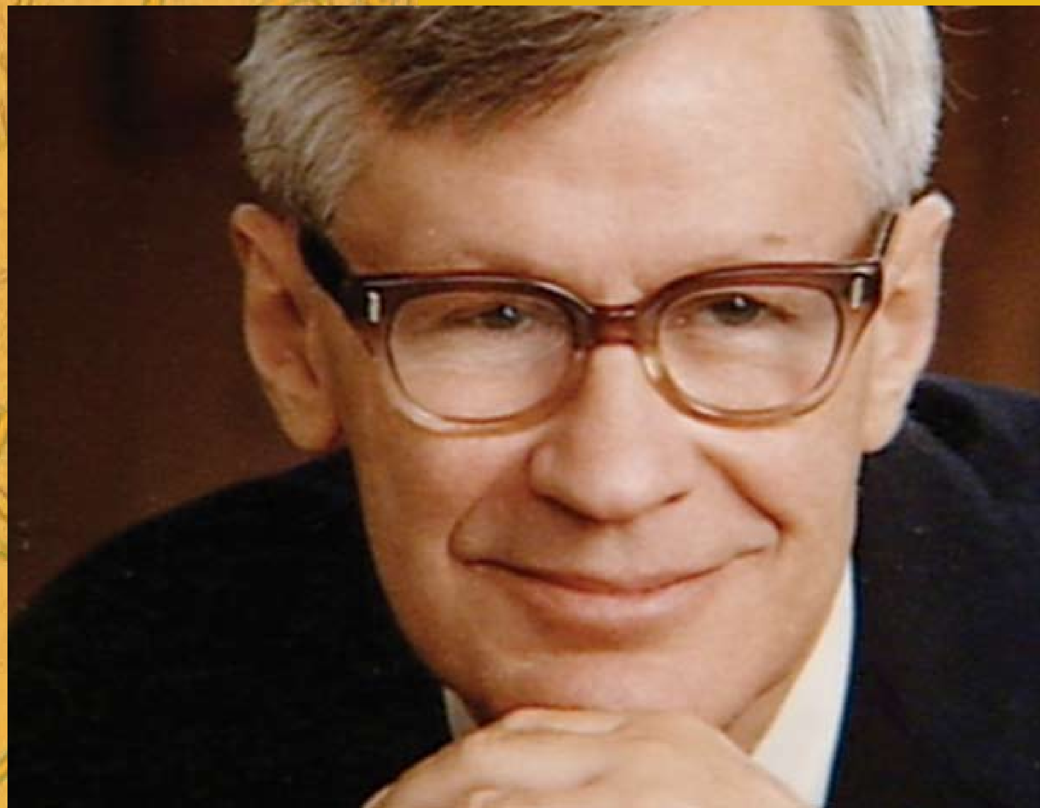
UCLA

Department of Physics & Astronomy

Annual Report 2005 - 2006

David Saxon 1920 - 2005



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*

Department of Physics & Astronomy
2005-2006

University of California, Los Angeles

Message from the chair. . .

Joseph Rudnick, Chair
2005-06

The feature article of this year's annual report recalls the exceptional life and many achievements of David S. Saxon, an accomplished physicist, an extraordinarily gifted academic leader and a man of high and consistent principles. The article gives a clear sense of his qualities and attainments. However, no words can describe the pleasure of having known David. My father, Izzy Rudnick, joined the Department in 1948, a year after David arrived. He and my mother counted David and Shirley Saxon among their closest and dearest friends. When David returned to UCLA as an emeritus faculty member, I had a chance to become better acquainted with him. I had the privilege of talking to David from time to time, often when I found myself at a loss with regard to some personal, professional or administrative dilemma. I always left with a deeper understanding of the issues I had to face and with a renewed appreciation for his wisdom, his sense of humor, his bracing honesty and his unfailing humanity. The three years he served as departmental chair, from 1963 to 1966, was a period of rapid growth and profound change. The department of physics and astronomy as it exists today still bears David Saxon's imprint. A few of us are destined to make a difference in the world. David was one of that select group of people. His passing was a loss to all of us.

The past year has seen a number of positive developments. The work of Professor Edward (Ned) Wright and the COBE team, in particular the success of COBE collaboration in mapping out the spectrum of the cosmic microwave background and, even more remarkably, in uncovering the first convincing evidence of its spatial anisotropy, has been recognized twice. First, Ned and the rest of the COBE team shared this year's Gruber Prize in Cosmology with the team leader, John Mather. Second, the 2006 Nobel Prize in Physics was awarded to Dr. Mather and Professor George Smoot, a member of the COBE collaboration, "for their discovery of the blackbody form and anisotropy of the cosmic microwave background radiation." Given the central and essential role that Ned played in extracting the first unambiguous signal of that anisotropy from COBE data, we are especially pleased to offer our heartiest congratulations to him, along with his colleagues in this key endeavor. As you will read in this report, Ned continues to play a key role in satellite-based investigations into the history and structure of our universe, as a collaborator on the Wilkinson Microwave Anisotropy Probe (WMAP), which reported the results of three years of observations in March 2006 and as principal investigator of the Wide-Field Infrared Survey Explorer (WISE), which has been approved for development leading to launch in 2009.

Many other members of our faculty have made their mark this last year. For example, Professor Robert (Bob) Cousins now occupies a leading position as Deputy Spokesperson in the international collaboration working on the Compact Muon Solenoid (CMS), one of two large detectors on the about-to-be-commissioned Large Hadron Collider (LHC) at CERN in Geneva, Switzerland. He is the highest ranked of any U.S. experimentalist on this key enterprise. Look for him and his UCLA colleagues, Professors David Cline, Peter Schlein, Katsushi Arisaka, Jay Hauser, David Saltzberg and Rainer Wallny to play a leading role in uncovering the new physics that we all expect to emerge from measurements on the CMS as the LHC generates the most energetic beam of colliding protons ever produced. For more information on what the members of our faculty have been up to, I refer you to the body of this report.

A few additional honors and some milestones deserve special mention here: Professor Jian-Wei (John) Miao was awarded a Sloan Fellowship this year. Professor Eric D'Hoker was elevated to Fellowship in the American Physical Society. Three valued members of our faculty, Professors William Slater, Ernest Abers and Chun Wa Wong, joined the ranks of our emeriti. The Department joined in the celebration of the 90th birthday of Emeritus Professor Robert Finkelstein (for a picture of Bob, along with Izzy Rudnick and Dave Saxon, see the feature article). Finally, the Department welcomed two new faculty members. Yaroslav Tserkovnyak, a condensed matter physicist, has joined us from Harvard where he was a junior fellow. Pietro Musumeci, a specialist in accelerators and beams, who received his graduate training here at UCLA, will be arriving in January 2007 from the University of Rome. We are extremely pleased to be adding these two talented and energetic young scientists to our ranks.

Ferdinand Coroniti, Vice Chair
2005-06

I cannot close without a special expression of appreciation to all of you who will receive this annual report, most particularly our alumni and friends. Your continued attention to this department and the contributions that you make to our well-being are among our most valuable and prized assets. Please accept our gratitude for your interest in us. We hope to remain worthy of your regard, as we expect to continue to contribute to the exploration of the frontiers of human understanding, the dissemination of knowledge, and the education of the future leaders of science and society.

Contents . . .

iv.........Message from the Chair

1..........David Stephen Saxon
A Man of Courage and Integrity

5..........Donors

8...........Physics & Astronomy Alumni Association
(P A A L)

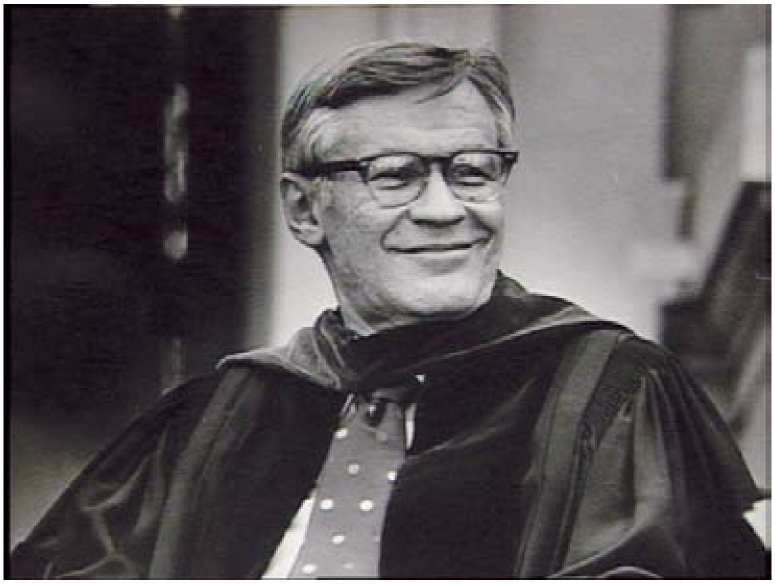
9............Research Highlights

24...........Faculty

25...........Education Highlights

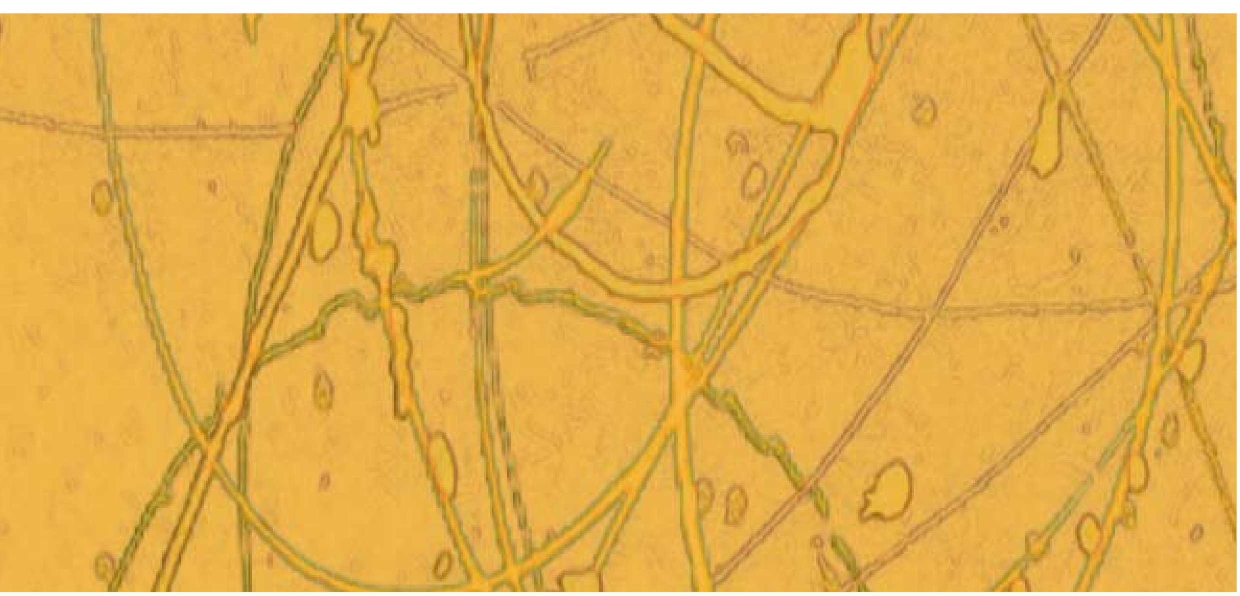
29..........Graduation 2005-06

David Stephen Saxon
A Man of Courage and Integrity



"California, and the University of California, have lost a great leader in David Saxon," said current UC President Robert C. Dynes.

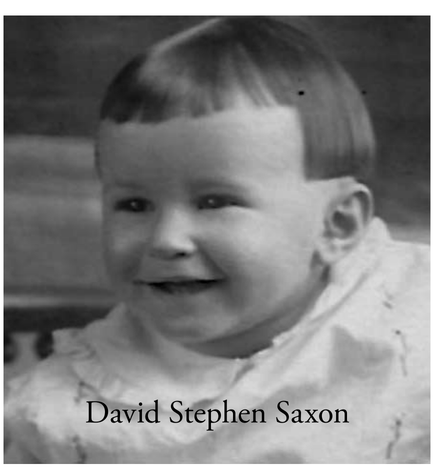
He was a physics scholar who rose through academia at UCLA to become president of the University of California and leader of the Massachusetts Institute of Technology — after having been dismissed for taking a principled stand against the loyalty oath at the outset of his career. David S. Saxon, a beloved figure in the Department of Physics and Astronomy and well beyond, died last December at UCLA Medical Center after a lengthy illness. He was 85.



In the year since his death, much has been said and written about the courage and integrity Saxon showed in refusing to sign the McCarthy-era loyalty oath, which he saw as a breach of academic independence. But Saxon never wanted to be remembered for that chapter, and family members, friends and colleagues are quick to point out that courage and integrity were qualities evident throughout his life. Saxon is also remembered for his incisive mind, his sense of humor, and his abiding interest in students and commitment to the quality of their education.

"California, and the University of California, have lost a great leader in David Saxon," said current UC President Robert C. Dynes. "David was a passionate believer in the university and, during a period of severe fiscal challenge, a tireless advocate for public higher education and the benefits it conveys to society. He was a man of principle and vision whose outstanding scholarship and thoughtful leadership made a lasting contribution to the university and the state."

Former UCLA Chancellor Albert Carnesale, himself a physics scholar, called Saxon "a brilliant physicist, a devoted teacher, and a skilled administrator who played a crucial role in the growth and development of UCLA and the University of California system."



David Stephen Saxon

David Stephen Saxon was born Feb. 8, 1920 in St. Paul, Minn., the son of parents who had immigrated from Eastern Europe. The family moved to Philadelphia in the late 1920s. As a high school senior, David decided he wanted to study chemical engineering at MIT. It was a financial stretch. "Providing funds for his education became a family project," says Byron Wright a longtime friend and colleague in the physics department at UCLA.

Saxon at MIT

Saxon entered MIT in September 1937 and it wasn't long before he switched majors. "He knew right away that it had to be physics," says Shirley Saxon, who met her future husband of 65 years at a mixer the month after he arrived at MIT.

Saxon stayed at MIT for both his bachelor's (1941) and doctoral (1944) degrees. As a graduate student during wartime he worked in the MIT radiation laboratory's theoretical physics group, where he completed his dissertation on classical electromagnetic theory. In that group he shared an office with Alfredo Banos, Jr. and Julian Schwinger, with whom he would eventually be reunited at UCLA.

The UCLA Physics Department's "New Crop" of Faculty

Banos joined the UCLA physics faculty in 1946 and proved instrumental in bringing Saxon aboard a year later.

Saxon joined the UCLA faculty as an assistant professor of theoretical nuclear physics in 1947, around the same as contemporaries including Wright, Bob Finkelstein, Ed Gerjuoy and Harold Ticho. "The UCLA physics department was at that time on a post-World War II hiring spree," recalls Ticho. The "new crop" of faculty, which had a less staid approach to academia than the "old boys," quickly became a remarkably cohesive group, holding lively discussions on teaching approaches, weekly faculty journal club meetings, and occasionally rowdy parties where friendships were cemented.

It was an optimistic time. "We were beginning our careers as independent physicists," says Finkelstein. "Although UCLA was very much in its infancy, we were both convinced that it would become a major university. The future looked very promising. Then disaster struck: The loyalty oath hit us in 1949."

The Loyalty Oath

At the height of the McCarthy era, with the nation gripped by anti-Communist fervor, the UC Board of Regents was asking all new and current employees to affirm their loyalty to the U.S. and California constitutions and swear they were not members of the Communist Party. Saxon objected, not based on political grounds but on principle, to that kind of government involvement in academia. "He felt that such an oath was inconsistent with the concept of intellectual freedom that should be a hallmark of any university, and its imposition a dereliction by both the university president and the regents," explains Ticho.

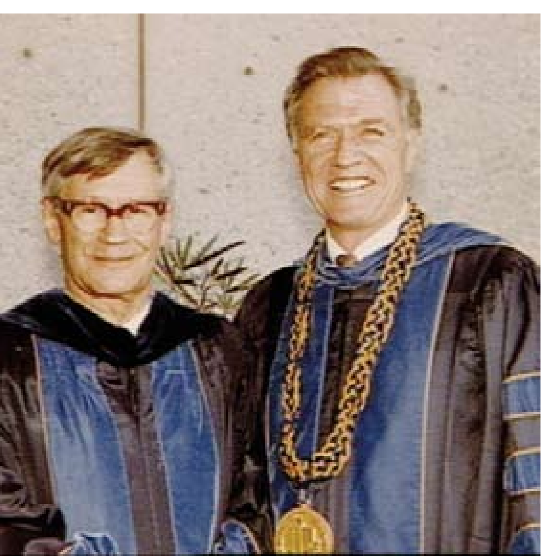
Other UC faculty joined in the fight, but ultimately most of them signed. The 31 who didn't, including Saxon, were dismissed.

Shirley Saxon recalls that it wasn't a difficult decision for her husband. "He knew he just had to do it," she says, "not only for himself but also for the physics department and the university."

Ticho, who would one day follow Saxon as chair of the physics department and then as dean of the physical sciences at UCLA, says he agonized for months over an oath he regarded as highly improper, but in the end decided to sign. "I greatly admired David's integrity and I was truly awed by his principled stand — after all, he also had a family to think about," Ticho says. "From then on, all of us thought of him as a model."

"It was remarkably brave," says Gerjuoy. "It endeared me to him. And that was just one example of his integrity. I always knew that I could really rely on Dave."

Following his dismissal, Saxon took a position with the U.S. government, working for the National Bureau of Standards. Shortly thereafter, the California Supreme Court invalidated the UC loyalty oath requirement, and Saxon rejoined the UCLA faculty in 1952.



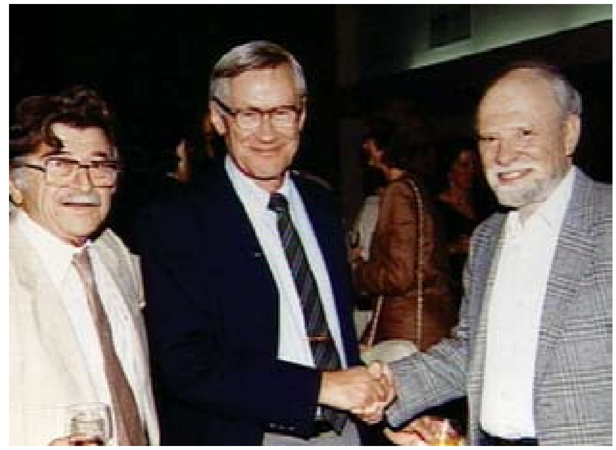
Saxon and Chancellor Charles E. Young

Back on Track

His career back on track, Saxon wasn't interested in being known as one of the professors who took a stand against the oath; he preferred to be recognized for his scientific work. Saxon's academic interests included theoretical physics, nuclear physics, quantum mechanics and electromagnetic theory. "People tend to specialize in one sub-area or another, but when it came to understanding and explaining, he was quite good at just about every aspect of physics," says Ticho.

Julian Schwinger and David Saxon

His work in nuclear physics focused on techniques for studying high-energy scattering of electrons and protons by nuclei, and on refinements of the optical model of the nucleus. "He quickly became a leading theorist in this field," says Finkelstein. "In particular, the Saxon-Woods potential became an important tool of nuclear physics. At the same time he had begun a series of papers, alone and with Ed Gerjuoy, on the use of variational methods for the study of scattering." Saxon wrote two textbooks, including the popular Elementary Quantum Mechanics. He also established a reputation as an outstanding lecturer. In 1967, that prowess was recognized when Saxon was given the university's Distinguished Teaching Award.



Izzy Rudnick, Saxon, Bob Finkelstein

Saxon and Finkelstein also worked hard to expand the theoretical physics group, hoping to attract a senior theorist. Saxon was ultimately successful in landing a major coup for the department with the recruitment in 1972 of his old MIT friend Julian Schwinger, who by then was a Nobel Laureate for his contributions to quantum electrodynamics.

A New Direction

By then, Saxon's career had begun moving in a new direction.

It had become clear to the "new crop" that he possessed a knack for leadership, so when the chairmanship of the department was vacated in the early 1960s, several faculty — including Finkelstein and Izzy Rudnick, a close friend of Saxon's and father of current physics chair Joe Rudnick — actively campaigned for Saxon's appointment. "Izzy warned me at the time that if David's interpersonal and organizational skills came to the attention of the administration we might very well lose him," Finkelstein recalls. "That is of course what happened, but our loss was the university's gain."

Indeed, Saxon lasted only three years as physics chair, from 1963 to 1966. He was appointed dean of the physical sciences in 1966. Two years later, when Charles E. Young was appointed UCLA chancellor, he asked Saxon to be his "right arm" in what was the university's number two position, then called academic vice chancellor.

"I remember first meeting David when he was chair of the department of physics and I was a wet-behind-the-ears assistant to then-chancellor Franklin Murphy," says Young. "It was clear even to one so inexperienced that this was a man to count on to get things done, and get to know."

13th and 14th Presidents of UC: Charles Hitch and David Saxon

In his vice chancellor role, Saxon initiated reviews of all campus departments and set funding priorities, making difficult and sometimes unpopular decisions. Young credits Saxon with helping to steer UCLA through a critical phase of its history, during a turbulent period of student activism. "David stood tall and unwavering for what was right and was instrumental in making the 'right' happen," Young says.

"David stood tall and unwavering for what was right and was instrumental in making the 'right' happen," Young says.

14th President of the UC system

It wasn't long before he caught the eye of statewide leaders. In 1974, Saxon was named UC provost. The following year, he became the 14th president of the UC system, and the first to ascend to the position from UCLA.

In the eight years during which he held the top UC post, Saxon was an energetic advocate for the academic quality of the university and the public benefits it conveyed. It was a time of fiscal uncertainty, as the state and the nation grappled with a recession. In 1978 California voters passed Proposition 13, the initiative that restricted property tax assessments and led to cuts in education funding. Saxon worked to preserve the university's many strengths while also traveling the state to make the case for appropriate public investment in higher education.

David Saxon (middle) with UC Chancellors

He often tangled with then-Governor Edmund G. "Jerry" Brown over funding issues, but he won Brown's respect. "I remember him as a tireless fighter for the independence and well-being of the university," Brown said upon Saxon's death.

While making the case for public funding, Saxon also moved to accelerate the university's private fundraising. He provided seed money to assist the smaller campuses in jump-starting their fundraising efforts. He solicited outside support for important initiatives, such as the Ten Meter Telescope Project, a radically new telescope that would pave the way for the Keck facility in Hawaii, home of the world's largest optical and infrared telescopes. Saxon also gave generously out of his own pocket, making a gift each year to a UC campus.

As someone who was forced to make tough decisions, Saxon occasionally clashed not only with Brown but also with campus leaders, including his former mentor at UCLA. But, says Young, "He was, first and foremost, a man of great integrity. Whether we agreed or disagreed I knew that there was a reason for David's belief and that it would stand the test of time."

Saxon served until 1983. Three months after leaving UC, he returned to his alma mater as chairman of the MIT Corporation, that university's board of trustees. He retired from that position in 1990, coming back to UCLA as an emeritus professor in the department of physics and astronomy. Upon Saxon's return, Young immediately asked him to chair a special task force evaluating the organizational structure of the UCLA School of Medicine and UCLA Medical Center. Saxon's recommendations in 1991 laid the foundation for the UCLA Medical Enterprise's success ever since.

He remained active at the university until his final months, walking in from his Westwood home to UCLA, where he was a beloved presence. "He would go into campus four or five days a week," says Shirley Saxon. "He had colleagues he met regularly and they would have lunch together and discuss current events. The only thing that would stop him was bad weather." Saxon was active in his department's faculty meetings. "Whenever he spoke, everybody listened," says current chair Joe Rudnick. "He would put everything in perspective."

Saxon also took the time to indulge in his personal hobbies, from gardening and listening to Baroque music to travel and, most important of all, spending time with his family. He had broad interests and loved to read; as his reading vision deteriorated in his final years, he listened to hundreds of books on tape.

A celebration of his 85th birthday was held at the UCLA Faculty Center in February 2005.

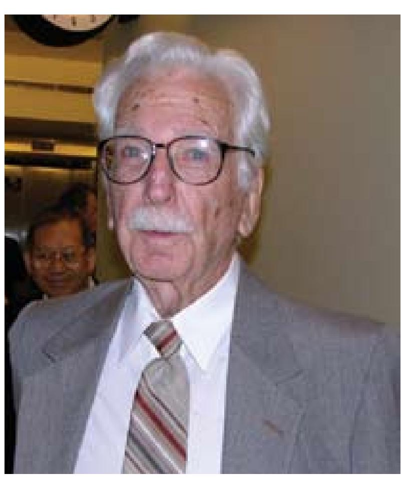
The Saxon Clan David & Shirley in the center

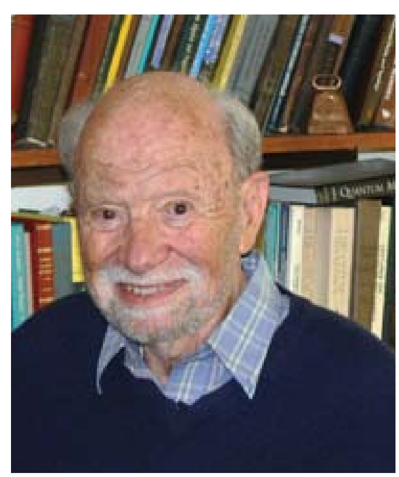
His name lives on at the UCLA campus. In 1986, the UC Regents approved the naming of the endowed David Saxon Presidential Chair in the department of physics. The following year, the UC Regents named the two student residential suite complexes in the northwest section of the UCLA campus as the David and Shirley Saxon Student Residential Suites and the Charles and Nancy Hitch Student Residential Suites. (Hitch, a professor of economics at UCLA, served as the 13th president of the university from 1968 to 1975 and was succeeded by Saxon.)

David & Shirley

Saxon is survived by his wife of 65 years, Shirley; six daughters (Barbara, Cathy, Charlotte, Linda, Peggy, and Vicky); and six grandchildren. The family suggests contributions in Saxon's memory to the David Saxon Physics Graduate Fellowship Fund, UCLA Foundation, 10920 Wilshire Blvd, Los Angeles, CA 90024; or the Braille Institute, 741 N. Vermont Avenue, Los Angeles, CA 90029.

The "New Crop" remembered David Saxon at the department of physics & astronomy memorial held on June 10, 2006. From left, Harold Ticho, Byron Wright, Ed Gerjuoy, Robert Finkelstein





Donors 2005 - 2006

Donors don't give to institutions.

They invest in ideas and people in whom they believe.

C. T. Smith

Arthur Levine and Lauren Leichtman and family have their picture taken in the mirror-barn during a tour at the Keck Observatory with Andrea Ghez.

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Ben Holmes and Carol Scheifele-Holmes

The Scheifele-Holmes Foundation Laboratory is now home to Professor Karoly Holczer, and his research group. Professor Holczer and his research team focus on experimental condensed matter physics.

Last year, Ben helped inaugurate the Ben L. Holmes Auditorium on the first floor of the Physics and Astronomy Building when he was honored as our Distinguished Alumnus for 2005-2006. The Ben L. Holmes Auditorium is used daily as a classroom, and is also in demand for special events.

Ben Holmes and Carol Scheifele-Holmes

Howard and Astrid Preston

Nicholas Endowment

The department is grateful to the Nicholas Endowment for its generous gift to repair and upgrade the star projector in UCLA's planetarium. The planetarium hosts astronomy students, visiting elementary and high school students, and the general public. The Nicholas Endowment's support has provided our visitors with an outstanding star show that is completely up to date with recent discoveries in astronomy.

Planetarium shows are offered every Wednesday evening during the academic year at 7 pm on the roof of the Mathematics Building.

Preston Family Reading Room

Our students are fortunate to have use of a library in the Physics and Astronomy Building. The Preston Family Reading Room, on the third floor, is a great spot for our students to read and do research.

Charles Chak Woo

When Charlie Woo was a student at UCLA, he spent much of his time in the student lounge, studying and interacting with other students and faculty. Now the CEO of Megatoys, Charlie made a gift last year to assist in underwriting the cost of the new Physics and Astronomy Building, asking that it be used to support the kind of unstructured communications that Charlie remembers from his years at UCLA. In appreciation of this gift, the department of physics and astronomy has named the student/faculty lounge on the fourth floor of the building "The Charlie Woo Lounge."

Charlie Chak Woo

PAAL OUTSTANDING GRADUATES:

Riley Crane

Jeungphill Hanne

CAREER DAY 2005

This year the PAAL Career Day was held during the winter quarter of 2006, a couple of months earlier than previously held to give the students some ideas on the types of jobs they can apply with a physics graduate with BS, MS, PhD. The success of this year's event was made possible by the generous support of time we have received from our alums and friends from both the academic and public sectors. This year's panelists included: Bob Baker, president of PAAL (BS Physics, 1970 UCLA); Patrick Convery, intellectual property attorney, Connolly Bove Lodge & Hutz LLP (BS, MS, PhD Physics 1997 UCLA); Perry Lanaro, director of financial systems, Universal Motion Pictures (BS Physics, 1982, MBA, 1987 UCLA); David M. Morse, intellectual property attorney, Connolly Bove Lodge & Hutz LLP (BS Physics 1992 UCLA); Dusan Petrac, consultant, JPL (PhD 1971 UCLA); Dave Stephens, senior systems engineer, launch & operations, Northrop Grumman Space Technology (MS Aerospace Engineering, 1989 UCLA); John G. Tabor, PhD, UCLA Career Center; and Gil Travish, associate researcher, UCLA (BS Physics, 1989 UC Berkeley, MS and PhD Physics1996 UCLA).

PAAL ALUMNI AWARD DINNER & LECTURE 2005

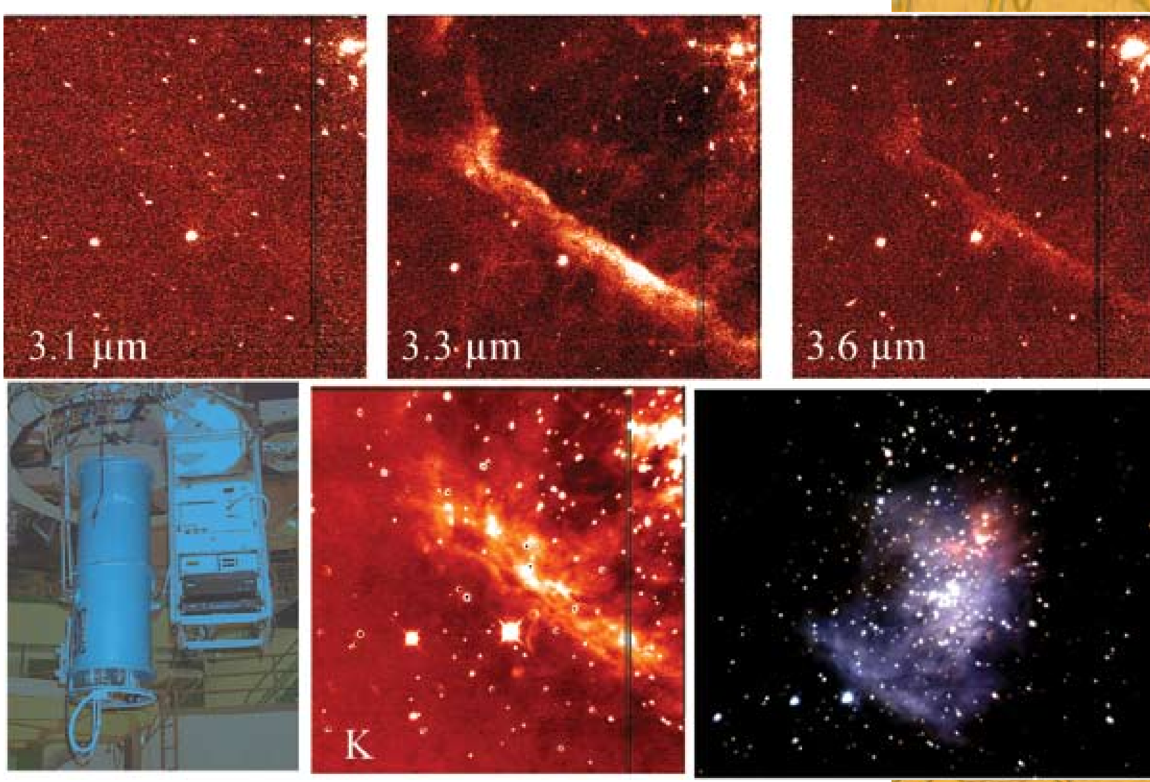
Ben Holmes holds a framed copy of a stainless steel plaque which hangs outside The Benjamin L. Holmes Auditorium.

This year was the PAAL Alumni award, which has been created to recognize important contributions by UCLA alumni to physics and astronomy, as well as to the welfare and economic development of our country, was awarded to Mr. Benjamin L. Holmes (UCLA BSc Applied Physics 1959.) The dinner and lecture were held on Saturday, May 6, 2006, at the Physics and Astronomy building. Mr. Holmes is the president of The Holmes Company, a consulting firm specializing in health care that focuses on the medical device industry. He serves as a member of the board of directors and chairman of the compensation committee at PLC Medical Systems. PLC is the leading medical device company specializing in the design and manufacturing of carbon dioxide lasers that treat cardiovascular disease. Mr. Holmes worked for the Hewlett-Packard Co. for 33 years serving in various positions, the last as general manager of the Medical Products Group. This is the largest medical electronic instrument and system manufacturer in the world. In 1985 Mr. Holmes was elected vice-president of the corporation. Mr. Holmes' UCLA affiliations are: member, national committee for the basic sciences; past-member board of visitors, UCLA Medical School; alumni associtation life member; UCLA Foundation, board of trustees; UCLA Foundation, board of councilors; served as HP's liaison to UCLA; KELPS.

Research Highlights

Somewhere something incredible is waiting to be known.

Carl Sagan



Andrea Ghez and colleagues:
The advent of laser guide star adaptive optics (LGS-AO) has revolutionized what can be learned from studies of the Galactic center (GC), with its ability to obtain deep diffraction-limited multi-wavelength images and spectra shortward of 4 microns. One particularly exciting highlight from this past year was an experiment in which the emission of the plasma falling into the black hole was monitored with both Chandra X-ray Observatory and by us using LGS-AO at Keck. A particularly important aspect of this experiment was to measure the infrared color. These colors indicate a spectral index of -0.5. This suggests that the infrared emissions most likely arises from synchrotron emission from a high energy tail of electrons, which were possibly accelerated via local magnetic reconnection events. Independent of the brightness of SgrA*-IR or wavelength range probed, our color is significantly bluer than what was published from a low Strehl data set with the VLT. This is a clear demonstration of the need for the high Strehl data delivered by the LGS-AO.

Images from this work can be found at:
http://www.astro.ucla.edu/~ghezgroup/gc/images/rgb05jullgs.jpg
http://www.astro.ucla.edu/~ghezgroup/gc/images/rgb05jullgs_zoom_hires.jpg
Animation from this work can be found at:
http://www.astro.ucla.edu/~ghezgroup/gc/pictures/lgs05_movie.shtml

GD 362 is a white dwarf which was previously identified to be unusual because it has elements besides hydrogen in its atmosphere. In most stars of this sort, the heavy elements such as calcium and iron gravitationally settle below the atmosphere. UCLA astronomers **Eric Becklin, Michael Jura, Benjamin Zuckerman** and colleagues discovered that this star has a substantial infrared excess which is naturally interpreted as a dust ring analogous to Saturn's rings. Accretion from this dust ring -- likely produced by the gravitational shredding of an asteroid -- can explain the high metal abundances in GD 362. For the first time, we can measure the bulk abundances in an extrasolar asteroid.

Brad Hansen, **Michael Rich** and colleagues used the Hubble Space Telescope (HST) to study the white dwarf cooling sequence in the globular cluster NGC6397. The extreme faintness of these stars means that they can only be found among the brighter cluster stars by using HST. The images resulting from this project are among the deepest ever taken in a globular cluster and reveal the end of the white dwarf cooling sequence. Hansen and graduate student **Steven Berukoff** have simulated a scenario in which the remnants of a star cluster sinks into the center of the Galaxy, losing stars along the way due to the tidal forces. This simulation is stimulated by the observations of young stars near the Galactic center black hole and successfully matches several of the observed features. Hansen and colleagues from Columbia and the Carnegie Institute of Washington have published a third in a series of papers modelling the atmospheric dynamics and radiative transfer in the atmospheres of "hot Jupiters." Hansen, along with Rich and colleagues from Santa Cruz and British Columbia, have proposed a new model for the peculiar white dwarf cooling sequence in the Galactic Open Cluster NGC6791.

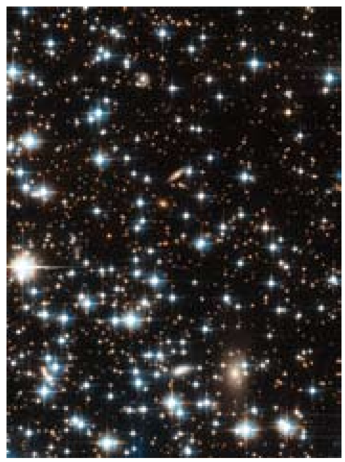
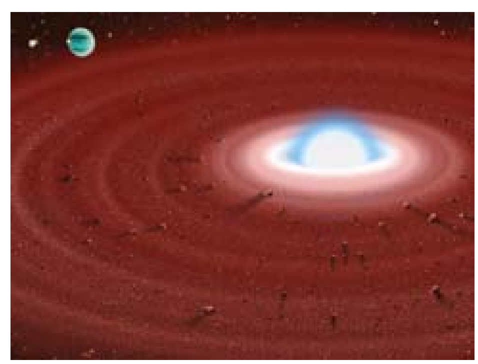


Image of the globular cluster NGC 6397, taken with the Hubble Space Telescope.

Michael Jura says that when instruments intended to detect light from planets outside our solar system succeed in spotting distant prin pricks of light, the data should be interpreted with care. The dust tails of comets similar to Hale-Bopp can scatter as much optical sunlight as does the Earth. Space-based observatories such as the Terrestrial Planet Finder or Darwin that will detect extrasolar terrestrial planets will also be able to detect extrasolar comets.



Artist's visualization of what a dust disk might look like around the white dwarf GD362. Gemini Observatory Illustration by Jon Lomberg

Under the leadership of **Ian McLean,** the UCLA Infrared Lab entered its 16th year of operation. The IR Lab has accumulated an impressive list of contributions to the instrumentation suite at the Lick and Keck Observatories, but this past year was perhaps the busiest ever. During this reporting period many significant milestones were achieved. First, the near-infrared camera known as FLITECAM, developed for NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA), was used on the Shane 3-m telescope in October 2005 and once more in May 2006. The successful five-night run in May was the 8th visit of this instrument to Lick Observatory. UCLA graduate student **Erin Smith** successfully added a powerful spectroscopic feature to FLITECAM, which is now ready for delivery to NASA.

Commissioning of OSIRIS, the unique near-infrared integral field spectrograph delivered to the Keck Observatory last year by **James Larkin,** continued throughout the year with spectacular success. OSIRIS was the second major instrument from UCLA to go to the Keck Observatory following the pioneering NIRSPEC instrument in 1999. However, in July of 2005, a joint UCLA, Caltech and UC Santa Cruz team began working on yet another instrument for the Keck Observatory. Called MOSFIRE, it is a multi-object near-infrared spectrograph (PI Ian McLean) capable of both imaging and spectroscopy over a large field of view and with the feature that up to 46 spectra can be obtained simultaneously. Preliminary design review was passed successfully in April 2006 and the team secured $10M to finish the project through private fund-raising and a successful application to the NSF TSIP program. The UCLA Lab also participated in the competitive design study for the Gemini Planet Imager (GPI), which is an integral field spectrometer and extreme AO system for

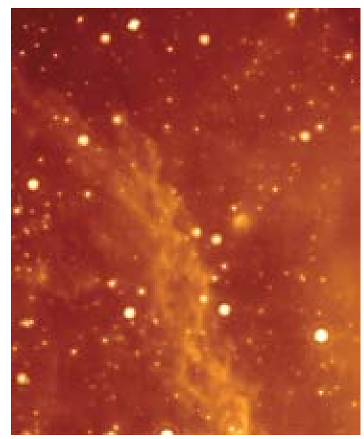
Ian McLean continued his appointment as Associate Director of the University of California Observatories and as co-chair of the Keck Science Steering Committee.

the Gemini South Telescope in Chile. After some protracted negotiations, contracts were signed in May 2006. The UCLA part of this $20M+ proposal is the integral field spectrometer (~$5M) and James Larkin is the PI. During 2005-06 the IR Lab also undertook a conceptual design study for IRIS, an infrared imaging spectrograph for the Thirty Meter Telescope (TMT). The study was submitted and reviewed positively. Finally, the IR Lab supported the refurbishment of the 12-year - old, closed-cycle cooler on the twin-channel IR camera at Lick Observatory, first delivered by UCLA in June 1993.

Mark Morris reported a newly observed phenomenon this year, based on data acquired with the Spitzer Space Telescope. Near the Galactic center, Morris and colleagues observed an infrared Double Helix Nebula. They interpreted it as a torsional Alfvén wave: a magnetic twist traveling along the galactic magnetic field lines, and driven by the rotation of the circumnuclear disk of gas around the central black hole. With colleague Andrea Ghez, Morris continues to study the orbits of stars around the central black hole, as well as the nonthermal emission from gas accreting onto the black hole. Electromagnetic radiation from radio to x-ray wavelengths is beginning to reveal the state of the hot gas that is approaching the event horizon of this surprisingly underluminous, 3.6 million solar mass black hole.

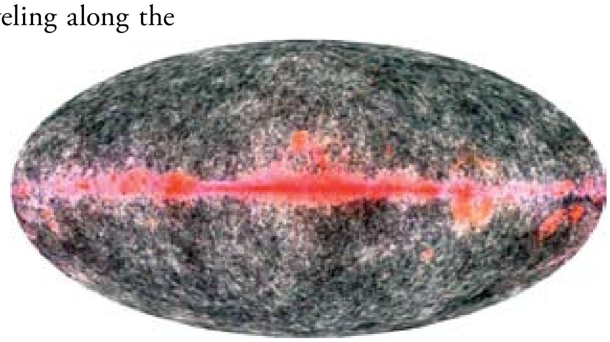
Ian McLean pictured with FLITECAM

Morris and JPL colleague Raghvendra Sahai have been investigating red giant stars, which are in their final stages of evolution creating spectacularly symmetric nebulae. One of these nebulae, CRL3068, shows an unprecedented spiral structure in Hubble Space Telescope images. Taken at visual wavelengths, they have demonstrated that this is owed to the presence of a relatively close binary companion, which flings the matter being lost by one of the stars outward into the observed spiral pattern. Using adaptive optics observations in the infrared with the Keck Telescope, they have found a relatively luminous companion star located at the appropriate distance for this hypothesis to be valid. The phenomenon of outwardly moving, helical dust shells can be invoked to explain luminous arcs seen around a number of mass-losing systems.



Never-before-seen phenomenon: a double-helix-shaped nebula reminiscent of the structure of a DNA molecule, the genetic material of living organisms

The Wide-Field Infrared Survey Explorer (WISE) with **Ned Wright** as principal investigator, had a successful confirmation review at NASA headquarters in November 2005. Unfortunately due to NASA budget constraints WISE was slowed down but a November 2009 launch appears possible. WISE will find the most luminous galaxies in the Universe and the closest stars to the Sun. Wright is also working on the Wilkinson Microwave Anisotropy Probe (WMAP), which announced results from three years of observations in March 2006. These results included the first publication of large angular scale Cosmic Microwave Background polarization data. WMAP has completed five years of data taking and is still observing.



This is an all-sky image at 41, 61 and 94 GHz as red, green and blue showing gray CMB fluctuation off the plane and galactic emission (red or pink) close to the plane.

Extra Galactic Astronomy

For her PhD dissertation, graduate student **Erin Hicks** worked with **Matt Malkan** to weigh giant black holes in the centers of galaxies. Their work used Ian Mclean's Near-Infrared Spectrograph on the Keck telescope, in combination with Adaptive Optics. The very high resulting spatial resolution allowed them to measure the orbital motions of molecular gas as it circles the centers of nearby "active" galaxies within a hundred light years of the massive black hole in the middle. These are the first direct measurements of giant black holes, which are currently in the process of fueling themselves by gas accretion.

With UCLA students **Chao-Wei Tsai, Alaina Henry,** and **Jill Naiman,** and colleagues Sara Beck (Tel Aviv) and Paul Ho (Center for Astrophysics), **Jean Turner** used the Very Large Array to detect and map the radio emission from embedded super star clusters in several nearby galaxies, including the large spiral galaxies, Maffei 2 and NGC 660. In the Milky Way, the analogues to super star clusters are the globular clusters, which are all 10 billion years and older. Thus, there is little information on how such large clusters, consisting of hundreds of thousands of stars, can form. These subarcsecond resolution extragalactic radio images are among the first observations capable of isolating potential globular clusters in the process of formation, young enough that their birth conditions can be studied. With former UCLA graduate student, and current Jansky Fellow **David Meier**, Turner is investigating the chemistry of molecular clouds in the nuclei of nearby spiral galaxies. The centers of spiral galaxies contain massive clouds of molecular gas, clouds with masses tens of millions of solar masses. These clouds are responsible for bursts of star formation, formation of super star clusters, and potentially are the fuel for active galactic nuclei. Meier and Turner's imaging of millimeter emission from molecules within the central 700 light years of nearby spiral galaxy IC 342 reveals dramatic spatial variations in molecular abundances. The images show that cloud chemistry is closely tied both to star formation and to cloud orbits.

Astroparticle Physics

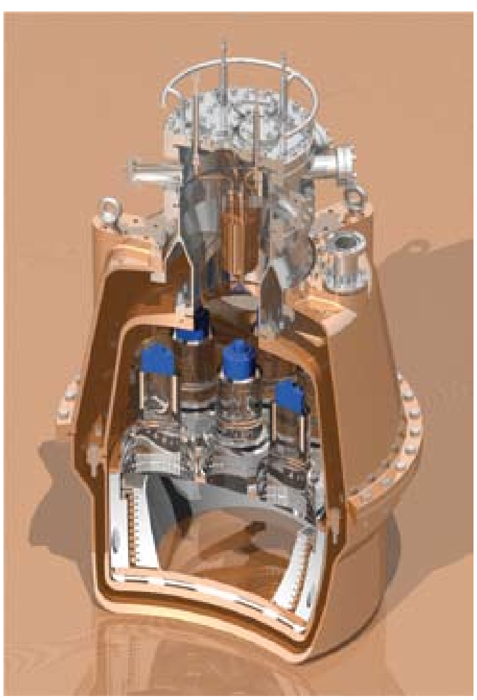
Rene Ong is studying astrophysical sources of very high-energy gamma rays using ground-based telescopes that detect atmospheric Cherenkov radiation. The STACEE telescope, located at Sandia National Laboratory in New Mexico, has been operating since 2002 and detecting gamma-ray sources at energies between 100 and 1500 GeV. Graduate student **Jennifer Carson** recently completed her thesis work on a new measurement of the spectral properties of the emission from a nearby active galaxy, Markarian 421. Carson has now moved on to a postdoc position at the Stanford Linear Accelerator Center. STACEE has also made observations of several gamma-ray bursts that comprise the thesis work of **Alex Jarvis.**

Artist's Impression of the VERITAS Array

Ong and **Vladimir Vassiliev** are developing VERITAS (Very Energetic Imaging Telescope Array System), a new state-of-the-art gamma-ray observatory located in southern Arizona. In early spring 2006, VERITAS obtained the first stereoscopic observations utilizing two newly constructed atmospheric Cherenkov telescopes. When completed in early 2007, VERITAS will comprise an array of four 12-meter diameter optical reflectors designed for gamma-ray astronomy in the 50 GeV - 50 TeV energy range. The UCLA group has had a major responsibility for the construction of VERITAS, making significant contributions to the simulation of the VERITAS performance, the design and development of various trigger systems, the telescope steering software, and the data reduction and archiving. Much of this work has been accomplished by postdoctoral researchers **StephenFegan** and **Amanda Weinstein,** and graduate students **Ozlem Celik, Yeuk Chun (Ken) Chow,** and **Matthew Wood.** The stereoscopic observations of two active galaxies utilizing the first VERITAS telescopes has already demonstrated a dramatic improvement of gamma-ray sensitivity and decreased observational energy threshold compared to previous instruments, such as the Whipple 10m telescope. Routine operation of VERITAS over the coming years will produce exciting scientific research opportunities for new graduate students to get involved in. The range of interesting problems in gamma-ray astrophysics is wide. For example, Celik is working on the detection of a gamma ray pulsar within the Crab Nebula supernova remnant. Chow's thesis research focuses on a survey of the sky; at present just a little more than five percent of the sky has been systematically surveyed above 100 GeV. Wood is working on the detection of super-symmetric dark matter annihilation in the cores of nearby galaxies and globular clusters. **Tim Arlen**, a new graduate student to the department, is studying the possibility of gamma-ray emission from nearby O, B stars. In general, the scientific interests of the group are in the areas of extragalactic astronomy (e.g. Active Galactic Nuclei), the extragalactic background radiation, primordial magnetic fields, Dark Matter, diffuse gamma-ray radiation from starburst galaxies and galaxy clusters, as well as the study of galactic sources such as gamma-ray pulsars, supernovae remnants, and unidentified sources. The VERITAS group at UCLA is also intensively involved in the development of new ideas for a new, major gamma-ray observatory which may become a successor of VERITAS in ten years.

Photo of UCLA VERITAS Group on Patio of PAB. sitting (left to right): Rene Ong, Cyrus Rustomji, Lara Loewenstein, Vladimir Vassiliev; standing (left to right): Amanda Weinstein, Matthew Wood, Stephen Fegan, Pierre-Francoys Brousseau.

Rene Ong was the chairman of the VERITAS Executive Committee Rapporteur, 29th International Cosmic Ray Conference (Pune, India) Plenary Talk, XXII Symposium on Lepton-Photon Interactions (Uppsala, Sweden)



Cut-away drawing of ZEPLIN II

David B. Cline is the principal investigator, along with **Hanguo Wang,** for the ZEPLIN II project. Housed at the Boulby facility in England, ZEPLIN II is a liquid Xenon direct dark matter search detector, now operational and producing new data for analysis. The UCLA team also leads the ZEPLIN project in the USA, collaborating with the University of Rochester, Texas A&M University and Southern Methodist University, in addition to the UK Dark Matter Collaboration. The next phase is to build a large 500kg liquid Xenon detector proposed for DUSEL (Deep Underground Science and Engineering Laboratory), a united effort from the current U.S. ZEPLIN groups in addition to other groups currently working on liquid Xenon technology in the USA. The current ZEPLIN II detector is the largest in the world and there is a chance to discover dark matter with this experiment. Graduate student **W. Ooi** is doing his PhD studies for this project.

Nuclear Physics

Huan Zhong Huang will serve as a STAR TOF coordinator for the Chinese STAR TOF groups. The Chinese groups are responsible for the production of Multi gap Resistive Plate Chambers (MRPC) necessary for all of the TOF detectors. Approximately 4000 MRPC modules will be produced by the Tsinghua and USTC group. The Chinese MRPC production started in April after a successful STAR MRPC production readiness review in China.

The **Huang-Igo-Whitten** group research programs continue to focus on heavy ion collisions and spin physics, at RHIC. For heavy ion physics our major scientific goal is to understand the QCD properties of the dense partonic matter created in nucleus-nucleus collisions at RHIC. Our physics analyses center on charm and strange quark production and elliptic flow parameter, with emphasis on nuclear modification factors and elliptic flow v2 for non photonic electrons from heavy quark decays, hyperons and mesons. We will continue our effort to search for exotic particles at RHIC. For spin physics we investigate the gluon spin structure function of the proton. Our physics analysis tasks concentrate on jet, di-jet and non photonic electron from charm decays in polarized p+p collisions at RHIC. Our new STAR hardware construction project is the Time of Flight detector upgrade. We will begin to participate in the project of the ALICE ElectroMagnetic Calorimeter (ALICE EMCaI) construction in FY2007. We will be responsible for testing of the APD readout and the calibration system.

Hai Jiang completed his PhD thesis research on strange hadron (lambda and cascade) production in d+Au collisions in the fall of 2005

Dylan Thien completed his PhD thesis research on A_{LL} measurement for jet production in polarized proton-proton collisions in the fall of 2005.

Weijiang Dong completed his PhD thesis research on non photonic electron measurement in February 2006.

Johan Gonzalez completed his PhD thesis research on analyses of J/ψ production in Au-Au collisions in May 2006.

Jingguo Ma completed his PhD thesis research on pentaquark searches and phi meson measurement in May 2006.

Hai Jiang, PhD
Fall 2005

Dylan Thien, PhD
Fall 2005

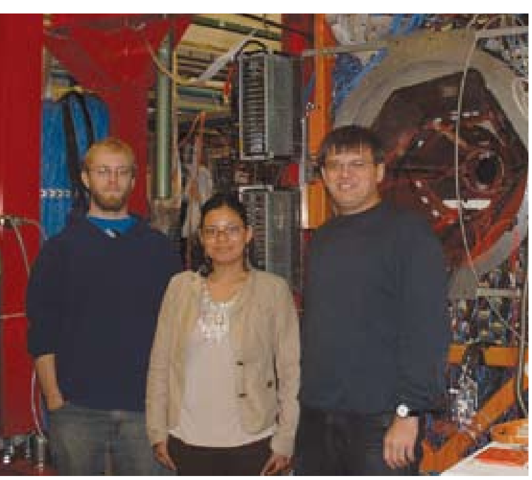
Weijiang Dong PhD
February **2006**

Johan Gonzalez, PhD
May 2006

Jingguo Ma, PhD
May 2006

Intermediate Nuclear Physics

The chief objectives of the Intermediate Energy Nuclear and Particle Physics Research Group are testing the basic symmetries of subatomic physics and delineating the structure of the proton. The team is led by **Bernard Nefkens** and includes post doctoral researchers **Sasha Starostin and Serguei Prakhov;** and starting in September, **Vitaly Baturin.** The graduate students are **Jason Brudvik** and **John Goetz** and the undergraduate student is **Indara Suarez,** who is receiving research credit.



Jason Brudvik, Indara Suarez, Sasha Starostin

The group is probing the origin of the well-known excess of matter over antimatter in the universe by testing charge conjugation invariance. This is done using rare meson decays. Flavor symmetry, which is the basis of the universality of the strong interaction, is investigated using the features of the excited states of the proton, which also reveal the dominant components of the structure of the proton. Subtle polarization effects are used to test the validity of CP, CPT, and time reversal invariance.

The group has a two-prong experimental program. A large effort goes into measurements using the Crystal Ball multiphoton detector. This versatile device has been moved to the University of Mainz (Germany) for a series of neutral meson photo-production experiments. A second major effort is going into a novel program in cascade physics. Cascades are doubly strange baryons. They are photo produced at Jefferson Laboratory and detected with a large magnetic spectrometer, CLAS.

Joseph Rudnick and **Robijn Bruinsma** continue to work on the physics of viruses and of structures associated with them. This includes the study by Bruinsma and post-doctoral fellow **Gregory Grason** of the statistical mechanics of frustrated polyelectrolyte bundle in which a connection between that system and a quantum frustrated Josephson array at zero temperature is established and exploited to predict thermodynamic and mechanical properties of the polyelectrolyte system. With graduate student **Amir Ahsan**, Bruinsma and Rudnick have explored the elastic properties of a network of complexed RNA, in a program to clarify the energetics and dynamical processes involved in viral self-assembly. Utilizing a model based on a network of duplexed and single-stranded RNA, they have identified parameter ranges in which such a network is characterized by a negative Poisson ratio, the unusual elastic property by which a material will, if subject to uniaxial compression, reduce its extent in all directions. Professors Bruinsma and Rudnick are also pursuing an investigation of the statistical mechanics of nucleosomal positioning. This in collaboration with a participant in UCLA's Research Experience for Undergraduates (REU) program, **Christian Rose** of Vassar College.

Additionally, Rudnick has been working with graduate student **Shimul Akhanjee** on investigations of strong localization in the plasma excitations of a one-dimensional array of charges in a random potential field; and with graduate student **Aviva Shackell** and colleagues **Roya Zandi** (UCR), **Lincoln Chayes** (UCLA Mathematics) and **Mehran Kardar** (MIT) on critical point Casimir forces in 4He films.

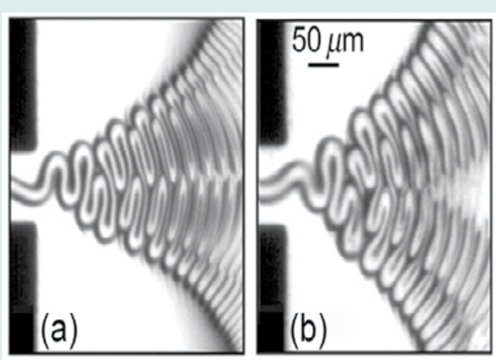
W. Gilbert Clark previously reported on the first NMR spin echo measurements of radio frequency induced flux lattice annealing (RIFLA). Annealing a distorted flux lattice (FL) by the rf pulses is used to generate the spin echo in a Type 2 superconductor in a magnetic field. This year, Clark has extended it to the high temperature superconductor Pr1.85Ce0.15CuO4-y. A summary is in the invited paper given at the Workshop on NMR/EPR of Correlated Electron Superconductors, October, 2005, in Dresden *(see http://www.ifw-dresden.de/iff/15/mr/Workshop/Talks/Monday/WGClark_NMR_ESR_CES_05.pdf)*. More recently, Clark has found that this RIFLA effect causes a significant change in the rf magnetic susceptibility of the superconductor. The interpretation is that for the distorted FL, the restoring force from pinning centers is lower, the FL moves more freely in response to the rf field, and the magnetic susceptibility is higher. With annealing by the rf pulses, its configuration has a lower free energy. It becomes more strongly pinned, and the sample has a correspondingly lower rf magnetic susceptibility. This reduces the inductance of the NMR coil and raises the tuning frequency of the NMR probe. By following this change, we have found a very sensitive way to measure the FL annealing by the rf pulses.

The work of **Hong Wen Jiang's** group on a quantized Hall system was featured on the cover of November 18, 2005, issue of *Physical Review Letters*. The experiment by postdoctoral fellow **Xinchang Zhang,** graduate student **Rich Faulhaber** and Jiang revealed a rich and intriguing phase diagram of the two-dimensional electrons in a semiconductor device with two quantized subbands. The researchers conjecture that the unusual topology observed is a consequence of magnetic instabilities due to the interaction of two energy levels with opposite spin and different orbital (i.e., subband) quantum numbers.

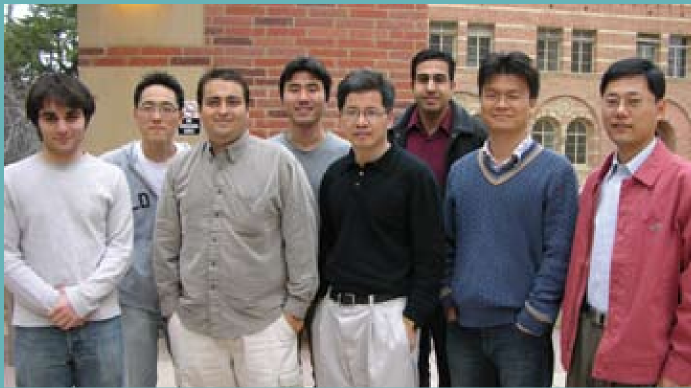
Thomas G. Mason's Group is folding of viscous threads in hard microfluidic channels marks a new level of control over stratified viscous flows. Postdoc **Thomas Cubaud** has discovered a route to chaos in this new system: the folding of a more viscous thread in a diverging microchannel. This work won the AIP's Gallery of Fluid Motion Award at the fall meeting of the APS Division of Fluid Dynamics (DFD). (see Cubaud & Mason PRL 2006).

Slippery diffusion limited aggregation (S-DLA) and slippery diffusion limited cluster aggregation (S-DLCA) are important new pathways for obtaining fractal clusters from particles that aggregate without forming shear rigid bonds. Through time-resolved small angle neutron scattering experiments, we discovered strong peaks in the structure factor at high wavenumbers for nanoemulsion droplets that had aggregated through slippery attractions. This peak, along with a tell-tale power law scaling at low wave numbers, provided the critical evidence for fractal aggregates comprised of dense clusters. (see Wilking.... & Mason PRL 2006).

Thomas G. Mason received the Glenn T. Seaborg Award (Alpha Chi Sigma- UCLA branch) spring, 2006.



Folding of viscous threads in hard microfluidic channels marks a new level of control over stratified viscous flows. This work won the AIP's Gallery of Fluid Motion Award for Thomas G. Mason and post doc Thomas Cubaud at the fall meeting of the APS Division of Fluid Dynamics (DFD).



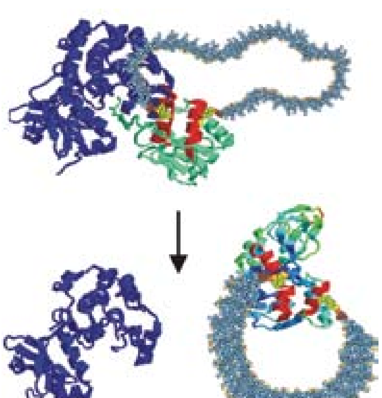
Back: Seo Ho Youn, Edwin Lee, Benjamin Fahimian
Front: Bagrat(Bago) Amirbek, Damien Johnson, JianWei Miao, Changyong Song, Huaidong Jiang

John Miao selected Alfred P. Sloan Research Fellow

John Miao's group has applied coherent X-ray diffraction microscopy to image cellular structures. By using two of the currently most brilliant X-ray sources in the world – the SPring-8 in Japan and the APS in Chicago, they obtained coherent x-ray diffraction patterns from dormant yeast cells and human B cells. Some of the diffraction patterns were successfully inverted to high-quality images with a resolution of ~ 20 nm by using iterative algorithms. Miao and his collaborators at the UCLA medical school will use these images to understand some of the biological functions inside cells. Furthermore, Miao's group is continuing to apply equally sloped tomography to cryo-electron microscopy and medical imaging. In collaboration with Grant Jensen's group at Caltech, they obtained equally sloped data sets from hemocyanin protein molecules, which carry oxygen in the blood of most molluscs and some arthropods such as the horseshoe crab. By using mathematical algorithms, they have reconstructed 3D images of hemocyanin protein molecules, which show not only a better resolution, but also a higher contrast than those obtained by using conventional cryo-electron tomography. They are currently working on the three-dimensional image reconstruction of HIV-I virus-like protein by using the new method.

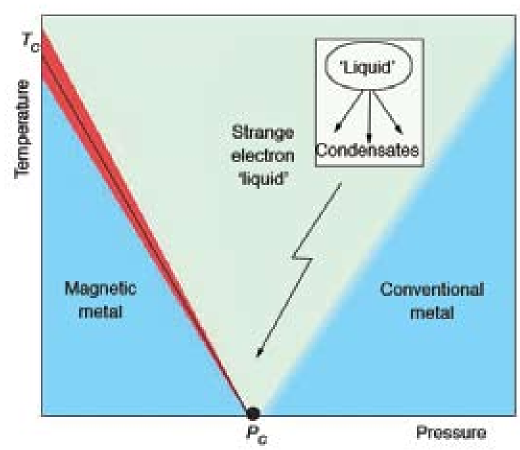
The biophysics group led by **Giovanni Zocchi** studies conformational changes in proteins and DNA, and explores nano-technology approaches to bio-molecular engineering, specifically artificial allostery. Presently the group is learning to control proteins mechanically. Attaching a "molecular spring" to an enzyme, they mechanically deform the enzyme, and control its activity ("artificial allostery").

The figure below refers to the mechanical activation of the enzyme complex Protein Kinase A (PKA) [*J. Am. Chem. Soc.* 128, 8541 (2006); UCLA press release "Physicists Report Advance toward a Nanotechnology Approach to Protein Engineering" www.newsroom.ucla.edu/page.asp?RelNum=7113)]. They were able to control PKA's regulatory subunit (green and red) through a molecular spring (light blue). Under tension (lower part of the figure), the spring drives a conformational change in the regulatory subunit which causes the catalytic subunit (purple) to separate, activating the enzyme. The mechanical action of the spring was designed to mimic the known conformational change (the relative displacement of the two red helices) induced by the natural chemical activator of PKA, which is the signaling molecule cAMP. Through this nanotechnology approach they hope to build devices to control parts of the molecular machinery of the cell.



On another front, the Zocchi group has continued their study of bubbles in DNA. Melting of the DNA double helix into separate strands proceeds through a local opening of single-stranded regions ("bubbles"). They studied the influence of mismatches on bubble formation in the DNA [*Biophys. J.* 90, 4522-29 (2006)].

Sudip Chakravarty, with his students **Angela Kopp**, **Pallab Goswami, Xun Jia**, and his postdoc **Amit Ghosal,** has been working on various aspects of quantum criticality in correlated systems and high temperature superconductors. A notable achievement in the past year has been to establish the extent of temperature to which the effect of a quantum critical point at zero temperature can be observed: Angela Kopp and Sudip Chakravarty, "Criticality in correlated quantum matter," *Nature Phys.* 1, 53-56 (2005). Together with Xun Jia they have gone further and have shown that a class of quantum phase transitions that cannot be detected by the conventional method can be tracked by the non-analyticity of the Von Neumann entropy, signifying the entanglement property of a quantum system. This may open up new ways of looking at quantum phase transitions. As to a theory of the phase diagram of high temperature superconductors, Kopp, Ghosal and Chakravarty have proposed that many puzzles of the overdoped regime can be understood if one postulates a radical idea that ferromagnetic fluctuations compete with superconductivity. In the same context Chakravarty and his former student Olav Syljuasen, now an assistant professor at Nordita, Copenhagen, have found an intriguing quantum phase of matter, which is dubbed to be a "resonating plaquette phase:" O. Syljuasen and S. Chakravarty, "Resonating plaquette phase of a quantum six-vertex model," *Phys. Rev. Lett.* 96, 147004 (2006).



David Cline, along with Franco Sergiampietri at CERN, are working on the just-completed ICARUS T600 liquid Argon detector housed at the CNGS laboratory at CERN, as well as LANNDD-5m, a 5-meter drift experiment. The knowledge gained will be of key importance for future proton decay and neutrino liquid Argon detectors. With **Kevin Lee,** Cline is also working on the NOVA long baseline project, a collaborative effort with FNAL.

UCLA professors took various paths toward their work on CMS and joined it at various times, beginning with David Cline who helped initiate CMS in 1989. Happily, regardless of when each joined and what responsibilities each took on, the result is a collegial group with a broad range of commitments which form a coherent whole around the unifying theme of muons in CMS. Muons are a key to much of the physics potential of CMS, whether it be the Higgs boson, supersymmetry, Z' bosons, top and bottom quark physics, or other new physics involving leptons. This group is deeply involved in muon detection, triggering, simulation, reconstruction, and physics analysis. As the exciting period of LHC turn-on approaches, much of the group is based at CERN in order to install and commission the detectors and associated electronics, and prepare for the first beam. They will be well-positioned to use their knowledge of all these aspects of muon-related work in order to pursue discoveries with each increment of integrated luminosity, beginning with startup in 2007.

The accelerator-based part of our elementary particles physics program is based on hadron collider physics at the highest energies, currently at the Collider Detector at Fermilab (CDF) experiment and soon at the Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider CERN.

The CDF group, led by **Jay Hauser, David Saltzberg**, and **Rainer Wallny**, has produced a number of physics papers on top quark and exotic physics topics while maintaining parts of the detector and trigger systems. Graduate student **Brian Mohr** has won a UCLA dissertation-year fellowship to finish up his work that uses sophisticated statistical techniques to measure the mass of the top quark particle more precisely than any previous measurement. Graduate student **Alon Attal** has searched for spectacular "multi-lepton" events, and having not found them, is preparing a paper that limits a theory known as "R-parity violating supersymmetry." As discussed in more detail below, Wallny's subgroup is also using diamonds in novels ways.

The CMS group currently consists of **Katushi Arisaka, David Cline, Bob Cousins, Jay Hauser, Rainer Wallny** and **Peter Schlein**; six research physicists and postdoctoral researchers; two graduate students; and two electronics engineers. About half of the group is based at CERN. The focus of their efforts in the past year has been installation and commissioning of the muon detection system in CMS, and much of the associated hardware, firmware, software, and simulation. They have also studied in detail several aspects of the discovery physics potential of CMS.

With so many aspects of the CMS work to describe, this year we highlight the work of Jay Hauser's subgroup.

Postdoctoral researchers **Greg Rakness** and **Yangheng Zheng** and graduate student **David Matlock** have been building and installing electronics. This group has now built more than

Photographer: Mimmo Dattola; Date: 17 Feb 2006

Pictured: All the drift tube ("DT") and resistive plate chambers ("RPC") packages foreseen to be installed in the central barrel ring ("YB0") before the magnet test have been installed (some are missing in the photograph but have since been installed). These silver-coloured rectangular boxes in the gaps between the steel of the rings (red in the image) detect muons.

Bob Cousins has served since 2004 as U.S. CMS deputy research program manager, the highest-ranking university-based position in the line management of this consortium of 48 universities and two national laboratories. In January, 2007, Cousins will change to the position of deputy spokesperson for the entire international CMS collaboration, some 2000 people in 38 countries.

1600 electronics boards for the CMS experiment, thanks in part to a crew of 10-20 capable UCLA undergraduate students who have tirelessly tested the boards and debugged and fixed them (under Zheng's guidance). Rakness has then "commissioned" the UCLA electronics as well as boards from Ohio State and Rice universities at the CERN laboratory. Recently, an important milestone was reached when parts of each of the CMS detector measuring systems were tested with the huge 4 Tesla solenoid coil energized for the first time, using cosmic ray muon particles largely captured by the UCLA electronics. David Matlock has begun developing software tools to make sure that they collect the muon particles efficiently when the Large Hadron Collider (LHC) first begins operation in late 2007.

Diamonds are not only the chosen jewel in romantic endeavors. Graduate student **Peter Dong,** undergraduate student **Charlie Schrupp** and **Rainer Wallny** have become attached to them as well. Diamonds are being used in their research on radiation hard beam monitoring devices. Wallny and his group built the first large-scale beam abort system being used to protect the large particle physics detectors; such as the Collider Detector at Fermilab (CDF) or the Compact Muon Solenoid (CMS) at CERN. These expensive detectors operate only a few centimeters away from powerful hadron beams. The Large Hadron Collider (LHC) carries the equivalent energy of 100 kg of TNT, which is concentrated on a beam spot of a few hundred square micrometers. Protecting the detector from any damage is imperative to the performance of the very precise measurements and the exploration of new physics which Wallny and his colleagues are pursuing. Should beam instability occur, Wallny's beam monitoring system, based on artificially produced diamond sensors, is the first system built to face the challenge of aborting such hadron beams within microseconds. Only a small number of institutions in the United States have mastered this novel detector technology and Wallny's involvement has resulted in being awarded an Advanced Detector Research Grant from the Department of Energy to further develop this technology.

UCLA diamond aficionados at work. Undergraduate student Charlie Schrupp, Rainer Wallny and graduate student Peter Dong marvel at an artificial diamond detector Dong is presenting.

David Saltzberg's group (as part of the ANITA collaboration) successfully launched the engineering module of the ANITA balloon payload from the Columbia Scientific Ballooning Facility in Fort Sumner, New Mexico in August 2005. The full payload will be launched from Antarctica in December 2006 and will look for ultra high energy neutrinos that are produced when highest energy cosmic rays collide with the photons of the cosmic microwave background radiation. Major parts of the payload's strong but lightweight frame were built by the UCLA machine shop.

Amy Connolly

May 2006, UCLA postdoc **Amy Connolly** led an expedition consisting of UCLA graduate student **Abby Goodhue** and collaborators from Louisiana State University to the Cote Blanche Salt Mine in Louisiana. They measured the attenuation length of the large underground salt dome that contains the mine. If they can prove the attenuation length is long enough, the salt dome may be used as a 50 cubic kilometer cosmic neutrino detector.

David Saltzberg was awarded the NSF's Small Grant for Exploratory Research (SGER) and the Department of Energy's Advanced Detector Research (ADR) award to determine the suitability of the Ross Ice Shelf in Antarctica as a large neutrino detector to be called ARIANNA. The support allows him and UC Irvine professor Steven Barwick to fly out to near Minna Bluff on the Ross Ice Shelf by helicopter where they will camp out in a tent on the ice for a week in order to make radio attenuation length measurements of the 500 meter thick ice. The support also allows them to build and deploy the first prototype station this season as well. If the attenuation length proves long enough, a 30km x 30km array of low-cost antennas and stations could be deployed there to hunt for ultra-high energy cosmic neutrinos.

David Saltzberg in Antarctica

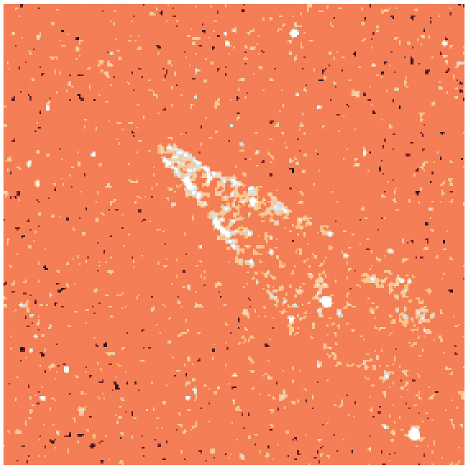
Eric D'Hoker was elected as a fellow of the American Physical Society: for contributions to quantum field theory and string theory, including string perturbation theory, supersymmetric Yang-Mills theory, and AdS-CFT correspondence.

Eric D'Hoker, graduate student **John Estes** and **Michael Gutperle** developed new techniques to study the fate of supersymmetry in interface quantum field theory. They constructed new Janus-type solutions to supergravity using the AdS/CFT correspondence.

Eric D'Hoker and D.H. Phong (Mathematics, Columbia University) continue their superstring perturbation theory, and are in the process of proving the holomorphic structure of the chiral blocks that enter the construction of 2-loop amplitudes.

In the early 1970s, the work of Stephen Hawking and others established that the first approximation to the entropy of a black hole is proportional to its surface area. Computing the corrections to this result is a stringent test for any quantum theory of gravity. In the past year **Per Kraus** has developed methods by which one can compute the exact corrections in certain cases, even for black holes which are of microscopic size, and hence highly nonclassical. Further, it was demonstrated that these results are in precise agreement with those coming from computations in string theory.

Alexander Kusenko has pointed out that several independent astrophysical observations point to the existence of a new, yet undiscovered particle: sterile neutrino. This particle can account for cosmological dark matter, and can explain the observed velocities of pulsars; it might have played an important role in star formation and reionization of the universe, and it could have helped generate the matter-antimatter asymmetry of the universe. Each of these phenomena can have an independent different explanation, and, therefore, neither one is a proof of the particle's existence. However, the preponderance of independent hints makes one excited about the possible discovery beyond the Standard model. This subject was the focus of a recent conference, "Sterile Neutrinos in Astrophysics and Cosmology (SNAC '06)," that took place in Crans Montana, Switzerland.



Head of the "guitar nebula" imaged with the Hubble Space Telescope Planetary Camera in 2001

A sterile neutrino with mass of several keV could be produced in the early universe in the right amount to be dark matter. In a supernova explosion, the same particle would be emitted from a cooling nascent neutron star preferentially in one direction set by the star's magnetic field. The anisotropy of sterile neutrino emission is sufficient to give the neutron star a recoil velocity of hundreds of kilometers per second, which is in agreement with observations.

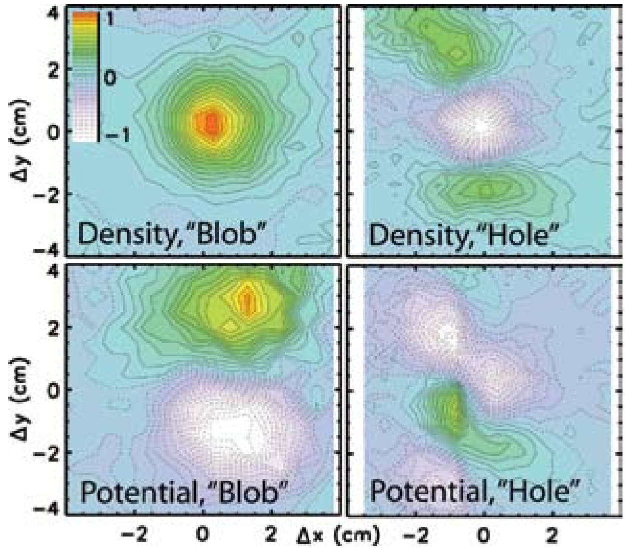
Dark-matter sterile neutrinos can decay into a lighter neutrino and an x-ray photon. This decay is the most promising path to discovery. The same decays, happening in the early universe, could have produced enough ionization to catalyze a rapid production of molecular hydrogen, which is the most important cooling agent for primordial gas. Enriched with molecular hydrogen, halos of gas begin to cool and collapse, forming the first stars.

Christian Fronsdal has developed a new approach to dealing with general relativity in astrophysics and cosmology that features an action principle for the matter component, which has turned out to be very successful. He has been dealing with ideal stars and has discovered that he is able to predict the temperature, something that is not true in the usual treatment. Results in all other respects are quite the same as the usual treatment.

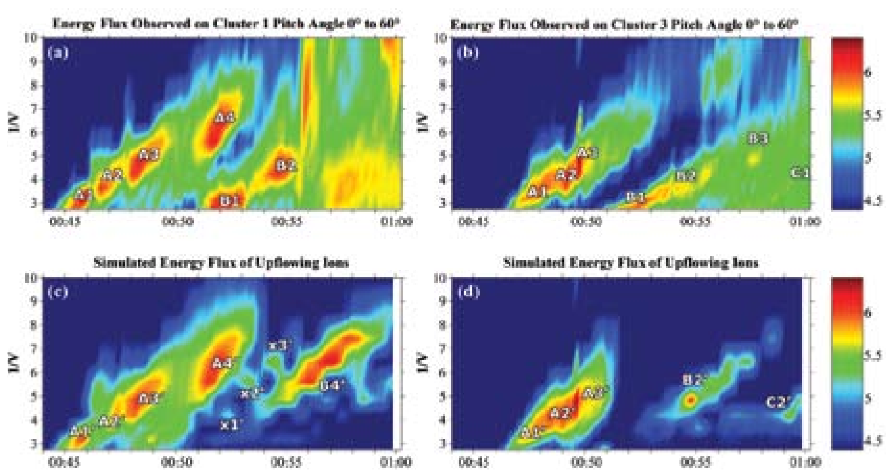
Maha Ashour-Abdalla and the space plasma simulations group have carried out research for the Cluster Spacecraft concerning multiscale multipoint measurements. They examined the occurrence of velocity dispersed ion structures (VDIS) in the plasma sheet boundary layer (PSBL) and the implications of VDIS observations on the structure and dynamics of the magnetotail. They inferred the sources and acceleration mechanisms of the ions in these VDIS observations by following millions of ion trajectories backward and forward in time through time-dependent electric and magnetic fields obtained from a global MHD simulation. ACE data were used as input for the MHD model.

One of the more interesting results of the investigation was the detection of the same particles by more than one spacecraft. They found that some ions first observed by SC1 subsequently interact with the current sheet and are then observed by SC3 at a later time. This mixing of particles between spacecraft, as well as the addition of ions from other sources, can account for the lack of clear structuring in SC3 observations by filling in the gaps seen in the SC1 observations. Furthermore, some SC1 ions interact with the current sheet and arrive at the SC3 location at the time SC3 observes secondary structures ("echoes"). This implies that echoes are complicated structures that can result from the mixing of primary ions originating from several beamlets observed on both spacecraft. These results show that the combination of event-driven global MHD simulations, particle tracing calculations, and spacecraft observations can be a powerful tool for understanding the physics of the magnetotail and the acceleration and transport processes in that region of the magnetosphere.

Troy Carter has continued work on nonlinear processes, turbulence and transport in magnetized plasmas. Using the Basic Plasma Science Facility (BaSF) at UCLA, he has investigated the formation of structures in drift-Alfv´en wave turbulence. Once formed, these structures (called "blobs" and "holes") are observed to propagate ballistically down the density gradient, causing significant particle transport in magnetic confinement fusion devices such as tokamaks. The two-dimensional structure of these objects has been measured for the first time, showing that "blobs" are dipolar filaments. Carter, along with graduate student **Brian Brugman**, has continued work on large amplitude Alfv´en waves. This effort recently resulted in the first laboratory observation of a nonlinear interaction between these important waves. Future work, now funded by an NSF CAREER award, will focus on heating, background plasma modification, and particle acceleration by large amplitude Alfv´en waves. Carter is also involved in a new research effort on the DIII-D tokamak at General Atomics in San Diego. Graduate student **Anne White,** in collaboration with **Tony Peeble**s and **Lothar Schmitz**, has constructed and fielded a new electron cyclotron emission correlation radiometer on DIII-D. The instrument has yielded the first measurements of electron temperature fluctuations in the core of a high performance tokamak. Highlights of the measurements include an observation of a significant change in the turbulent spectrum following the L-mode to H-mode transition in DIII-D, with the turbulent power reduced below the sensitivity of the radiometer during H-mode.



Two-dimensional structure of "blobs" and "holes" generated in strongdrift-Alfv´en wave turbulence, showing that blobs are polarized filaments (magnetic field direction is into the page).

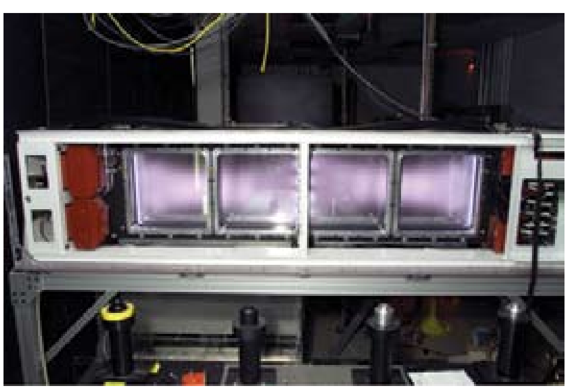


Spectrograms of energy flux of observed and simulated upflowing ions for SC1 and SC3. Each panel shows 1/v ,plotted against time, with the color scale shown on the right of the figure. Observed ion energy flux for (a) SC1 and (b) SC3 (structure labels A, B, and C by Keiling et al. [2004]). Simulated upflowing ion energy flux for (c) SC1 and (d) SC3.

Laboratory experiments performed by **Walter Gekelman** and graduate student **Bart Van Compernolle,** together with computer simulations and analytical results by **George Morale**s and **Frank Tsung**, have demonstrated that the irradiation of a magnetized plasma by a large amplitude, high-frequency pulse results in the efficient generation of low-frequency Alfvén waves. The transfer of energy corresponds to a down-conversion in frequency by a factor of approximately 105. The spatially localized absorption results in signals that propagate distortions in the ambient magnetic field to distant locations. In essence the problem involves issues of multi-scale coupling, which is a topic of contemporary interest in a broad range of plasma applications. The phenomena investigated is of relevance to on-going ionospheric heating experiments, to the understanding of electromagnetic disturbances produced by nuclear explosions in the near earth plasma, and to naturally occurring events in astrophysical plasmas.

The consistency and complementary of the experimental, computational and analytical results have provided a detailed picture of a complex fluid/kinetic process. The early stage consists of fluid nonlinearities that result in large modifications in the plasma density profile. Strong electron acceleration arises from short-scale electric fields excited in the modified profile. The fast electrons exit the original footprint of the high-frequency pulse and act as a moving antenna that results in the Cerenkov radiation of Alfvén waves. The experiments were performed in the Basic Plasma Science Facility (BaPSF), a national and international user facility at UCLA. The computations were implemented in the Dawson cluster, also at UCLA. Both of these unique research tools have been developed with Major Research Instrumentation (MRI) awards given by NSF to members of the UCLA plasma group.

Christoph Niemann, through a joint position in both electrical engineering and the physics department, has begun to establish a research group on high-energy density science and laster-plasma physics. In close collaboration with scientists from the Lawrence Livermore National Laboratory (LLNL), the group will perform experiments on laser plasma interactions and high-energy density science in connection with the laser fusion program at the National Ignition Facility (NIF). NIF – the world's largest laser – was designed to demonstrate thermonuclear fusion ignition in the laboratory – the combining or 'fusing' of two light nuclei to form a new heavier nucleus. Upon completion, NIF's 192 laser beams will deliver an energy of 1.8 Megajoule and a power of 500 Terawatt, more than 500 times the U.S. peak generating power, onto a millimeter size DT fuel capsule in the center of its 10-meter-diameter target chamber. The pressure of the ablating material will compress the capsule to 1000 times liquid density and to temperatures of tens of millions of degrees – similar to those inside the Sun and stars. NIF's carefully controlled pulses can drive experiments to pressures, never before seen in a laboratory setting. NIF will achieve pressures higher than a billion times atmospheric pressure, equivalent to pressures at the center of the Sun and stars.



Plasma Electrode Pocket Cell (PEPC) undergoing testing. The PEPC is used as an optical switch to allow multiple laser passes through the main amplifier for more efficient operation of NIF

Niemann's group specializes in the development of novel detectors and the study of laser plasma interactions and extreme plasma physics relevant to inertial confinement fusion (ICF) and fast ignition. The group has recently installed a 50 J glass laser system at UCLA that will be used to train students and to develop and test diagnostics before they are employed at larger facilities. The laser will also be used to study astrophysical shockwaves at UCLA's Basic Plasma Science Facility that operates the 20 m long Large Plasma Device.

The plasma group of **Reiner Stenzel** and **Manuel Urrutia** has investigated how magnetic fields from a loop antenna penetrate into a magnetized plasma. It was found that a field-reversed configuration is generated which propagates as nonlinear whistler waves into the plasma. Such nonlinear structures form vortices in the electron flow which cause heating and secondary waves. Electron heating is visible as a blue glow around the loop antenna in the time-resolved picture (1/8000sec) of the loop in a the red plasma. Efficient wave injection and electron scattering are of interest in space plasma applications.

Advanced Accelerator Physics

The Particle Beam Physics Laboratory (PBPL), headed by **James Rosenzweig**, has continued its frontier efforts on ultra-fast particle beam systems: advanced accelerators based on lasers and plasma, and free-electron lasers (FELs). In the Neptune Advanced Accelerator lab, measurements of electron beam manipulations with femtosecond resolution have been made possible by the introduction of radio-frequency sweeping techniques.

The lifecycle of one experiment in the Particle Beam Physics Laboratory Group (top to bottom): from concept (3D CAD design), to simulation, to first prototype (aluminum cold test model), to second prototype (steel cold test model), to installed system, and finally to data. The device, part of graduate student Joel England's dissertation research, is an RF deflecting cavity used as a bunch length diagnostic forultra-short (fs time-scale) relativistic electron beams.

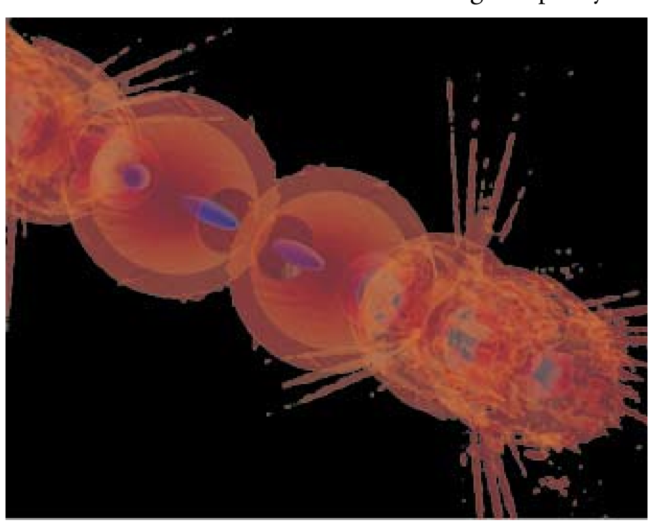
In off-campus experiments, PBPL continued its emphasis on wakefield acceleration with observation of >10 GV/m fields excited in dielectric structures. The SPARC project at Frascati (Italy), a collaboration with strong UCLA involvement, was commissioned, and first observation of plasma-expansion of ultra-short beams observed. At Brookhaven, experiments on relativistic electron beam compression yielded the first measurement of coherent edge radiation; seeding experiments using the VISA high-gain FEL experiments were initiated. The PBPL in the last year joined the FINDER inverse Compton scattering project at Livermore, an experiment which will create monochromatic gamma rays, as well as the FERMI FEL in Trieste (Italy).

The LCLS x-ray free-electron laser, proposed by Claudio Pellegrini, has undergone ground-breaking at Stanford Linear Accelerator Center this year. This light in which Pellegrini has played a major role since its inception, promises to revolutionize nanoscience by providing coherent, high power x-rays in 100 femtosecond bursts.

The PBPL group has added a new faculty member: Pietro Musumeci will join the department in January of 2007.

The Computer Simulations of Plasma Group under the leadership of **Warren B. Mori** and **Jean-Noel Leboeuf, Viktor Decyk**, and **Phil Pritchett,** continues to do pioneering work in high-performance computing of complex plasma phenomena. The group continues to consist of four junior researchers and seven PhD students. Its research remains focused on the use of fully parallelized particle-based simulation models to study magnetically confined plasmas, laser and beam plasma interactions, space plasmas, Alfvenic plasmas, and high-energy density science. The group specializes in particle-in-cell (PIC) techniques and continues to develop and maintain over five separate state-of-the-art PIC simulation codes including OSIRIS, UPIC Framework, UCAN, Recon3D, QPIC, and QuickPIC.

Recent highlights include one of its recent graduates, **Cheng-kun Huang**, receiving the Nicholas Metropolis Thesis Prize from the Division of Computational Physics within the American Physical Society. Huang is currently a post-doctoral researcher in the group. The group remains committed to answering fundamental questions regarding magnetically confined plasmas, as well as determining the feasibility of using plasma acceleration techniques in future high energy colliders and whether the fast ignition fusion concept is viable. The group is also actively involved in simulating several key experiments throughout the world on plasma based acceleration. In one plasma-based acceleration scheme called the energy doubler or afterburner, the space charge forces of an existing particle beam excites a plasma wave wakefield as it propagates through a plasma. The gradients of these wakefields can approach 50 GeV/m. A properly phased trailing beam can surf on the wake and thereby gain 100 GeV in a few meters. In this way the size of a linear collider can be reduced from 10's of kilometers to a few meters. The group does full scale modeling using OSIRIS and QuickPIC of collaborative experiments between Stanford, UCLA, and USC, which are carried out at the Stanford Linear Accelerator (SLAC). These experiments have recently demonstrated ~40 GeV energy gain in less than one meter. During the past year they have modeled experiments in which the radiation pressure of an intense laser rather than the space charge forces of a charged particle beam are used to excite the wake. The group continues to study the feasibility of the fast ignition fusion concept, as well as laser-plasma interactions relevant to the National Ignition Facility. Using the local DAWSON Cluster they have recently carried out the largest PIC simulation to date on fast ignition.



Bill Slater got his PhD from the University of Chicago in 1958 and came to UCLA less than a year later. As a postdoc, he joined the high energy group, then led by Harold Ticho. Slater retired last June 30, 2005, after 47 years in the UCLA physics department. Slater continues building an experiment for Physics 180F that looks like it will be ready for teaching in the spring quarter, for which he anticipates being recalled.

Chun Wa Wong received his undergraduate degree in physics from UCLA and his PhD in physics from Harvard. He did postdoctoral research on nuclear theory in Princeton, Oxford and Saclay. He returned to teach at UCLA in 1969, and has been here since. Wong retired on June 30, 2006. After his retirement, he intends to continue his research on theoretical physics and the history of physics.

Ernest Abers received his BA from Harvard and PhD from UC Berkeley (1963). He was a postdoc at CalTech and CERN before coming to UCLA in 1965 as assistant professor. Ernest spent leaves and sabbaticals at CERN, MIT, Stony Brook, Brookhaven Nat. Lab., Ecole Polytechnique (Paris), and maybe other places he has forgotten.

Abers works in particle physics (high energy physics) theory, mostly in field theory. A long time ago he wrote a textbook with Charlie Kennel for a physics non-scientist course, and recently wrote a graduate level textbook for quantum mechanics. Abers retired in November 2005, after 40 years in the UCLA physics department. Abers is still teaching, and will continue to teach at least through the end of next year.

New Faculty

Christoph Niemann was born in Duesseldorf, Germany, in 1973. He received his Dipl. Phys. diploma from the Friedrich Alexander University in Erlangen, Germany, and his PhD in physics from the University of Technology in Darmstadt, Germany, in 1998 and 2002, respectively. From 1997 to 1998 he was at the Max Planck Institute for Plasmaphysics (IPP) in Garching where he studied transport phenomena in magnetically confined plasmas. He spent a year in the fusion energy group at the Lawrence Berkeley National Laboratory in 1999 to study discharge plasmas for beam transport in heavy-ion beam fusion. From 1998 to 2002, he was a research scientist at the Gesellschaft fuer Schwerionenforschung (GSI) accelerator facility in Darmstadt, where he worked on the transport and focusing of heavy ion beams with plasmas and the interaction of intense ion beams with matter. In 2002 he joined the Inertial Confinement Fusion Program of the National Ignition Facility at Lawrence Livermore National Laboratory (LLNL) as a postdoctoral researcher. He has since been working on laser-plasma interaction physics for inertial confinement fusion. In 2005 he joined both the electrical engineering department and the physics and astronomy department at UCLA as a young faculty member, and is currently an assistant professor in both departments. He is also the NIF professor and has a joint appointment with the Lawrence Livermore National Laborotory.

FACULTY 2005-2006

PROFESSOR

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Retired 11/05
Katsushi Arisaka
Maha Ashour-Abdalla
Eric Becklin
Retired 11/05
Zvi Bern
Stuart Brown
Vice Chair Resources
Robijn Bruinsma
Charles Buchanan
Vice Chair Academic Affairs
Sudip Chakravarty
David Cline
Ferdinand V. Coroniti
Vice Chair for Astronomy and Astrophysics
Robert Cousins
Steven Cowley
Eric D'Hoker
Sergio Ferrara
Christian Fronsdal
Walter Gekelman
Graciela Gelmini
Andrea Ghez
George Grüner
Jay Hauser
Kàroly Holczer
Huan Huang
Hong-Wen Jiang
Michael Jura
Steve Kivelson
Adj . Prof. 7/01/06
James Larkin
Matthew Malkan
Ian Mclean
George J. Morales
Warren Mori
Mark Morris
Chetan Nayak
Bernard M.K. Nefkens
William Newman
Rene Ong
C. Kumar N. Patel
Roberto Peccei
Vice Chancellor for Research
Claudio Pellegrini
Seth J. Putterman
James Rosenzweig
Joseph A. Rudnick
Chair of Physics and Astronomy
David Saltzberg
Peter E. Schlein
William E. Slater
Retired 06/30/06
Reiner Stenzel
Terry Tomboulis
Jean Turner
Roger Ulrich
Charles A. Whitten
Gary A. Williams
Chun Wa Wong
Edward Wright

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George Igo
Leon Knopoff
Steven Moszkowski
Richard Norton
Mirek Plavec
David Saxon
Deceased December 2005
Alfred Y. Wong
Eugene Wong
Byron T. Wright
Benjamin Zuckerman

RESEARCHER

Viktor Decyk
Samim Erhan
Jean Noel Le Boeuf
Anthony Lin
James Maggs
William Peebles
Philip Pritchett
R. Michael Rich
Robert Taylor
Retired 06/06
Steven Trentalage
J. Manuel Urrutia
Mahmoud Youssef

ASSOCIATE RESEARCHER

Vahe Ghazikhanian
Neil Morley
Terry Rhodes
Lothar Schmitz
Gil Travish
Frenc Varadi
Hanguo Wang

ASSISTANT RESEARCHER

Shahriar Abachi
Luca Bertello
Yasuo Fukui
Pierre Gourdain
Mikhail Ignatenko
David Leneman
Sven Reiche
Glenn Rosenthal
Shoko Sakai
John Tonge
Frank Tsung
Stephen Vincena
William Wright
Jeffrey Zweerink

Education Highlights

Let us think of education as the means of developing our greatest abilities, because in each of us there is a private hope and dream which, fulfilled, can be translated into benefit for everyone and greater strength for our nation.

John F. Kennedy

Students explore liquid nitrogen vapor

Summer 2006 saw the first year of the department's second three-year cycle of the NSF-sponsored Research Experience for Undergraduates REU, a 10-week immersion in research and instruction for physics students from all over the country. These top-level students compete to come to UCLA to work with our faculty in such areas as plasma physics, condensed matter physics, astroparticle physics, astrophysics and biophysics. In total, 14 students participated in the 2006 summer program, from amongst 300 applicants. Besides involvement in a research project under the supervision of one faculty member, the program activities included faculty seminars, machine shop and electronics workshops, physics GRE preparation workshop, and a hiking trip to the high Sierras. The capstone of the program is the end-of-the program symposium where students present the results of their summer research in a 20-minute powerpoint presentation. Some of the project reports are destined for publication. We were very impressed with the high quality of their work and the amount they had learned. Their very enthusiastic responses to the summer experience indicate that this program is projecting a strong and positive image of UCLA physics and astronomy to what will be the next generation of scientists.

OUTREACH

NSF-Sponsored Outreach

In what is now a tradition, the UCLA Plasma Science and Technology Institute participated in several outreach events. As in previous years, J. Manuel Urrutia has coordinated UCLA's participation in the annual Celebrate Books Fair (November 21, 2005) and the Chavez Memorial March Celebra la Ciencia Fair (April 3, 2006). He was again joined by Charles Whitten, George Morales, and Troy Carter, as well as research faculty Phillip Prittchet, and Frank Tsung, and graduate students Humberto Torreblanca, David Pace, Ann White, Jay Fahlen, Adrian Soldatenko, and Benjamin Winjum. The hands-on approach continues to be very successful and allows children and their parents to be active participants in exploring physics. For the second time, they have also participated in the "I am Going to College" program coordinated by UCLA's Financial Aid Office. This year, they hosted two groups of fourth-graders from Montebello's Bella Vista Elementary and Los Angeles' Cimmarron Avenue Elementary and their parents who were shown what physics is all about via hard-working demonstration equipment. These activities have led to a new partnership with UCLA's Early Academic Outreach Program and several events have been scheduled for the 2006-2007 year.

Celebra la Ciencia Festival

DOE-Sponsored Outreach

Steve Cowley and several members of the Center for Multiscale Plasma Dynamics (CMPD), a Fusion Science Center funded by DOE, initiated an outreach program at Para Los Niños Charter School. Para Los Niños is an elementary school serving the working families of downtown Los Angeles.

Cowley and others perform physics demonstrations that give the students a hands-on, close-up feel for physics. On one visit, demonstrations using liquid nitrogen were used to supplement the students' introduction to states of matter. Other visits included demonstrations of the principles of kinetic and potential energy and of simple machines. CMPD's involvement provides not only supplies and equipment, but also expertise that would otherwise not be available to Para Los Niños. The CMPD group was able to leave the students with memories that will become the basis of understanding.

Visits to Para Los Niños continue, taking place about once a month during the school year. They are coordinated by Lisa Rosenthal Schaeffer, UES teacher and Para Los Niños curriculum consultant, and led by Cowley, CMPD administrator Becky Carter, and graduate students Eric Wang, Gabriel Plunk, and Russell Neches.

Steve Cowley, Lisa Rosenthal Schaeffer and graduate students Eric Wang and Russell Neches begin the demonstration.

UCLA Physics & Astronomy Building Hosts First International Conference

Huan Huang chaired the International Conference on Strangeness in Quark Matter (SQM), which was held March 26-31, 2006, at the UCLA campus. This was the first international conference held in the new Physics and Astronomy Building The conference program on March 26, 2006, included a symposium where graduate students and post-docs reported their research results. The conference marked the first one in the SQM series where heavy quark physics is featured as significantly as strange quark physics in nucleus-nucleus collisions. Many exciting results from RHIC experiments were highlighted. The conference organizers also used the gathering of the heavy ion physics community to recognize Professor Walter Greiner's great contribution to nuclear physics. Under his leadership the Frankfurt School of Theoretical Nuclear Physics has played a significant role in the growth of heavy ion physics. The proceedings of the SQM2006 are dedicated to Professor Greiner's 70th birthday. The SQM2006 conference was organized by Kenneth Barish (UCR), Huan Zhong Huang (UCLA), Joseph Kapusta (Minnesota), Grazyna Odyniec (LBNL), Johann Rafelski (Arizona), and Charles A. Whitten Jr. (UCLA).

Roberto Peccei presented Walter Greiner with a poster signed by all the attendees

Fellowships

GAANN Fellowship Recipients

The Department of Education grant proposal for Graduate Assistance in Areas of National Need (GAANN) fellowship funding has been accepted for another three years. This program is able to support eight incoming graduate students. The recipients for the academic year 2006-07 are: **Eric Angle, Timothy Arlen, Keri Dixon, Alex Gigliotti, Seung Ji, Cheyne Scoby, Artin Teymourian,** and **Oliver Williams.** Selection criteria for this fellowship is competitive and based on financial need and academic ranking. Recipients of this fellowship are encouraged to seek out research opportunities earlier in the PhD program and are required to participate in a scientific writing course with Professor Eric D'hoker.

Dissertation-Year Fellowship Program

The University of California's Dissertation-Year Fellowship Program provides support to outstanding PhD candidates during their final year of graduate school, providing support which allows them to focus on writing their dissertation. The program is designed to identify doctoral candidates who have been educationally or economically disadvantaged, or whose research or planned career direction focuses on problems relating to disadvantaged segments of society. This program assists students by providing faculty mentorship as they prepare to become postdoctoral fellows or candidates for faculty positions. This year **Brian Mohr** has been selected from the physics and astronomy department.

Eric D'Hoker for the second year was awarded Outstanding Teacher of the Year, Physics Department (2005-2006)

E. LEE KINSEY TEACHING PAVILLION

On January 6, 2006, the 3-lecture hall complex 1200, 1220 and 1240, located at the south end of Knudsen Hall were renamed the E. Lee Kinsey Teaching Pavilion, as approved by President Atkinson in June, 2000 and pursuant to the initial request of the department of Physics in spring 2000. A new bronze plaque installed in the foyer of lecture hall 1220 describes the background of Professor Kinsey.

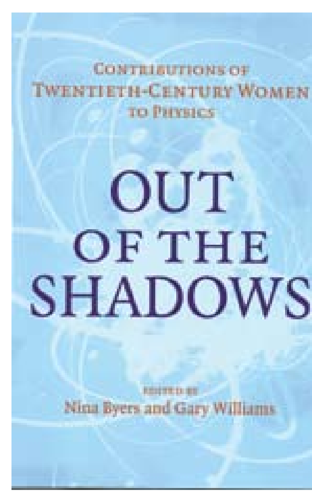
In 1928 Kinsey came to UCLA, where he became nationally known for his work in spectroscopy, the analysis of matter by light. Kinsey was chair of the department from 1949 to 1959. He was also vice chairman of the Academic Senate from 1947 to 1948, and in the 1940s and 1950s he served on more than 20 of its committees.The Department is delighted to honor Professor Kinsey in this way.

Cambridge University Press recently published *Out of the Shadows: Contributions of Tewentieth Century Women to Physics,* edited by Nina Byers and Gary Williams.

"What's a nice girl like you doing in Physics 55?"

"As this inspiring gallery of heroines makes plain, there's no such thing as female science — just female scientists, including some very great ones..." Frank Wilczek,Nobel Prize in Physics, 2004.

"This book fills a vacuum in the history of physics. For the first time we have in one place clear accounts of careers and contributions to physics of 40 distinguished women from a variety of fields..." Margaret W. Rossiter, MacArthur Prize Fellow 1989-1994.



"*Out of the Shadows* gives us fascinating accounts of some of the ground-breaking achievements of women physicists and astronomers, many of whom have never received the recognition they truly deserve. ..." Jerome I. Friedman, Nobel Prize in Physics, 1990

GRADUATES 2005-2006

B.S. ASTROPHYSICS

Awad, Christina
Beatty, Michelle
Bolotov, Dmitriy
Bowen, Stephen
Charles Geoffrey Hilton Astronomy Award
Calvo, Phillip
Khalil, Matthew
Koshy, Sam
Mendez, Demian
Schiavo, Gregory
Soukiassian, Hovhannes
Spatariu, Alina
Stone, Zachary
Villanueva, Edward
Wells, Patricia
Wong, Andre

B.S. PHYSICS

Aharoni, Daniel
Alvarado, Geraldo
Baisman, Maurice
Batra, Arunabh
Blum, Nathan
Boyle, Katie
Butler, David
Cheng, Adrian
Chu, Thien
Cohen, Aaron
Cook, Zachary
Corralejo, Erin
Davia, Carlos
Dunfee, Lauren
Erickson, Michael
Foster, Ian
Graham, Rion
Harrison, Mark
Lake, Michael
Lampert, Alexandra
Lurie, Helen
Ma, Teng (Frank)
E. Lee Kinsey Senior Award
MacDonald, Christopher
Maronde, Daniel
Moody, Joshua
Nuger, Jeremy
Otoide, Eric
Reed, Galen
Saldana, James
Santore, Chris
Schaffner, David
Schiller, David
Seager, Clair
Steinmetz-Deer, Justin
Wieczorek, David
Williams-Garcia, Rachid
Wright, Kainoa-Kaahanui
Xia, Shuang (Claire)
Yoon, Clara
E. Lee Kinsey Senior Award
Youn, Seo Ho
Young, Justin

B.A. PHYSICS

Czer, Petper
Lojacono, Francis

B.S. BIOPHYSICS

Kim, Sunmin

This year's Abelmann-Rudnick Scholars are Onnie Luk and Emin Menachekanian

DOCTORAL DEGREES AWARDED

ASTRONOMY

Jennifer Carson
Denise Kaisler
Mark McGovern

ASTROPHYSICS

David Barnhill

BIOPHYSICS

Mikhail Briman
Brian Choi
AY0506 Dissertation Year Fellowship
Riley Crane
PAAL Outstanding Graduate Student Award
Vassili Ivanov
AY0405 Dissertation Year Fellowship

EXPERIMENTAL ACCELERATOR PHYSICS

Gerard Andonian
Jae-Ku Lim

EXPERIMENTAL CONDENSED MATTER

Carlos Camara
AY0405 Dissertation Year Fellowship
Donald Faulhaber
Brian Naranjo

EXPERIMENTAL PLASMA PHYSICS

Bart Van Compernolle

HIGH ENERGY EXPERIMENT

Brandon Hartfiel
Jason Mumford
Tohru Ohnuki

NUCLEAR EXPERIMENT

Weijiang Dong
Johan Gonzalez
Hai Jiang
Jingguo Ma
Dylan Thein
Jeffery Wood

THEORETICAL CONDENSED MATTER PHYSICS

Ian Bindloss
Angela Kopp

THEORETICAL PLASMA PHYSICS

James Kniep
AY0405 Dissertation Year Fellowship

UCLA Physics and Astronomy Department
2005 - 2006
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For more information on the Department see our website:
<http://home.physics.ucla.edu>

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