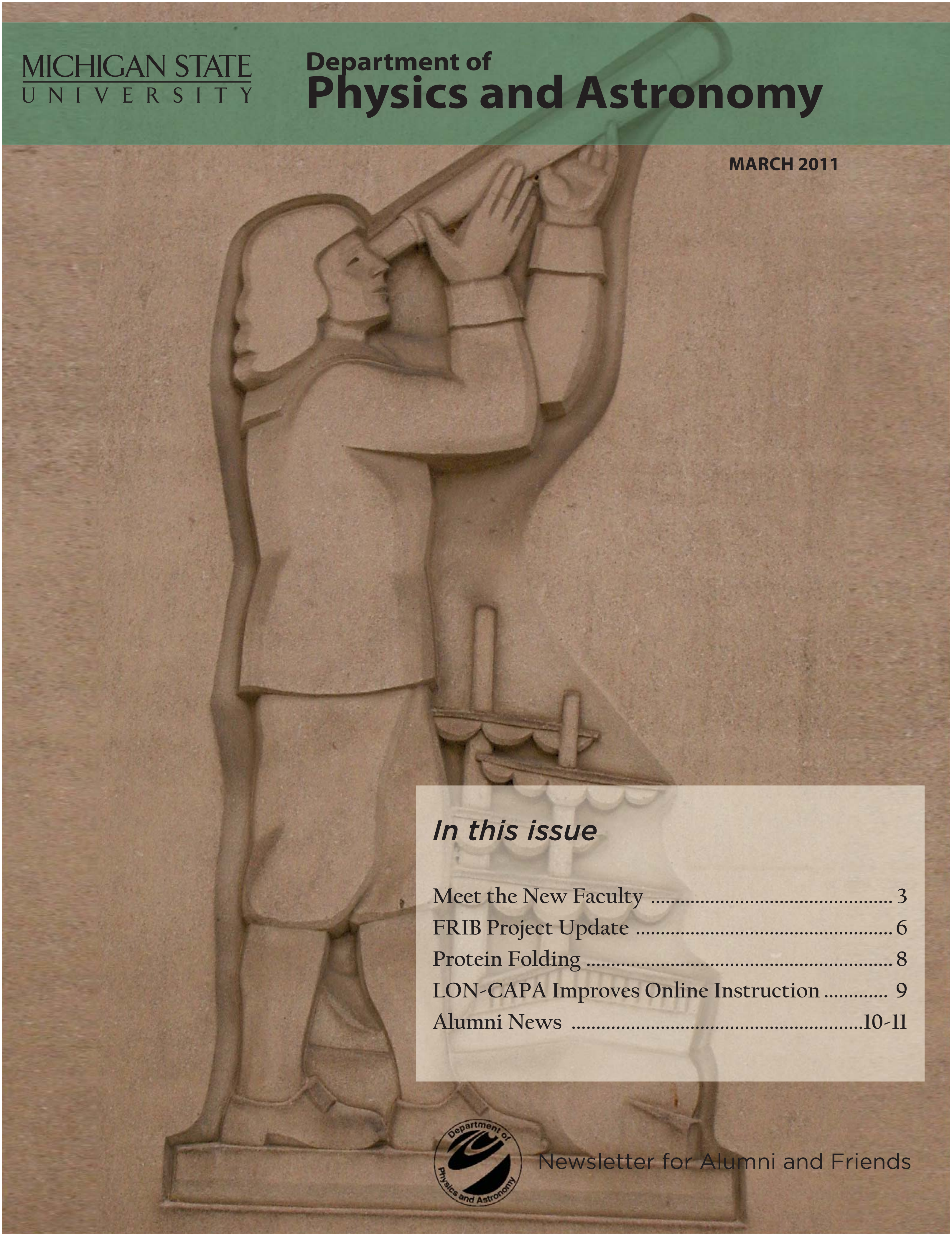
MICHIGAN STATE UNIVERSITY

Department of Physics and Astronomy

MARCH 2011



In this issue

Newsletter for Alumni and Friends

Department of Physics and Astronomy Newsletter
Volume 12, Spring 2011

Wolfgang Bauer, Chairperson
Daniel Stump, Undergraduate Program Dir.
Scott Pratt, Graduate Program Director
Steve Zepf, Associate Chair, Astronomy

The MSU Department of Physics and Astronomy newsletter is published annually by the College of Natural Science and Department of Physics and Astronomy for alumni and friends.

Send correspondence to: Dept. of Physics and Astronomy, c/o College of Natural Science Advancement Office, 103 Natural Science Building, East Lansing, MI 48824-1115. Phone (517) 432-4561, E-mail: natsci4u@msu.edu

Contributing writers: Wolfgang Bauer, Layne Cameron, Mark Fellows, Angela Hobson, Brian O'Shea, Alex Parsons, Scott Pratt, Mike Steger, David Tomanek, C.P. Yuan and many other faculty and alumni provided content for the publication.

www.pa.msu.edu

A Letter from the Chair:
Energy and Environment

Dear Friends of the Department,

In this issue of our newsletter I would like to focus on the issue of energy and the environment. At the very least since the explosion of the Deepwater Horizon oil platform in the Gulf of Mexico last April, we have all become aware of the perils of relying on fossil fuels as our primary energy source. Oil exploration has become much harder and more costly as we try to recover oil from ever-more inaccessible locations.

Wolfgang Bauer

Human activity since the onset of the industrial revolution in the mid-19th century has increased the level of CO_2 in our atmosphere to almost 400 parts per million (ppm), whereas it had always been between 200 and 300 ppm during the previous 500,000 years of Earth's history. And the level of atmospheric CO_2 is still increasing exponentially!

Global warming is real, but so far has only had a small effect during the past century. It is very likely that this global warming is connected with the increase in CO_2, a potent green-house-gas. The question, however, is by how much our average temperature will rise, and how much disruption to climate and the biosphere this will cause.

What is the way out? Physics can contribute greatly to the solution of energy and climate problems. In our department, we have made great strides in doing our part. We are participating in a new MSU initiative to build an anaerobic digester for waste processing and biogas production, we are participating in a national initiative on nuclear waste transmutation, and we are studying pathways toward other and much safer nuclear power plants.

Perhaps our biggest investment in future energy solutions is our Complex Materials with Energy Applications initiative. We are partnering with Chemistry, Engineering, and Computer Science to produce better materials for batteries and for photocells. Last year this partnership resulted in six new faculty hires, two of them (John McGuire and Pengpeng Zhang) in physics, and we are planning on hiring three or four additional faculty members in this initiative.

The problems of energy and the environment have to be solved, and you can count on our faculty, students, and staff doing their part.

With best wishes,

Wolfgang Bauer
Chair
Department of Physics and Astronomy

Join us in welcoming these new faculty members to the Department of Physics and Astronomy.

Daniela Leitner joined the faculty in October as a professor and as a member of MSU's National Superconducting Cyclotron Laboratory. She is part of the Accelerator Research and Development Group.

Daniela Leitner

Leitner's research focuses on the development and implementation of high-intensity Electron Cyclotron Resonance ion sources for high charge state heavy-ion beams and heavy-ion linear accelerators. She is overseeing the construction of the ReA3 ReAccelerator at NSCL and is involved in the development of the Deep Underground Science and Engineering Laboratory.

Leitner received her PhD from the University of Technology, Vienna in 1995.

leitner@msu.edu

Mike Syphers joined the faculty in August as a professor and as a member of MSU's National Superconducting Cyclotron Laboratory.

Mike Syphers

Syphers' research focuses on high energy accelerators and efficient acceleration of high intensity particle beams. He is working on the development of the Facility for Rare Isotope Beams which is scheduled to come on-line in 5-10 years.

Syphers received his PhD from the University of Illinois in 1987. He previously worked in the Accelerator Division of Fermilab and has taught courses in accelerator physics for the U.S. Particle Accelerator School.

syphers@msu.edu

Oscar Naviliat-Cuncic started a joint appointment between the department and the cyclotron in August 2010. He earned his PhD in experimental nuclear physics at the Catholic University of Louvain in Louvain-la-Neuve, Belgium, in 1989, where he carried out nuclear structure studies using gamma-ray spectroscopy techniques. He then spent eight years as a research associate at the Swiss Federal Institute of Technology (ETH) in Zurich and twelve years as a professor at the University of Caen Lower-Normandy in France, before moving to MSU.

Oscar Naviliat-Cuncic

After his PhD thesis, Naviliat's research topics oriented toward the study of fundamental interactions and the tests of discrete symmetries by means of precision measurements at low energies. He has contributed to several experiments involving polarization observables in weak decays, using polarized neutrons, nuclei and muons. He led, in particular, the experiment which resulted in the most precise test of maximal parity violation in nuclear beta decay so far. More recently, he has been involved in correlation and decay measurements using trapped radioactive ions and trapped ultra-cold neutrons.

Naviliat plans to further broaden the experimental possibilities using exotic nuclei, which offer a rich spectrum of candidates for precision measurements at low energies due to the large number of isotopes, the diversity of states and the different decay modes involving the fundamental interactions. He also plans to perform challenging experiments at the new facility for stopped beams – currently under construction at the cyclotron.

naviliat@nscl.msu.edu

Most-Cited Paper

An article in the November 2010 edition of the journal *Science Watch* identified a paper by MSU faculty and postdoctoral researchers as the most-cited paper in hadron collider physics during the past decade.

The article, "New generation of parton distributions with uncertainties from global QCD analysis," was authored by professors **Jonathan Pumplin, Dan Stump, Joey Huston**, and the late **Wu-Ki Tung**, along with post-docs **Hung-Liang Lai** and **Pavel Nadolsky**. The article has been cited nearly 1,000 times since it was published in the *Journal of High Energy Physics* in 2002.

The second most cited paper over the 10-year period also has an MSU connection as it was co-authored by the STAR collaboration which includes Professor **Gary Westfall**.

MSU Growing Complex Materials Area

Michigan State is in the process of filling several tenure-stream faculty positions as part of a broad-based effort to expand its research and educational expertise in complex materials for energy applications.

Phil Duxbury, professor of physics, is Director of MSU's Center of Research Excellence in Complex Materials. The center welcomed seven new faculty during the 2008-09 hiring initiative, and the active searches are focused on materials chemistry and materials theory with appointments spanning physics, chemistry, and engineering.

The center is also sponsoring the 2011 International Conference on Thermoelectrics to be held in July at Traverse City, Michigan.

Comparing Models with Data Sets

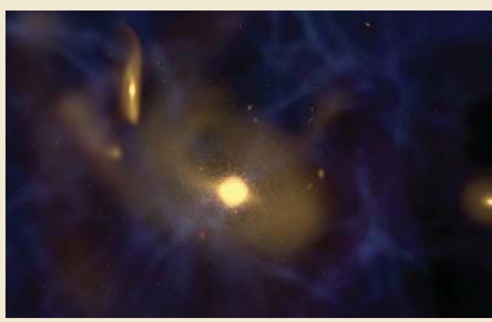
Advances in the development of sensors, detectors, computation and data storage have vastly improved the abilities to collect data. Similarly, the increased speed and availability of computers have extended the reach of scientific modeling. A detailed comparison between the data and the models is required, and the Modeling and Data Analysis Initiative, or MADAI, collaboration has been developed to rigorously compare the two.

The MADAI collaboration is composed of an interdisciplinary group of physicists, climatologists, statisticians, and visualization experts. It is led by **Scott Pratt**, professor of physics, and also involves **Wolfgang Bauer**, **Brian O'Shea** and **Mark Voit**. Other members in the collaborative include statistics and geology faculty from MSU along with faculty from several departments at Duke University and the University of North Carolina.

The scientists are developing statistical analysis and visualization tools for the purpose of comparing complex theoretical models and simulations to large-scale, heterogeneous data sets. These tools will be applied to several different pressing scientific challenges, including relativistic heavy ion collisions, galaxy formation, cosmology, supernova dynamics, atmospheric modeling, and bio-chemical evolution. The MADAI analysis infrastructure is designed to simultaneously address several pressing scientific challenges and, once finished, should be extensible to many other problems of current scientific interest.

The MADAI collaboration is funded by the National Science Foundation's Cyber-Enabled Discovery and Innovation program. More information about MADAI can be found at http://www.pa.msu.edu/~pratts/madai/.

Using the tools developed by the MADAI collaboration, the model shown at left can be directly compared and tested by data taken using the telescope on the right.



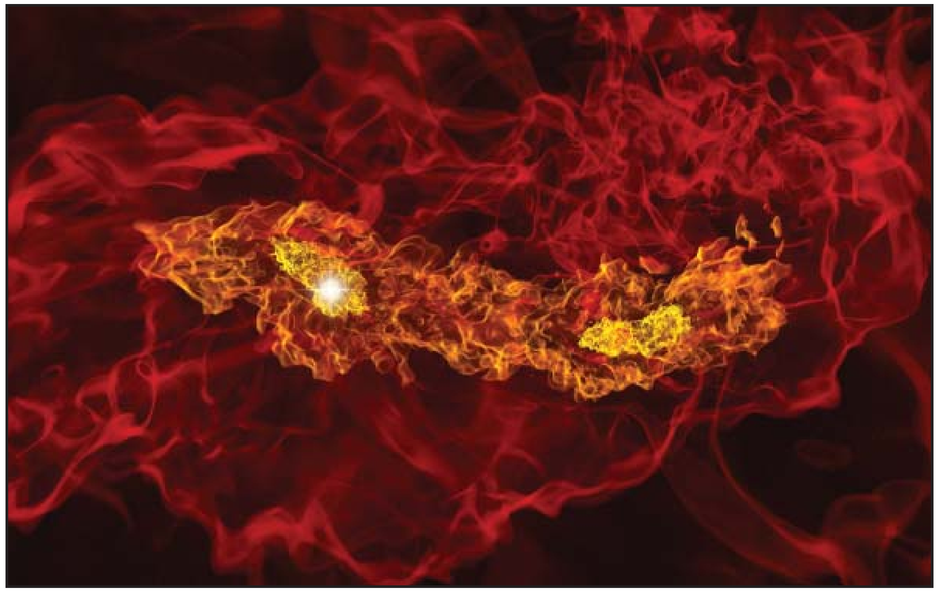
Left: *Snapshot of a simulation of the formation of a Milky Way-sized galaxy, taken right before a major merger of two galaxies will take place. Yellow points are stars, brown clouds are gas (out of which stars form), and the blue filamentary material in the background is distant cosmic structure. Image by MSU's Brian O'Shea and Donna Cox from the Advanced Visualization Lab, National Center for Supercomputing Applications.*

Right: *The telescope used by the Sloan Digital Sky Survey, in which MSU is a partner. This telescope, located at Apache Point Observatory, New Mexico, has imaged hundreds of millions of stars in our own galaxy, and provides spectra for over half a million of these stars. Image by the Sloan Digital Sky Survey consortium.*

From Galaxy Formation to Nuclear Proliferation

As a computational astrophysicist, Brian O'Shea finds himself juggling a range of projects and collaborations while finding time to delve into discussions with his students related to history, science and nuclear proliferation.

O'Shea's primary research focuses on galaxy formation and evolution. This makes him one of the larger users of computing time on campus, and his office is conveniently located in the heart of MSU's Institute for Cyber Enabled Research (iCER). He is part of the Modeling and Data Analysis Initiative (MADAI) grant, where researchers are developing statistical and visual tools for comparing theoretical models to large data sets.



A computer-simulated, false-color image of the formation of a binary star system. Visualization by Matthew Turk, Tom Abel and Brian O'Shea.

"To learn about the formation of galaxies and build the research tools necessary, you must be interdisciplinary and actively involved in many areas of physics and astrophysics," says O'Shea. In addition to collaborations with many of the faculty in the department's astronomy group, O'Shea is also involved with the National Superconducting Cyclotron Laboratory and the Joint Institute for Nuclear Astrophysics.

Brian O'Shea

Using supercomputers and custom-designed software to study the formation of cosmological structures such as galaxies is a major part of his research. O'Shea's visualizations can be seen on NASA's James Webb Space Telescope website (http://www.jwst.nasa.gov/). His work indicating that the universe's earliest inhabitants, Population III stars, were not nearly as massive as originally thought was published in *Science* in 2009. Again, the modeling and computation involved required massive computing power and complex models.

O'Shea joined MSU in 2008 as an assistant professor and is jointly appointed in the Department of Physics and Astronomy and Lyman Briggs College. He earned a PhD in physics from the University of Illinois at Urbana-Champaign and spent three years as a Director's Postdoctoral Fellow at Los Alamos National Laboratory.

Given his background at UIUC and programming skills, O'Shea is involved with developing code for "Blue Waters" – an NSF-funded petascale computing system scheduled to go online in late 2011.

Aside from the research and supercomputing, this semester O'Shea is teaching a senior seminar titled "Nuclear Weapons and Nuclear Proliferation." The class is composed of primarily science majors, and is as much history as it is science.

"The class understands and enjoys the science aspects of the class, yet once we get into the biographies of many of the scientists involved in the early development of nuclear weapons, the students really enjoy the context and can connect with the history," says O'Shea. "The students have a different concept of nuclear war than people who grew up during the Cold War. Bridging the science with the social aspects of that era and then weaving in the history of how the U.S. model for basic science research developed is giving the students a better understanding of how science and government interact."

View the video of the Galaxy Evolution simulation at: http://www.jwst.nasa.gov/videos_science.html

Facility for Rare Isotope Beams Preps for 2012 Review

In the almost two years since the U.S. Department of Energy Office of Science (DOE-SC) awarded the Facility for Rare Isotope Beams (FRIB) Project to Michigan State University, the project has made significant progress and is on track for completion in 2020. A significant milestone was passed in September 2010 when DOE-SC approved the preferred alternative design in Critical Decision-1 (CD-1) with an associated cost up to $614.5 million and a schedule range from fall of fiscal year (FY) 2018 to spring of 2020.

Figure 1. The FRIB preferred alternative design, approved by the DOE Office of Science in September 2010. The existing National Superconducting Cyclotron Laboratory (NSCL) is shown with current construction for office space and experimental areas highlighted in yellow. Gray roofs indicate new construction for FRIB. The dashed line borders underground facilities.

When FRIB becomes operational, it will be a new DOE national user facility for nuclear science, funded by the DOE-SC Office of Nuclear Physics and operated by Michigan State University. FRIB will provide intense beams of rare isotopes (that is, short-lived nuclei not normally found on Earth). There are about 3000 known isotopes and as one approaches the limits of stability (unstable nuclei having extreme proton-to-neutron ratios), isotopes become rarer and harder to produce. The main focus of FRIB will be to produce such rare isotopes, study their properties, and use them in applications to address national needs. FRIB will provide researchers with the technical capabilities to study the properties of rare isotopes, and to put this knowledge to use in various applications, including in materials science, nuclear medicine, and the fundamental understanding of nuclear material important to nuclear weapons stockpile stewardship.

An optimization from the facility layout initially proposed for FRIB to the preferred alternative design moves the linear accelerator (linac) from a straight line extending to the northeast through Michigan State University's campus to a paperclip-like configuration next to the existing structure at the National Superconducting Cyclotron Laboratory, shown in Figure 1. The linac will have over 344 superconducting radiofrequency (SRF) cavities in an approximately 550 foot long tunnel about 40 feet underground accelerating stable nuclei to kinetic energies at a minimum of 200 MeV/nucleon for all ions with beam power up to 400 kW. (Energies range from 200 MeV/nucleon for uranium to above 600 MeV for protons.)

The Critical Decision (CD)-2 review to approve the performance baseline is planned for spring 2012 and CD-3 review to approve start of construction is planned for 2013. The selected architect/engineering firm and FRIB construction manager are exploring options to advance civil construction to summer of 2012.

Recent meetings between NSCL and FRIB User Groups have put a merger in the works, expected to be initiated this year with the final merger for more than 800 members and functions by the end of the year or early in 2012.

More information about the Facility for Rare Isotope Beams Project is available at: www.frib.msu.edu.

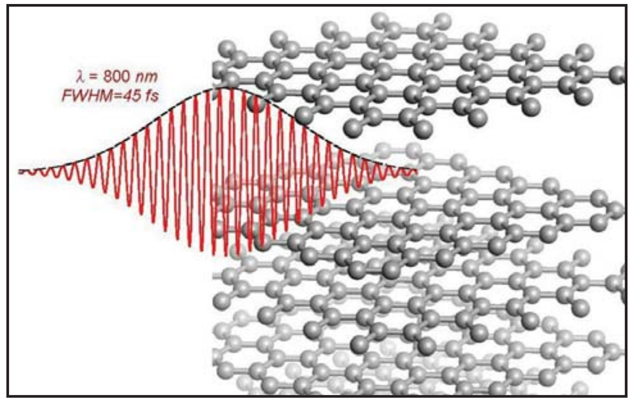
More information about the FRIB User Group can be found at: www.fribusers.org.

Better Than Scotch Tape: Exfoliating Graphite by Light

A black line, the trace of a pencil on paper, contains one of the most exciting high-tech materials, namely graphitic carbon. Even though many consider the diamond form of carbon as most precious, the layered graphitic structure has been puzzling scientists much more due to the vast number of related nanostructures, ranging from buckyballs to nanotubes and, more recently, graphene.

Graphene, a monolayer of graphite, is the elusive material that captured the imagination of scientists during the last few years, resulting in the 2010 Nobel Prize in Physics. To harness its unique electronic properties for applications requires mass production of graphene with no or few defects. This has proven unusually challenging. Best quality samples are still being produced by mechanically detaching graphene monolayers from graphite using Scotch tape. Chemical methods all leave substantial residue and typically produce highly defective samples that are not suitable for high-tech applications.

Part of the mission of the Nanoscale Science and Engineering Center for High-Rate Manufacturing is to design efficient processes to produce nanostructures. With recently renewed funding of $12 million from the National Science Foundation, **David Tomanek**, professor of physics, coordinates computer modeling research.



The topmost graphene monolayer detaching after graphite has been exposed to a shaped femtosecond laser pulse.

Recent theoretical study by Miyamoto, Zhang and Tomanek, published in *Physical Review Letters* Vol. 104, Page 208302 (2010), suggests an unusual alternative to mechanical and chemical fabrication processes, namely femtosecond laser pulses. By performing extensive computer simulations on the Japanese "Earth Simulator" supercomputer, which treat the quantum motion of electrons and atoms in a nanostructure exposed to intense light by first-principles techniques, the researchers found that laser pulses can exfoliate graphite. By carefully tuning the laser pulse shape, only the topmost graphene layer may detach when the graphite surface is exposed to a strong laser pulse with a wavelength of 800 nanometers and a pulse width between 10-50 femtoseconds. When verified experimentally, optical detachment may allow for a mass-production of defect-free graphene monolayers for a wide range of applications, in particular in electronics. To view this process through an animation by Thomas Moore, go to http://nanotube.msu.edu/photo-graphene/photo-graphene.mov.

iCER: Crunching an Increasing Amount of Data

As the volume of research using increasingly larger datasets continues to grow across science disciplines, the demand for processing power and access is a never-ending quest. MSU recently committed ten million dollars over the next five years to develop the Institute for Cyber-Enabled Research, or iCER.

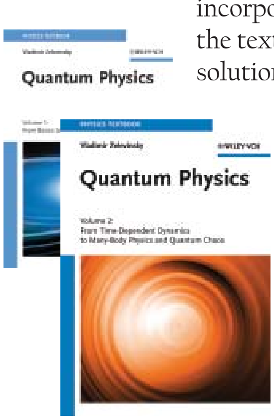
The institute hosts the High Performance Computing Center, MSU's main supercomputer, while providing the most powerful computational resources possible for faculty and students. iCER coordinates available resources across many systems in order to efficiently increase faculty access to high performance computers. Led by Wolfgang Bauer, iCER is giving MSU scientists a strong competitive edge in research fields which depend on advanced computing.

iCER is part of the National Science Foundation's Petascale Computing Initiative which is building a computer capable of one quadrillion floating point operations per second. MSU is a partner in the Great Lakes Consortium for Petascale Computation led by the University of Illinois at Urbana-Champaign. Together with other universities, they are developing the next generation of computers.

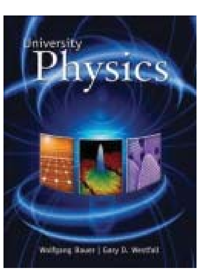
"The institute is developing interdisciplinary projects to efficiently use MSU's computing assets," says Bauer. "We have a faculty scholars program and post-doctoral fellowships to support the goal as we recognize the increasing demand for high performance computing. This extends beyond physics and computational sciences as we grow in areas of bioinformatics, evolutionary biology and other life science research areas where researchers need processing power."

Recent Faculty Publications

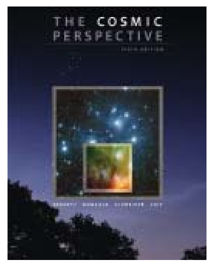
The 2-volume set *Quantum Physics* was published by professor **Vladimir Zelevinsky**. The two textbooks present a full course of quantum physics starting from scratch and ending with quantum chaos and entanglement. Problems are incorporated into the text, partly with solutions, yet no mathematical supplements are required as the whole formalism is consistently explained. Many important applications are discussed – superconductivity and superfluidity, Aharanov-Bohm effect, neutrino physics, isospin, teleportation and no-cloning theorem. The relativistic quantum mechanics and quantum radiation theory are also included. The two volumes are designed so an instructor can select material appropriate for a specific group of students including undergraduates.



The first edition of *University Physics with Modern Physics* was published by MSU professors **Wolfgang Bauer** and **Gary Westfall**. The comprehensive text provides enhanced calculus coverage incorporating a consistently used 7-step problem solving method. The book includes a wide variety of everyday contemporary topics as well as research-based discussions designed to help students appreciate the beauty of physics and how physics concepts are related to the development of new technologies in the fields of engineering, medicine and astronomy.



The Cosmic Perspective, Sixth Edition was published by MSU professors **Megan Donahue** and **Mark Voit** along with Nicholas Schneider and Jeffrey Bennett from the University of Colorado. Building on a long tradition of effective pedagogy and comprehensive coverage, the textbook provides the most up-to-date introduction to astronomy for non-science majors. The text provides a wealth of features to help enhance student skill building, including new Visual Skills Check end-of-chapter questions that provide an opportunity for students to test their visual interpretation skills, new Cosmic Context Figures that help students synthesize key concepts and processes, and a new comprehensive visual overview of scale to help students explore the scale of time and space.



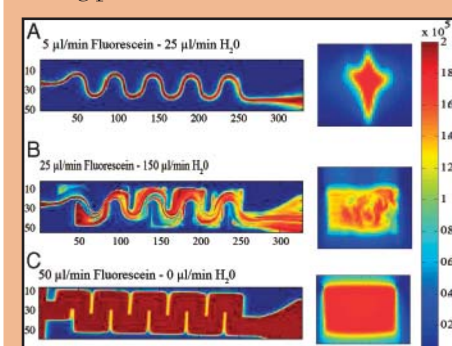
Physics Helps Biologists Understand Protein Folding

Understanding how wiggling chains of amino acids fold into the proteins that make the body work is far less frantic than previously thought, according to research by **Lisa Lapidus**, assistant professor of physics.

Lisa Lapidus

In a recently publication in the *Proceedings of the National Academy of Sciences*, Lapidus investigated one of the biggest mysteries in biochemistry: understanding the physics of protein folding. Along with Steven Waldauer, whose doctoral dissertation formed the basis of the study of the pre-folded state of proteins, the findings may lead to new treatments for disease.

"People thought they understood how protein diffusion worked, but now our data suggests they're wrong by a factor of 1,000," Lapidus said. The research blends biology and physics by focusing on the speed at which the unfolded proteins assemble into their lowest-energy state. Lapidus and her team constructed an entirely new apparatus with a custom designed microfluidic chip capable of measuring protein movement within a fraction of a millisecond.



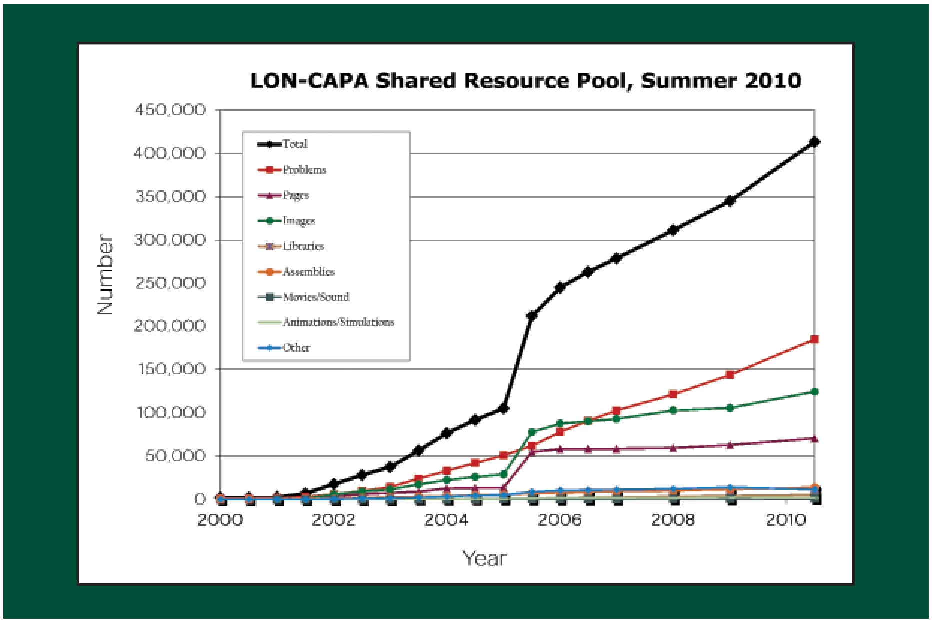
Microscopic images of the serpentine-form mixing process for the Waldauer-Lapidus team's protein folding study. The different views show the effects of different flow rates. Panels at right show cross-section views.

Protein folding is the process by which chains of amino acids rearrange into complex three dimensional structures. How a protein's final structure is chosen from the hundreds of possible structures is unknown.

"Now we can start changing the models," Lapidus said. Lapidus and her team speculate that proteins which rearrange more rapidly may be more prone to errors when folding. Improperly folded proteins contribute to diseases and the team's work may lead to new therapeutic strategies.

LON-CAPA Grows and Improves Student Learning

What started 19 years ago as a way to provide randomized homework with immediate feedback has evolved into an open-source system used today by 160 institutions around the world. The Learning Online Network with Computer-Assistant Personalized Approach, or LON-CAPA, continues to play a major role in teaching physics and other disciplines at MSU as nearly 25 percent of all MSU students are using the program as part of their coursework each semester.



Gerd Kortemeyer

Gerd Kortemeyer, associate professor of physics, oversees the management of the LON-CAPA system that brought together different lines of teaching, research and innovation developed by physics professors Signell, Kashy, Benenson, Westfall, Bauer, and Kortemeyer. Recent university changes have allowed for the system to move from a central facility back into the full oversight and management of the Department of Physics and Astronomy.

"With LON-CAPA housed in the department, we can be more responsive and nimble," says Kortemeyer. "I expect us to be able to deploy updates quickly and we will soon be launching version 3.0 which features a more intuitive interface."

The strength of the system is the 400,000 pieces of content in the shared resource pool. The content, which includes 184,649 problems, is a tremendous resource for faculty as writing teaching materials can be time consuming, adds Kortemeyer. Faculty members have written most of the resources in the content pool, sometimes in connection with externally funded projects, but originally for use in their own courses.

Students receive individualized problems selected by the faculty and adjusted to their skill level. The completely web-based interface allows for multimedia content and on-demand access by students.

"The amount of shared resources has been steadily growing over the past five years, so locating resources has become a big problem," says Kortemeyer. "We have the data for helping faculty select the appropriate content; so we are working on making it visible and easier to locate."

Also in development is a module for users to manipulate graphs. This will allow for students to translate between formulas and graphs, and better access their learning process, says Kortemeyer. A fundamental component of the system is assessing the effectiveness of individualized online homework. Using data going back to 1993 when online homework was introduced, researchers have found that the system does improve learning and that students most helped are those who are on the brink of failing the course.

At MSU, more than a dozen departments across seven colleges use LON-CAPA. Physics accounts for the largest user at 25% of the system, yet other primary users include the departments of accounting, biological sciences, computer science and statistics.

As more institutions use the system and contribute to the shared resource pool, the collection of homework problems, images and pages will continue to grow. Kortemeyer is going on sabbatical this fall where he will be installing LON-CAPA at the Massachusetts Institute of Technology.

"Sharing resources fits into the academic culture," says Kortemeyer. "Having resources provided by 160 institutions enables us all to more effectively teach both science and non-science majors."

Alumna Recognized as one of the Top 100 "History Makers in the Making"

Njema Frazier, PhD '97, was recognized as one of "TheGrio's 100: History Makers In The Making." The list includes 100 African-American men and women who are writing the next chapter of American history. She was recognized for her work in "modernizing the way the United States will defend itself in the 21st century" and for helping to develop future scientists.

Frazier graduated from MSU in 1997 with a PhD in theoretical physics. She is a senior physicist with the National Nuclear Security Administration's Defense Science Division. Frazier oversees and coordinates the weapons-related science activities at Los Alamos, Lawrence Livermore, and Sandia National Laboratories. Her work addresses national security needs, science-based stockpile certification, and confidence-building measures essential to a credible national nuclear deterrent without nuclear testing.

Frazier manages the development of codes for weapons simulations which create computer models to test the safety, performance, and reliability of aging warheads. As the United States government moves from a test-based defense system to a simulation-based one, Frazier's work is modernizing the way the United States will defend itself in the 21st century.

"I am incredibly proud of Dr. Frazier, both for being named to this highly prestigious list of history makers in the making, and for being a shining example of the outstanding scientists, researchers and engineers working day and night to keep the American people safe," said Don Cook, NNSA's Deputy Administrator for Defense Programs. "This recognition demonstrates her commitment and dedication to community outreach, including her leadership of community-based science events for K-12 students."

Njema Frazier graduated from MSU in 1997 with a PhD in theoretical physics and is a senior physicist with the National Nuclear Security Administration's Defense Science Division.

Frazier has lectured and mentored students, from kindergarteners to high school seniors, to teach them about science education. She uses her public status to set an example to black students as a science role model.

Prior to joining the NNSA, Frazier spent four years as a Professional Staff Member for the U.S. House of Representatives Committee on Science where she assisted and advised committee members on various policy, budget, and technical matters within the jurisdiction of the committee.

TheGrio's 100 shines a spotlight on the next generation of African-American history makers and industry leaders from 10 fields, including business, education, sports, science and the environment, media, service and activism, politics, health, pop culture and the arts. Other honorees include First Lady Michelle Obama and Olympic Gold Medalist Cullen Jones. TheGrio's 100 is released by theGrio.com, a division of NBC News.

Frazier has also been featured in *Essence Magazine*, *Black Enterprise Magazine*, and the PBS Profile Series on the National Society of Black Engineers.

Send us your career news and accomplishments:
www.pa.msu.edu/alumni

Connect with alumni and students
Facebook
facebook.com/MSUCNS

Linked In
http://bit.ly/CNSlink

ALUMNI CLASS NOTES

Richard Peterson, MS '66, PhD '69, is serving as a program director in the National Science Foundation's Division of Undergraduate Education (DUE). He is also a senior staff physicist at Bethel University, St. Paul, MN. Peterson is a past president of the American Association of Physics Teachers (AAPT), a fellow of the American Physical Society (APS), and past recipient of the APS Prize for physics research at an undergraduate institution. He is also a senior member of the Optical Society of America and an OSA traveling lecturer.

James Zeidler, MAT '68, retired from the University of California, San Diego, in September. He advised 25 PhD students while at UCSD and is now an emeritus research professor in the Department of Electrical Engineering at UCSD. He also is the President and CEO of Adaptive Dynamics, a company specializing in communications signal processing.

Bonifacio Vega, '88, has been appointed Director of Technology Transfer and Business Development at the Madrid Institute for Advanced Studies in Nanoscience in Spain.

Amanda Bayless, Astrophysics '02, received a PhD in astronomy from the University of Texas at Austin in August and is a postdoctoral researcher with the Space Science and Engineering Department at the Southwest Research Institute (SwRI) in San Antonio, Texas.

Michaela Kopka, '05, graduated from the University of Toronto with a Medical Doctorate degree in May. Kopka is pursuing orthopedic surgery training at the University of Calgary with a research focus related to surgery in the developing world.

Derek Marshall, '06, recently joined the IBA Engineering Team in New Jersey as an Electronic Systems Engineer working on the proton therapy particle accelerator.

Dan Bruder, '08, is an associate software developer for Auto-Owners Insurance in Lansing. He previously spent two years teaching high school physics at a Tennessee boarding school.

Joseph Kimball, '10, was accepted into the doctoral physics program at Texas Christian University.

Workshop and Alumni Reception in Taiwan

C.-P. Yuan organized two workshops last fall at the National Center for Theoretical Sciences (NCTS) at Tsing-Hua University in Taiwan. The workshops discussed physics issues related to the CERN Large Hadron Collider (LHC). High energy physicists from USA, Japan, Korea, China and India participated in the program titled LHC Physics: W, Z and Beyond. Useful information was exchanged among experimentalists and theorists in the meetings, and pedagogical lectures helped the participating students and postdocs better understand the issues. Among the invited speakers were MSU physics professors R. Sekhar Chivukula and Elizabeth Simmons and doctoral alumni Tim Tait ('99) and Chuan-Ren Chen ('08).

In October, Simmons, Chivukula and Yuan helped Claire Brender, director of international alumni relations, host a gathering for MSU alumni in Taiwan. The very lively crowd, pictured here, includes several physics alumni, including Shang-Fan Lee ('94), Lung-Sheng Lee ('94) and Keng-Ching Lin ('96).

MICHIGAN STATE UNIVERSITY

DEPARTMENT OF
PHYSICS AND ASTRONOMY

c/o College of Natural Science
103 Natural Science Building
East Lansing, MI 48824-1115

Nonprofit Org.
U.S. Postage
PAID
East Lansing, MI
Permit No. 21

The Crab Nebula from the SOAR Telescope

The Crab Nebula, the remnant of a supernova that exploded in 1054 AD, seen in infrared light emitted by relativistic electrons spiraling through the strong magnetic field that surrounds the central neutron star.

The image was taken by MSU astronomers led by Professor Ed Loh during six nights using the new Spartan Infrared Camera on the SOAR Telescope.

The field of view is about 6 minutes of arc across, corresponding to 11 light years at the Crab Nebula's distance of 6500 light years.

The Southern Astrophysical Research, or SOAR, Telescope is at Cerro Pachon, Chile, and is operated by a consortium, including Michigan State University.

http://www.pa.msu.edu/soarmsu/