papers so the journal can apply the highest possible quality standards.

Two of Professor Tevfik Kosar's graduate students, Esma Yildirim and Dengpan Yin, had papers accepted in IEEE Transactions on Parallel and Distributed Systems, a prestigious research journal. Brandon Ross, one of Dr. Kosar's undergraduate research students, received the Department of Computer Science Undergraduate Research Award at the LSU College of Basic Sciences Choppin Honors Convocation.

Jintao Cui (CCT and LSU Department of Mathematics), a graduate student of Professor Susanne Brenner, was awarded a postdoctoral position at the Institute for Mathematics and its Applications (IMA) at the University of Minnesota.

Professors Thomas Sterling and Gabrielle Allen were invited to participate in the DOE Workshop on Cross-cutting Technologies for Exascale Computing in Rockville, Maryland.

Susanne C. Brenner was named the Michael F. and Roberta Nesbit McDonald Professor in the LSU College of Science.

CCT-Sponsored Conferences and Events 2009-10

IEEE CLUSTER 09
Date: Aug. 31-Sept. 4, 2009
Attendees: 210
Location: Hotel Monteleone, New Orleans

ACM Regional Programming Contest
Dates: Nov. 6-7, 2009
Attendees: 79 teams across five sites
Locations: LSU, Abilene Christian University, Texas A&M University, LeTourneau University and East Central University

Scientific Computing Around Louisiana
Dates: February 5-6, 2010
Attendees: 75
Location: LSU campus

17th Annual Mardi Gras Conference on Computational Materials and Methods
Dates: Feb. 11-13, 2010
Attendees: 70
Location: LSU campus

Llama Coding Workshop
Dates: March 8-10
Attendees: 15
Location: LSU campus

Lunch & Learn Oracle Workshop
Date: March 16, 2010
Attendees: 40
Location: LSU campus

3rd Computational Biology Workshop
Dates: March 26-27, 2010
Attendees: 39
Location: LSU campus

NanoDays
Date: March 27, 2010
Attendees: 125
Location: Highland Road Park Observatory

Laptop Orchestra of Louisiana Debut Concert
Date: April 14, 2010
Attendees: 75
Location: Claude L. Shaver Theatre at LSU

LONI HPC Workshop
Dates: April 26-28, 2010
Attendees: 23
Location: LSU campus

CCT Research Experience for Undergraduates
Dates: May 31-July 30, 2010
Attendees: 16 selected; 99 applicants
Location: LSU campus

LSU Get Animated! Summer Camp
Dates: June 7-11, 2010
Attendees: 20
Location: Shaw Center for the Arts

Beowulf Boot Camp
Dates: June 14-18, 2010
Attendees: 37
Location: LSU campus

Virtual Summer School: Petascale Programming Environments & Tools
Dates: July 6-9, 2010
Attendees: 10
Location: LSU Campus

LONI Technical Forum
Dates: July 19-20, 2010
Attendees: 35
Location: Pennington Biomedical Research Center

Computational Science Workshop for Louisiana Educators
Dates: July 19-23, 2010
Attendees: 25
Location: LSU campus

Virtual Summer School: Proven Algorithmic Techniques for Many-Core Processors
Dates: Aug. 2-6, 2010
Attendees: 13
Location: LSU campus

Lectures 2009-2010

Sponsored by CCT and held on LSU campus
Speakers Fall 2009 through Summer 2010: 35 total

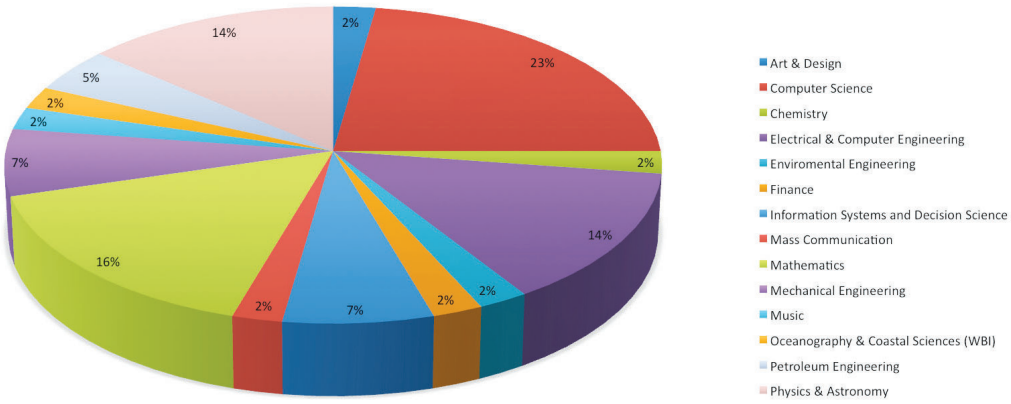
CCT Colloquium Series: 7
Frontiers of Scientific Computing Lecture Series: 3
Computational Mathematics Seminar Series: 9
Special Guest Lectures: 11
AVATAR Lecture Series: 3
CCT Distinguished Lecture Series: 1

IT Eminent Lecture Series, sponsored in partnership with LSU Department of Computer Science: 1

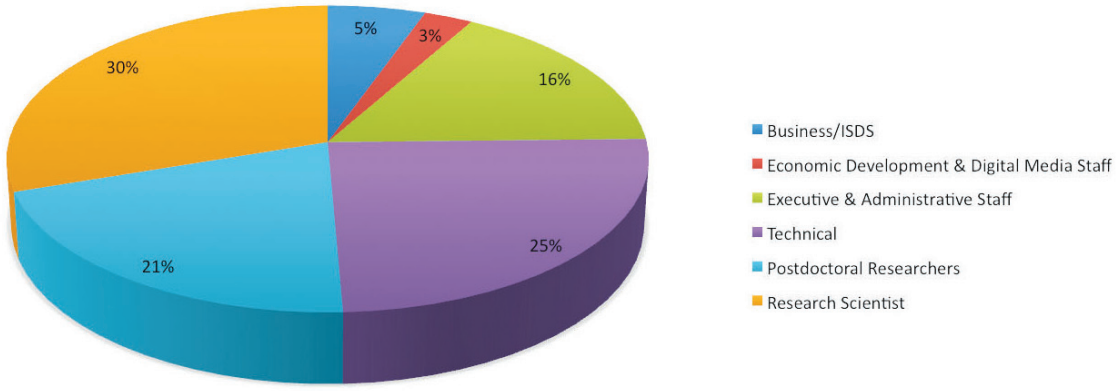
High-Performance Computing Tutorials 2009-2010
Hosted on the LSU campus
Organized by CCT and HPC @ LSU

Fall 2009: 18 tutorials
Spring 2010: 11 tutorials
Summer 2010: 7 tutorials

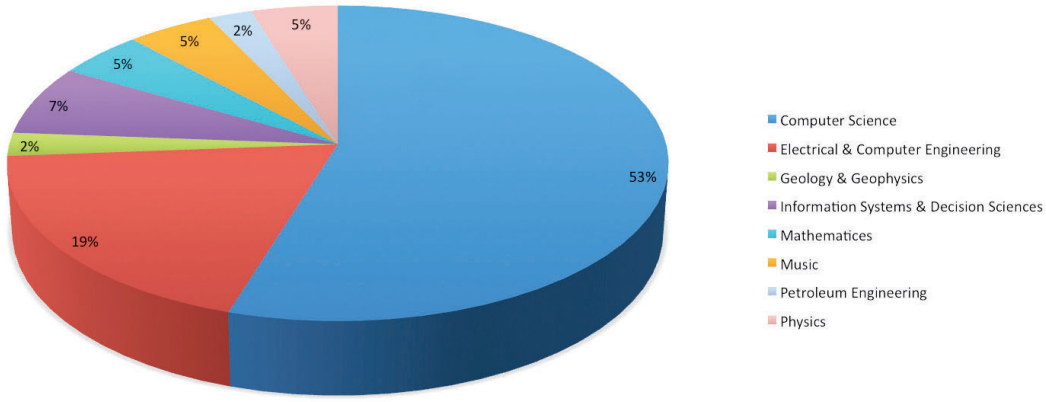
CCT Faculty by Department for 2010



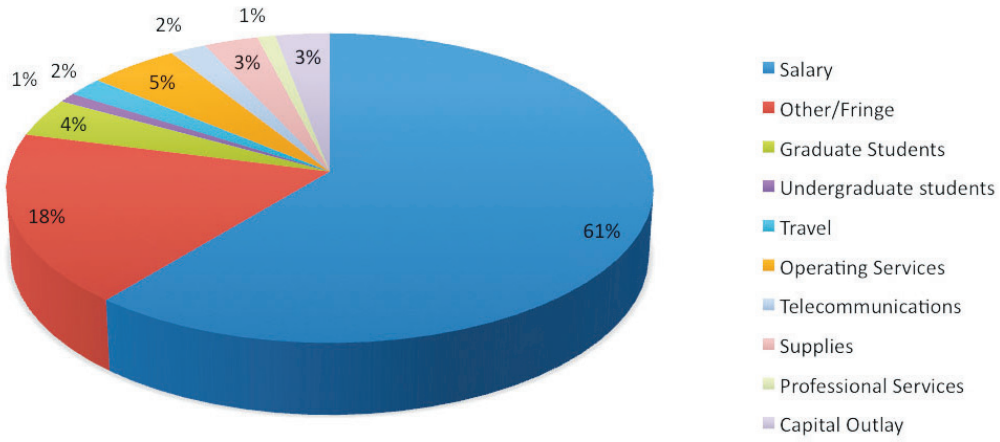
CCT Professional Staff for 2010



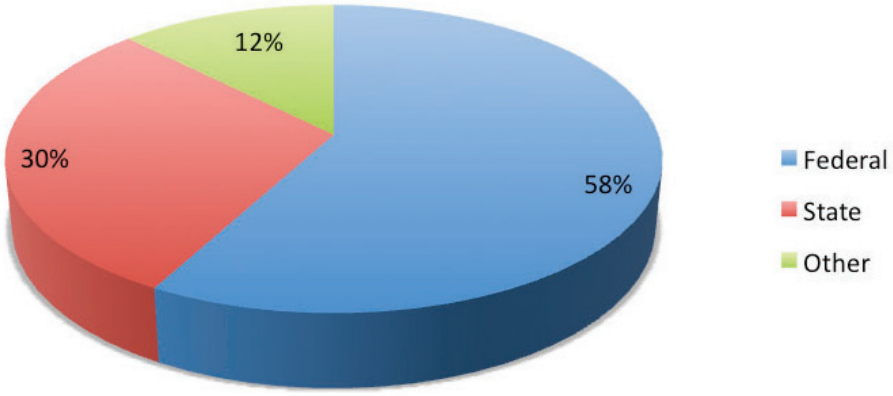
CCT Graduate Assistants by Department for 2010



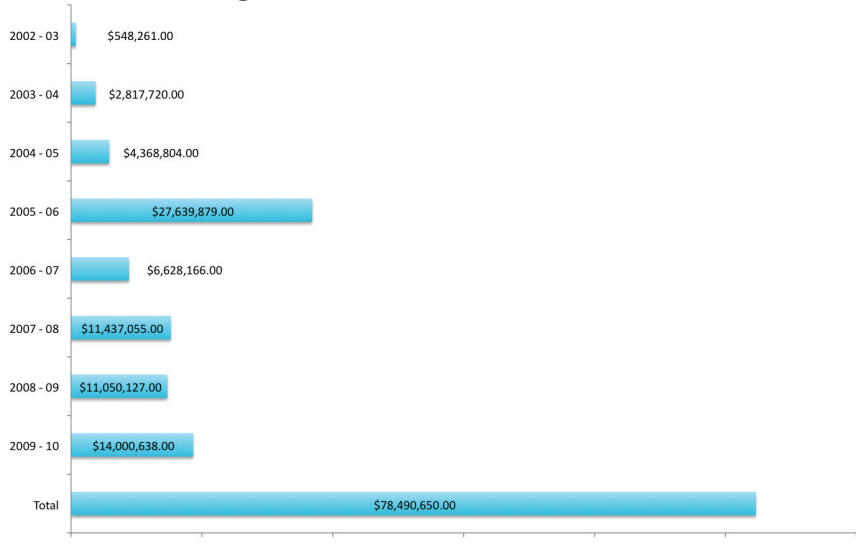
CCT Investment Summary 2009-2010



Cumulative External Funding by Source FY 2003-2010



External Funding FY 2003-2010



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