Volume 3 Number 1

#### **HIGH HONORS:**

#### ALEX SMALL NAMED 1998 CO-SALUTATORIAN

Last May, Senior Alex Small was named Co-Salutatorian of the 1998 graduating class. Originally from Milwaukee, Wisconsin, Alex chose to attend USC in the Fall of 1994 after receiving the Trustee Scholarship. While maintaining a 4.0 over the last four years, Alex was able to find time for community service feeding the homeless, launching rockets, studying in England for a summer, participating in the Mortar Board Senior Honor Society (he adds, "We were actually active and it was a great way to finish my time at USC."), and resurrecting the Society of Physics Students with the aid of Professor Gene Bickers.

Alex's interests are varied and original. His Physics interests are focused on the latest fields of condensed matter theory (particularly research in small quantum structures), biophysics, and space exploration. His goal is to apply these fields to the space program.

In addition to Physics, Alex earned a minor in Economics. As always, Alex applied his love of hands-on research by completing field research for a paper on souvenir prices. Outside of academics, Alex enjoys politics, science fiction, cooking, juggling, and snow, which he misses a great deal. In the spirit of a true dreamer, Alex quips, "If I weren't a physicist I'd probably open a restaurant with juggling waiters and run for Congress as a business owner."

Upon his arrival to the USC Department of Physics and Astronomy in the Fall of 1994, Alex says, "The first thing I did as a freshman was visit the Seaver Science Center and start knocking on doors in search of a lab job. After a few days of this, Dr. Bozler talked to me and sent out an e-mail asking that a professor hire me - presumably, so I'd stop bothering busy people." Persistence paid off, and Alex began his research career at USC working with Professor Melvin Daybell. During his two years with Professor Daybell, Alex worked on a spectrometer that has flown in space several times. He says, "It was pretty

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### DEPARTMENT CHAIR, Tu-NAN CHANG, WINS RAUBENHEIMER AWARD

or the second year in a row, one of our faculty has been chosen for the prestigious Raubenheimer Award, the highest honor of the College. This year's winner is our recently appointed Department Chair, Professor Tu-nan Chang. Established in 1980, this honor is presented annually by the College of Letters, Arts and Sciences to exceptional faculty members within each of the College's three disciplines (humanities, natural sciences, and social sciences) who have excelled in the areas of teaching, research, and service to the University.

Since joining our department in 1975, Professor Chang has taught a wide variety of courses, including elective special topics, general education, undergraduate, and graduate courses. Well-liked by his students, he maintains consistently high course evaluation ratings every semester.

In addition to being a dedicated teacher, Tu-nan Chang is a diligent researcher who is internationally known for his work in the fields of atomic, molecular, and optical physics. Emphasizing studies of strong multi-electron interactions in atomic transitions dominated by multiple excitations in complex atoms, he makes continuous efforts on the development of theoretical formalism related to atomic structure theory. Furthermore, he has also made considerable progress in the development of the state-of-the-art computational techniques suitable for applications on the most powerful high speed computers.

Presently serving the University and our department as Chair, Professor Chang has been a leader throughout the USC campus in many organizations. Over the years, he has held various faculty committee assignments, participated in ethnic student mentoring and orientation programs, and served on the Martin Luther King Birthday Celebration Committee from 1993 - 1995. Furthermore from 1994 - 1996, he represented USC faculty as the President of the Academic Senate.

He is also the recipient of the 1998 Achievement Award for his contributions to basic research and education from the Chinese American Faculty Association of Southern California.

Please visit his web page at http://physics.usc.edu/Faculty/Chang/@

WE WOULD LIKE TO THANK ALUMNI, SHANG SONG AND XIAO WANG, AND FORMER STAFF MEMBER, HENRY LEE, FOR THEIR GENEROUS GIFTS TO THE DEPARTMENT. YOUR SUPPORT IS GREATLY APPRECIATED®

## PERSPECTIVES ON TEACHING: PHYSICS FOR BUSINESS APPLICATIONS

Due to the persistent efforts of our former Chair, Professor Hans Bozler, the University of Southern California has been funded by the Alfred P. Sloan Foundation to create four new professional master's degrees in the sciences.

One of these four new programs is Physics for Business Applications which is designed for the physical sciences, mathematics, or engineering graduate who wants to pursue a career in management, consulting, and finance, rather than follow the traditional path of research and teaching. "We expect the physics-plus degree to be comparable to MBA and law degrees, but grounded in the tools and techniques of advanced technology," says Hans Bozler.

After first consulting and holding conferences with potential employers who have shown an interest in the hiring of our future Physics for Business Applications graduates, our department has designed a program which is interdisciplinary, hands-on (an internship is required), and designed to meet the demands of graduate students and employers. Professor Bozler explains, "We expect that the resulting professional master's degrees will be 'high-valued' and will attract recent graduates as well as professionals already in commerce, government, and industry who perceive the need for more specialized training."

This two-year program consists of three parts. The first is a core of physics courses taught by our own Physics and Astronomy faculty which include the ability to read and apply the results of physics research, advanced modeling and problem solving techniques, and computational techniques. A specifically designed track in business with an emphasis in one of several areas, such as Corporate Finance, Information Systems, and Operations Management, constitutes the second part of the curriculum. These courses will be taught by the faculty of USC's Marshall School of Business.

The third part of the curriculum includes discussions of emerging technologies and an internship within business and industry where students will be excepted to present technical reports, both orally and in writing,

in an effort to hone their communications skills. As well, many practicing professional scientists who are working in business and industry in Southern California will be invited as guest lecturers where their expertise adds to the classroom experience.

Additionally, each student will be proficient in modern programming languages including C++. These languages will be used in physics courses, and each graduate will be familiar with modern networked computer systems and analytical and data management tools.

Many of the physics core courses are newly developed specifically for this program by our Physics and Astronomy faculty. Professor Hubert Saleur developed and taught one of the core courses which deals with complex systems this last Fall '98, and the newly appointed Professor Haas has developed a course, as well, concerning computational physics.

In addition to consulting local industry and our Physics and Astronomy faculty, Professor Bozler solicited the input of our domestic Physics and Astronomy alumni, who were very receptive to his three-page questionnaire. As for the results, he found that 48% of our responding alumni work for companies, while 16% work at universities; 15% are employed by the government; 9% are self-employed; and the remainder are retired or did not indicate current employment. When asked how well informed they had been about the diversity of careers in science, only 8% said they had been well informed; 36% said they had obtained enough information to choose jobs; and 54% said that they had not been informed well enough.

Furthermore in a free-response question, alumni were asked which skills derived from their scientific training have proven to be the most valuable throughout their careers. 44% of the respondents named analytical and critical thinking, while 16% chose mathematics and statistics; 12% mentioned the content of their physics and science courses; and 7% cited computer skills. When asked in another open question what they felt they should have studied in addition to

science, 35% volunteered business; 15% named computers; and 11% said social science.

Presently, we are recruiting graduates scheduled to begin classes this next Fall '99 with the goal to enroll 20 students.

Candidates for admission will have a completed bachelor's degree in mathematics, one of the physical sciences, or engineering, and prior knowledge of computer languages is preferable. The GRE is required.

For more information about the Professional Master's Programs in the Sciences, please send e-mail to Professor Hans Bozler at hbozler@usc.edu or call (213) 740-1125. Please visit the Physics for Business web page at http://www.usc.edu/dept/physics/SloanWeb/physicsforbiz.htm for further information®

## WARNER AND RATHFELDER RECEIVE G.E. AWARD

In November of '98, Professor Nicholas Warner was awarded the 1997-1998 General Education Teaching Award from the USC College of Letters, Arts, and Sciences for his contributions to the USC General Education Program during the Fall of '97 through the Spring of '98 academic year. Recipients were chosen on the basis of statistics and student comments on evaluation forms, course syllabi, and evidence of rigorous grading. Professor Warner elected to share his award with our General Education Lab Director, Robert Knol, for his assistance in creating a comprehensive, hands-on Astronomy 100 Lab experience for undergraduates.

Additionally, the College has awarded the 1997-1998 General Education Graduate Assistant Award to graduate student, Charles Rathfelder, for his outstanding leadership in the General Education Program during the same academic year &

## DEPARTMENT AWARDED HEWLETT PACKARD EQUIPMENT GRANT

In January of '98, the USC Department of Physics and Astronomy was awarded a Hewlett Packard U.S. University Equipment Grant which is given to programs who are directly involved with the undergraduate education of engineers. Rather than awarding a monetary prize, our department was given \$100,000 worth of equipment.

The proposal, entitled "Integration of Computer Technology into Physics Labs for Engineers", was drafted by our Director of Undergraduate Affairs and USC Physics Alumnus, Ty Buxman, and Professor Gene Bickers with input from Undergraduate Lab Director, Kristin Sabo, back in the Fall of '97 in hopes of making much needed improvements in our undergraduate labs.

As part of the successful proposal, Bickers and Buxman suggested that the Physics Department is the only department on campus that is guaranteed to teach every single engineering major in a lab course. Ty Buxman explains, "Even Engineering departments do not necessarily see every student. As a result, our introductory 3-semester physics sequence has a significant impact on engineering students. The fact that the sequence is also the first lab course for engineers simply heightens the impact."

The strength of the proposal was essentially in the development of new, innovative labs which integrate the basic physics curriculum with computer technology.

Ty continues, "We proposed to use video cameras, video capture cards, and HP computers to analyze 2-dimensional motion. Currently, we are developing labs which integrate the electronics test and measurement equipment, such as oscilloscopes and function generators, with computer monitoring software to improve how we teach students to use electronic equipment for physics measurements. We will also use this software to allow students to experiment with new concepts in the lab instead of simply requiring the completion of cookbook labs."

Having received the equipment in the Spring of '98, Bickers, Buxman, and Sabo are working towards a complete implementation of these new labs by the Spring of 2000 ❖

#### STATE-OF-THE-ART MULTIMEDIA FOR STAUFFER LECTURE HALL

As part of USC's continued commitment to keep its classrooms updated, the Stauffer Lecture Hall was chosen to be remodeled and refurbished with a state-of-the-art multimedia system. Since this lecture hall is where the USC Department of Physics and Astronomy holds 70% of its courses, our department was the major beneficiary when SLH re-opened its doors in September of '97.

At that time, David Mehrania, a USC Computer Sciences graduate student and full-time Physics and Astronomy staff member, was promoted to Equipment Manager for Physics and Astronomy Lecture Support in order to organize and implement the use of these new multimedia facilities for our department.

Each of the three lecture rooms is equipped with a PC or a Mac, a VCR, two separate connections for an external computer, laptop, or powerbook; two separate connections for external video, four ethernet connections, a built-in microphone and speaker, and three sets of hearing devices for students who are hearing impaired.

Since the remodel, our professors have been taking steps to implement the use of these facilities into their lectures. At present, Professor Edward Rhodes is exploring the potential of these new multimedia facilities by combining the use of interactive astronomy software with a slide presentation in every lecture, and Professor Krzysztof Pilch uses the computer in almost every lecture.

The use of demonstrations in the lectures has also increased as a result of these new resources. David works continuously to incorporate this equipment into these new demos. He has begun using a camcorder to project small scale physics demonstrations onto the big screen. David explains, "Projecting very small demonstrations on the big screen, to me, is the most important feature. It has given us the chance to do demonstrations that would have been either impossible to do or impossible for the entire class to see."

This Spring 1999, David has implemented another innovation by adding Science Workshop computer interfaces to each lecture room. He continues, "With these interfaces, our Physics faculty will be able to collect data and analyze them on the computer while performing a physics demonstration during a lecture. This will be the most creative use of the facility."

#### DARRELL JUDGE ELECTED APS FELLOW

We are pleased to announce the recent election of Professor Darrell Judge to the Fellowship of the American Physical Society. His citation reads, "Darrell Lynn Judge — Atomic, Molecular, and Optical Physics — for his pioneering work on the fundamental properties of atoms and molecules using selected monochromatic photon excitation and dispersed fluorescence, and their applications in space physics."

Other APS Fellows at USC include: L. Armstrong, I. Bars, G. Bergmann, T. N. Chang, H. K. Cheng, H. H. Forster, R. Hellwarth, T. Katsouleas, B. Koel, J. Kunc, K. Maki, E. P. Muntz, H. Reisler, I. Senitzky, R. Shakeshaft, W. Spitzer, H. Taylor, and C. Wittig. In addition, J. Feinberg and R. Hellwarth of the Department of Physics and Astronomy are Fellows of the American Optical Society.

## RESEARCH UPDATE: DELIDUMAN'S WORK WITH BARS

Cemsinan Deliduman, a fifth year USC Physics Ph.D. student, submitted the following article describing his research with Professor Itzhak Bars. Bars and Deliduman spent a year at CERN during the 1996-97 academic year. Deliduman plans to finish his Ph.D. this summer.

During my Ph.D. studies, I concentrated mainly in finding physical models which are defined in higher dimensions containing multiple timelike coordinates and become the ordinary string or particle theories upon fixing the extra gauge degrees of freedom. I was also interested in WZW models on non-compact group manifolds, in particular on SL(2, R) manifold which is  $AdS_3$ .

Spacetimes with multiple time-like coordinates begin to be taken seriously after Vafa's F-theory and Bars's Stheory proposals. In S-theory, even though one has multiple time-like coordinates, there is actually only one "evolution parameter" (i.e. time). In the first two of my published works, we described models that have Bars-Kounnas type supersymmetry algebra and defined in spacetimes with multiple time-like coordinates. We obtained ordinary superstring (IIA, IIB and heterotic) and superparticle actions from certain effective descriptions of the models. In the later works, we showed that the formalism is actually more powerful: In this formalism one has the freedom to choose the evolution parameter as any linear or non-linear function of time- or space-like

coordinates. The choice of the evolution parameter is done as follows: One begins in (d, 2) dimensional theory and turns the Sp(2, R) global symmetry of the phase space into a local symmetry of the theory. Sp(2, R) has three local transformation parameters including τreparametrizations. The choice of the evolution parameter is actually a gauge choice in this Sp(2, R) gauge theory. After various gauge choices one finds different physical systems that are "dual" to each other. These systems were found to have amazing variety: Massless and massive relativistic particle, Hydrogen atom, harmonic oscillator, particle in AdS spacetimes, spinning particles in various potentials, etc. We also showed that the theory defined in (d, 2) dimensions is covariant. Therefore all the mentioned systems above have SO(d, 2) conformal symmetry from the point of view of (d -1, 1) dimensional physics.

I am continuing to work in this exciting area of research. Recently we supersymmetrized this model and currently we are trying to find a formulation of the string theory in (d,2) dimensions. This theory could have far reaching consequences: It could help us to construct a covariant formulation of

M(atrix) theory, to get better understanding of AdS/CFT correspondence and the idea of holography.

I am also interested in the recently conjectured AdS/CFT correspondence. We constructed a vertex operator in WZW model on SL(2, R) manifold  $(AdS_3)$  and showed that it has the correct flat limit when one sends the level of the WZW model (or the radius of the  $AdS_3$ ) to infinity. This vertex operator can help us to better understand the relation between  $AdS_3$  and 2-dimensional CFT on the boundary of  $AdS_3$ . It can also simplify the calculation of the correlation functions. The paper is currently under preparation.

I find the unified theories in higher dimensions and the dualities between them very interesting and believe that they will help us to find non-perturbative answers to the questions we long have had in high energy physics.

For more information about Cemsinan Deliduman, please visit his web page at http://physics.usc.edu/~cdelidum/. To learn more about Professor Itzhak Bars' research activities, go to http://physics.usc.edu/Faculty/Bars/&

#### **CALTECH-USC THEORY SEMINARS**

Our High Energy Physics Group, consisting of Professors Itzhak Bars, Dennis Nemeschansky, Krzysztof Pilch, Hubert Saleur, and Nicholas Warner, began holding weekly joint seminars in the Fall of '98 that alternate between Caltech and USC. Lunch is followed by a talk and an informal discussion. Focus is on superstring theory and related topics. The highlight of the series has been a talk presented by Edward Witten of the Institute for Advanced Study at Princeton.

For information regarding dates, times, and speakers, please visit the Caltech-USC Theory Seminar web page at http://physics.usc.edu/HEP/Seminar/. For further information, please email Professor Krzysztof Pilch at pilch@usc.edu or call him at (213) 740-1145®

## UNDERGRADUATE RESEARCH AT THE AMERICAN ASSOCIATION OF PHYSICS TEACHERS 1998 WINTER MEETING

In January of '98, three of our B.S. Physics undergraduates, Doug Garrett, Kyler Keuhn, and Alex Small, had the opportunity to present talks to the American Association of Physics Teachers (AAPT) 1998 Winter Meeting in New Orleans, Louisiana.

Doug Garrett's talk, entitled "Magnetism of V, Mo, and Co Surface Impurities on Pb Measured by their Pair-Breaking Effect", outlined experiments where the tools of superconductivity were used to investigate the magnetic moments of impurity atoms and clusters on the surface of a very thin film of Pb. In this talk, he concluded that individual V atoms on the surface of Pb are magnetic while single Mo and single Co atoms are not. "However," Garrett goes on to explain, "we also found that clusters of Co are magnetic which one might expect given the Ferro-magnetic nature of bulk Co."

Kyler Keuhn presented the talk, "Multiple Wavelength Observations of the Sirius Binary Star System, with Applications for Research and Education", which was based on his research experiences from the previous summer at Los Alamos National Laboratory (LANL) where he had participated in their Research Experience for Undergraduates Program. This research focused on the ALEXIS (Array of Low-Energy X-Ray Imaging Sensors) satellite which is operated by LANL for the Department of Energy. He explains, "I worked with the satellite's scientific team, correlating their recent and archived data of the Sirius binary star system with other ground and space-based observations." In addition to his research, Keuhn also spoke of his educational experiences of his summer at LANL, such as peer learning and his work with LANL's Bradbury Science

Museum where he was responsible for updating the ALEXIS display.

Alex Small's presentation, entitled, "Computer Control of Reflection High-Energy Electron Diffraction Measurements", focused on work performed by Small under the supervision of USC Physics and Materials Science Professor, Anupam Madhukar, and USC Materials Science Professor, Ping Chen. Small elaborates, "I developed software to control RHEED experiments (Reflection High Energy Electron Diffraction), a technique that aims an electron beam at a surface and gathers information on the microscopic structure of the surface from the diffraction pattern of the electrons.

According to Small, "The USC contingent was clearly the best one [at the AAPT Conference]. Other schools sent larger contingents, but their talks were mostly about class projects whereas ours were from real research labs doing publishable research." Kyler Keuhn found the experience of presenting a conference talk to be "extremely valuable" for its practical aspects of learning how to present and explain research in a conference setting. Doug Garrett agrees, saying, "The actual act of delivering a presentation in front of an audience was, intellectually speaking, the most challenging and rewarding aspect of the experience. One must present in a concise and transparent way the main ideas and results of some very complicated experiments and theories. If this is properly done, then there will be many questions that will have to be answered in a diligent and clear manner. The reward is great when tasks such as these have been successfully completed."

For more information about the AAPT 1998 Winter Meeting, visit http://www.aapt.org/meetings/pasthighlights/98winhig.html®

#### CO-SALUTATORIAN,

CONTINUED FROM PAGE 1 cool to be only eighteen and already have a project flying in space."

Later, Alex joined Professor Anupam Madhukar's group as his interests began to tend toward condensed matter. With enthusiasm, he says, "Madhukar and Ping Chen are an amazing duo." Alex had the opportunity to present some of this work at the American Association of Physics Teachers (AAPT) conference in New Orleans in January of '98, and his name was included on one of the group's publications. He emphasizes, "I think being able to work in research labs from day one was one of the best things about the department."

In addition to his research relationships, Alex adds, "The other great thing in the department was interacting with Dr. Bickers." Professor Bickers became Alex's academic advisor when Professor Steve Trullinger left USC in the Spring of 1996. Alex says, "Dr. Bickers is a great teacher, on par with [Professor Jack] Feinberg. He advises the Society of Physics Students, which he helped me revive, and he is the person who first got me interested in UCSB where he was a post-doc."

Presently, Alex is attending the University of California, Santa Barbara where he is pursuing a Ph.D. in Physics. Working with the research group of Atac Imamoglu in Electrical Engineering, Alex's interests are centered on quantum computation. He explains, "We hope to implement simple quantum computations with quantum dots in a microcavity - a structure with only one accessible mode of the electromagnetic field." After graduate school, Alex Small would like to work for a few years in industry or government with an eventual return to academia &

## FACULTY NEWS: WELCOME, PROFESSOR STEPHAN HAAS

After a year long faculty search, the USC Department of Physics and Astronomy invited Stephan Haas to join our faculty as an Assistant Professor. With a strong research background and an invigorating enthusiasm for teaching, we are very pleased to welcome him to our department.

Born and educated primarily in Berlin in his youth, Professor Haas completed his Ph.D. in Physics at the National High Magnetic Fields Laboratory at Florida State University. Prior to his appointment at USC, he worked as a post-doc for the Swiss Federal Institute of Technology.

Professor Haas' research interests are focused in the area of theoretical and computational condensed matter physics, in particular the study of strongly correlated electrons, quantum magnetism, and the effect of impurities in these systems. Maintaining collaborative relationships with theory groups at the National High Magnetic Field Laboratory and the Swiss Federal Institute of Technology, where his work focused on phase diagrams and the dynamical spectra of microscopic models in the context of high-temperature superconductivity, such as the t-J, the Hubbard, and the Heisenberg model, Stephan Haas plans

to become an active member of our own condensed matter theory group, complementing the work of Professors Gene Bickers and Kazumi Maki.

In addition to working with our own distinguished faculty, Professor Haas is looking forward to supervising the research of our graduate and undergraduate students. He says, "I enjoy working with students, and I suspect that since these will be my first research collaborations as an adviser, it will be very intense."

Furthermore, Professor Haas loves to teach, saying, "I think teaching is somewhat of a gift or a miracle." In contrast to his European education where the chasm between student and teacher were great, Professor Haas believes that student-teacher involvement is the key to successful learning. He explains, "I think whatever gets students involved is great. That means also participating in teaching. The goal is to make them part of the lecture rather than having students sit by in passive participation. In principle, both sides should be learning during the lecture."

#### BICKERS, DÄPPEN, AND NEMESCHANSKY PROMOTED TO FULL PROFESSOR

Congratulations to professors Gene Bickers, Werner Däppen, and Dennis Nemeschansky on their recent promotion to Full Professor as of Fall '98. Each professor has contributed greatly to teaching and research in the department.

Gene Bickers came to USC as an assistant professor in 1988. During his tenure here, his research has been focused in the field of condensed matter theory with an emphasis on investigating the behavior of strongly interacting electrons in conducting solids. He says, "My group and I have worked on problems in high-temperature superconductivity and quantum magnetism using a combination of analytical and computational techniques." In addition to his extensive research, he also possesses a deep commitment to his teaching responsibilities. Professor Bickers has chaired the department Undergraduate Affairs Committee for the past several years and serves as a Fellow with USC's Center for Excellence in Teaching.

Starting as an associate professor, **Werner Däppen** began work here in 1991. Since that time, he has continued to study to learn more about the material properties of the hot dense gas of the solar interior by using the observations of solar oscillations. His study of residual unionized hydrogen inside the sun is important in, both, plasma physics and the astrophysically important determination of the abundance of elements in the sun, stars, and the universe. Presently on sabbatical in Aarhus for Fall '98 and Cambridge for

Spring '99, he is taking time to concentrate exclusively on his research. He says, "The direct contact with two leading groups in the field is a tremendous stimulation for new ideas, ready to be developed when I return to USC in Fall '99." With his usual dedication, Professor Däppen will continue advising his graduate students while he is away, and when he returns, he looks forward to continuing teaching Astronomy courses for General Education students and Astronomy majors.

Dennis Nemeschansky came to our department in 1986 after working as a post-doc at the Stanford Linear Accelerator Center. Upon his arrival, he continued his research in quantum field theory, string theory, and their application to the unification of forces. Recently his work has centered on strong-weak coupling duality in supersymmetric QCD as well as studying duality in string theory. In the past year, he has constructed several examples of string theories that are dual to each other. In addition to his High Energy Theory research, Professor Nemeschansky is an effective teacher who enjoys working with undergraduates and graduates alike.

Please visit the following web pages for more information about our three newly promoted professors: http://physics.usc.edu/Faculty/Bickers/, http://physics.usc.edu/Faculty/Dappen/, http://physics.usc.edu/Faculty/Nemeschansky/&>

#### PROFESSOR MELVIN DAYBELL RETIRES

Recently, Professor Melvin Daybell has begun a phased retirement, which will end in 1999, after 31 years of service in the USC Department of Physics and Astronomy. Until his retirement is official, he plans to fulfill his obligations to three NASA grants at the Space Sciences Center.

Born in May of 1935, Professor Daybell spent most of his formative years in California. Just before high school, his family moved to Santa Fe, New Mexico, where his father began supervising the construction of several laboratories at Los Alamos National Laboratory. After high school, he studied Physics at New Mexico State University. In 1956, following the receipt of an NSF Graduate Fellowship, he left New Mexico for Pasadena, California, to earn his Ph.D. in Physics at the California Institute of Technology.

Following his graduation from Caltech, he went back to NMSU in 1961 to work for Otto Theimer who was setting up a low temperature lab to investigate the temperature dependence of light scattering from impurity decorated dislocations in alkali halide crystals. About this same time, Professor Daybell spent two years at Los Alamos working in their low temperature group. At Los Alamos, he worked on the project to build the first dilution refrigerator which was used to discover many of the experimental properties of the newly predicted Kondo effect expected for localized magnetic moments in very dilute magnetic alloys such as iron impurities in copper.

In 1968, Professor Daybell began work in the USC Department of Physics and Astronomy, along with Professor Young B. Kim. Together, they built a highly successful low temperature group with a dilution refrigerator capable of reaching 30 millidegrees Kelvin on a regular basis. Continuing their work on diluted magnetic alloys over the years, Professors Daybell and Kim began to recruit faculty into the group that has evolved into the one we have today.

In 1992, Professor Daybell began working with the Space Sciences Center on the development of a novel spectrometer for the extreme ultraviolet region of the solar spectrum. Ultimately, he became one of two principal investigators for this project in which he has designed, built, and, repeatedly, flown the spectrometer on sounding rockets launched from New Mexico's White Sands Missile Range.

Over the span of his career here at USC, he has had the opportunity to work with outstanding former students, such as Ty Buxman, our present Director of Undergraduate Affairs; Michael Banks, the USC 1995 Valedictorian; and Alex Small, the USC 1998 Co-Salutatorian. Ty Buxman remembers, "Working with Professor Daybell was a great learning experience. He entrusts his students with a lot of responsibility and allows them to learn to work independently and confidently."

As a teacher, Professor Daybell was dearly loved by his students. His teaching experiences have allowed him the opportunity to work with, both, undergraduate and graduate students. Over the last ten years, he has, also, led the department in the development of the Senior Lab as a counterbalance to the mostly theoretical curriculum of our undergraduate program.

Professor Daybell and his wife, Dorothy, plan to spend their retirement in their newly purchased house near Shaver Lake, California. Professor Daybell plans to take this opportunity to pursue some long neglected hobbies, such as sailing, skiing, amateur radio (KM6M), model railroading, square dancing, and maybe even some new ideas for Senior Lab experiments.

For more information, please visit Professor Daybell's web page at http://physics.usc.edu/Faculty/Daybell/&>

## PROFESSOR WADDELL DIES AT AGE 75

It saddens us to acknowledge the death of nuclear and solid-state physics expert, Professor Charles Waddell, who died of cancer at the age of 75 on April 21, 1998, at his home in Torrance, California.

"Charlie was a kind and giving friend and will be missed by all who knew him," says retired USC Physics Professor, Robert Cole.

After serving in the U.S. Navy in World War II, Professor Waddell completed his B.A and Ph.D. at University of California, Berkeley. In 1958, he joined the USC Physics faculty leading an experimental program using USC's 30 MeV proton linear accelerator. He was appointed deputy chief investigator of the University's Nuclear Physics Laboratory in 1965. In 1970, USC's linear accelerator was phased out, yet Professor Waddell continued his research at UCLA and, later, with the 800 MeV linear accelerator at Los Alamos Scientific Laboratory.

From 1972 until his retirement, he spent his summers conducting materials science research at the U.S. Naval Research Laboratory in Washington, D.C. In 1990, he was awarded emeritus status.

Professor Waddell was also a committed teacher. Professor Cole elaborates by saying, "Charlie was an inspiring and dynamic lecturer and was loved by his students. His office was always open to everyone. When students came to him for help, he always had time for them." Charles Waddell is survived by his wife, Marjorie, four sons, two daughters, and nine grandchildren. Services were held on April 25, 1998&

### **ALUMNI NEWS**

Thank you to the following alumni for your show of support and interest. Your overwhelming response is encouraging and appreciated by the Faculty and Staff of the USC Department of Physics and Astronomy.

MR. HERBERT J. WINTROUB, B.A. PHYSICS '50, is, presently, a Distinguished Engineer and principal member of the technical staff for the Engineering and Technology Group at The Aerospace Corporation, after working in management for many years in the Electronics Research Laboratory. His current work is concerned with developing concepts for advanced space communication and data-relay systems and the supporting device and component technology. The emphasis is on systems in the upper microwave and millimeter-wave regions. Another professional/personal interest is developing closer relationships between the corporation and the academic community through arrangements such as the industrial affiliates. On a personal basis, he is interested in mentoring younger Members of the Technical Staff (MTS) and new graduates of our universities.

MR. DUANE OLINGER, B.S. PHYSICS '62, has retired after thirty years of applying Kepler mechanics in the aerospace industry. He lives in Norman, Oklahoma.

DR. ROGER A. LILLY, B.S. PHYSICS '61; M.A. PHYSICS '64, is, currently, the Chair of the Department of Physics at San Diego State University where he focuses his research in the general area of optical image processing. Please visit his web page at http://rohan.sdsu.edu/faculty/rlilly/ to find out more about his past and present work, as well as other interests.

MR. GORDON ELLISON, M.A. PHYSICS '66, is a self-employed consultant whose activities include thermal analysis and design of electronic components and systems,

software development in same field, the teaching of "Advanced Topics in Fluid Mechanics and Heat Transfer" as Adjunct Assistant Professor of Mechanical Engineering at Portland State University, and the offering of short courses in "Thermal Analysis of Electronic Components and Systems".

#### DR. CHIA CHEH (GEORGE) CHANG, M.A. PHYSICS '66; PH.D.

PHYSICS '68, is working in the research area of Experimental High Energy Nuclear Physics, and is, presently, involved in two major research projects. The first involves the study of quark effects in nuclei using the new high energy electron beam facility of the Thomas Jefferson Laboratory in Newport News, Virginia; and the second is a study of the solar neutrino problem with physicists from Taiwan and the People's Republic of China.

## DR. DAVID CRAIN, B.S. PHYSICS '68; M.S. MATERIALS SCIENCE '71; Ph.D. MATERIALS SCIENCE

'76, is, presently, the Director of Strategic Planning at Fluor Daniel in Irvine, California, and has been in the strategic planning field for 8 years, following more than 20 years as an engineer with the Department of Defense and the Southern California Gas Company. Crain writes, "After graduating in Physics in 1968, I took my Masters and Ph.D. in the Materials Science Department at USC (back then, it was called 'Applied Physics' so it seemed like a very natural progression). My professors in Physics most fondly remembered include: Drs. Judge, Wagner, Waddell, Cole, and Ogawa. All of us students were frightened at the thought of having to take theoretical physics from Dr. Nodvik . . . . "

## DR. CRAIG STEPHEN STERN, B.A. ASTRONOMY '69; PHARM.D. '76; M.B.A. BUSINESS

ADMINISTRATION '94. has worked as an independent consultant to multihospital corporations since 1986, and has expanded into Managed Care for the past twelve years through his Pharmacy Benefit and Strategic Planning and Implementation work with HMOs, physician groups, self-insured companies, and Taft-Hartley Trusts. In addition, he subcontracts as a specialist in Strategic Analysis, Planning and Implementation, and Benefit Consulting with companies such as KPMG Peat Marwick, William M. Mercer & Co., Alexander & Alexander (Aon) Consulting Group, etc. Furthermore, Stern is the author of over forty papers, multiple abstracts and poster sessions, and is a nationally known speaker in the areas of Clinical Therapeutics, Managed Care, and Strategic Analysis. He has been an Adjunct Assistant Clinical Professor of Pharmacy at USC for over six years, an Adjunct Professor of Business Policy and Strategy at Woodbury University, and a Professor in the Schools of Nursing and Business at the University of Phoenix.

#### Dr. Alan C. Nelson, B.A.

PHYSICS '72, is the founder, CEO, and President of NeoPath, Inc. After studying at USC, he received his Ph.D. in Biophysics in 1980 from the University of California, Berkeley. His career includes joint professorships at MIT and Harvard where he directed the Radiological Sciences Program. He was, also, the founding director of the University of Washington's Center for Imaging Systems Optimization and the Medical Imaging Graduate Program. Nelson holds a number of industry patents and has authored numerous

publications in the field of medical imaging technology.

## DR. FRANK S. FELBER, M.A. PHYSICS '73; PH.D. PHYSICS '75, is

developing a hand-held ultrasound detector which finds non-metallic and metallic weapons concealed under clothing at a distance for the National Institute of Justice. Recently, his team published the first remote ultrasound images of concealed weapons. Furthermore, Felber is developing a "smart air bag" sensor system for the Department of Transportation.

### DR. TERRENCE S. LOMHEIM, M.A. PHYSICS '76; PH.D. PHYSICS '78,

has worked for The Aerospace Corporation in El Segundo, California, for the past 20 years. In the past, he has held technical staff and management positions, and, currently, holds the title of Distinguished Engineer in the Sensor Systems Subdivision. His research involves the detailed experimental evaluation of the electro-optical properties, imaging performance, and radiation effects sensitivities of visible and infrared scanning, and staring sensors for a variety of Air Force space system programs. He is, presently, working on the development of modeling tools and simulations used to assess the performance of point-source detection, broadband, multispectral, and hyperspectral image sensors in the visible through longwave spectral regions. In addition to his work at The Aerospace Corporation, Lomheim has been a part-time instructor in the Physics Department at California State University, Dominguez Hills, since 1981, and teaches short professional courses several times a year for UCLA Extension, UCSB Extension, and at various International Society for Optical Engineering (SPIE) Symposia throughout the U.S. Lomheim has, also, authored and co-authored twenty-seven publications in the areas of applied optics, focal plane technology, chargecoupled devices, and electro-optical system performance.

### Dr. Shamasundar N. Dixit, M.A. Physics '75; Ph.D. Physics

'79, is, presently, at Lawrence Livermore National Laboratory working as a group leader for diffractive optics. He is responsible for the design and fabrication of large aperture diffractive optics for high power laser fusion applications. He writes, "We fabricate random phase plates, diffraction gratings, and Fresnel lenses at approximately 1 meter size for use in pulse compression, spatial beam smoothing, laser beam shaping, and space applications. In spite of their large size, the optics have feature sizes in the micrometer range; so our diffractive optics can be termed 'meter size, yet micron precise.""

#### DR. DAVID M. TRALLI, B.S.

PHYSICS '81, went on to receive a Ph.D. in Geophysics from University of California, Berkeley in 1986, and an MBA in Technology Marketing from the Claremont Graduate School in 1994. Presently, he is the Manager of JPL's **Targeted Commercialization Office** which he designed and formed in 1996 to develop new business for JPL by working with the commercial sector to target the needs of emerging markets. Collaborative technology development and applications research proposals have resulted in over \$3 million in funding. Additionally, Tralli's office supports the technology commercialization requirements of multi-million dollar space exploration missions at JPL. Current market interests include property insurance risk securitization, carbon offsets trading, modern agriculture, and collaborative environments. Technologies and applications under development include synthetic aperture radar, imaging spectroscopy, and information systems. Tralli has been with JPL for 12 years, and has fifteen peer-reviewed publications in the areas of seismology and Global Positioning System technology for land and atmospheric studies, and is, also, a consultant under

the National Science Foundation on innovative technologies for multihazard loss estimation. He lives in Arcadia with his wife and son.

#### Dr. Shin-Tson Wu, Ph.D.

PHYSICS '81, is working to develop new liquid crystal materials and devices for direct-view and projection displays and for laser beam steering. Wu writes, "In the display area, active matrix addressed liquid crystal display has become the dominant technology for notebook computers and is penetrating to the desktops. Recently, a liquid crystal based optical phase array has been demonstrated successfully to steer a high power laser beam for laser communication."

#### MR. VANCE BRESHEARS, JR., B.S.

PHYSICS'83, has recently published a technical paper, entitled "Design Approach for Multi-Channel Sound Reinforcement Systems", at the Audio Engineering Society Convention held this past Fall '98 in San Francisco. In his paper, he summarizes the use of PC based digital signal processing platforms in an innovative design technique for multi-channel sound reinforcement in large gathering and entertainment venues. Breshears, the President and Principal Consultant with Sound Technology Consultants in Alpine, California, has been involved in acoustics and sound system design for themed entertainment venues and sports facilities, as well as auditoriums and worship spaces with projects across the U.S. and overseas. Recent clients include Walt Disney Imagineering and Sea World. Other work includes product development and research for several pro-audio equipment manufacturers and 3-dimensional computer room modeling training for acoustics and sound systems designers.

#### DR. DAVID SUMIDA, M.A. PHYSICS '79; PH.D. PHYSICS '84,

researches diode-pumped solid-state lasers, specifically diode-pumped

#### PHYSICS & ASTRONOMY

Yb:YAG, for HRL Laboratories and

spent six months in 1993 at the MIT Lincoln Lab in Lexington, Massachusetts, as a visiting scientist in a cooperative research agreement with MIT/LL to transfer Yb:YAG laser technology to Hughes. He writes, "We, currently, hold the world record in output power at 1 kW of average power from a tiny 3-mm diameter rod with an optical-optical efficiency of 25%. This laser medium is ideally suited for high average power applications (both, high repetition rate and, also, cw) and has active sponsorship for, both, military and industrial applications. We have been fortunate to receive a number of awards because of this work." Sumida, himself, has been awarded for this work. His invited paper was awarded the 1997 Best Paper Award at the IRIS Specialty Group on Active Systems Conference, and he and his colleagues received the Outstanding Paper Award from HRL Laboratories for their 1997 journal article published in the IEEE Journal of Selected Topics in Quantum Electronics. Furthermore, he is a member of the Optical Society of America and the American Scientific Affiliation. In addition to his research activities, Sumida still finds time to be a "soccer dad" who plays a couple times a week on his lunch break, helps to coach his daughter's and older son's AYSO soccer teams, and became an official referee, as well.

## DR. ULF ISRAELSSON, M.A. PHYSICS '81; PH.D. PHYSICS '85,

is, presently, the Discipline Science Lead for NASA's Microgravity
Fundamental Physics at the Jet
Propulsion Laboratory. Funding
research in low temperature and
condensed matter physics, laser cooling
and atomic physics, and gravitational
physics at various institutions across the
U.S., Israelsson's discipline, currently,
has 54 investigators, eight of which
have been selected as potential flight
candidates in the future. This program
has flown two experiments on the Space
Shuttle, and future experiments will be

flown as part of the International Space Station. His current research interests involve studies of the lambda transition under the influence of a heat current.

#### DR. MARK W. SINCELL, B.S.

PHYSICS '86, went on to receive an M.S. ('88) and Ph.D. ('93) in Physics from Johns Hopkins University with a specialization in computational astrophysics after graduating from USC. Following two postdocs with the University of Illinois at Champaign-Urbana and the Observatoire de Paris, Sincell decided to leave research and become a full-time science writer. At present, he is living and writing in Tucson, Arizona.

### DR. STEPHEN DUCHARME, M.A. PHYSICS '82; PH.D. PHYSICS '86.

an Associate Professor for the Department of Physics and Astronomy at the University of Nebraska at Lincoln, is, currently, working in experimental physics with projects which include the development of photorefractive polymers, the study of ultrathin ferroelectric polymers, and ellipsometry. In addition to the usual physics courses, Ducharme teaches a custom laboratory course on "The Physics of Lasers and Modern Optics" for advanced science and engineering students and "enjoys manipulating photons in public and private." Additional information may be found on his web page at http://www.unl.edu/ physics/directory/ducharme/ducharme.html.

DR. LINN D. VAN WOERKOM, B.S. PHYSICS '82; M.A. PHYSICS '83; PH.D. PHYSICS '87, received tenure at Ohio State University in the Fall of '98 and is, now, an Associate Professor of Physics.

DR. XIAO-WU (CHARLES) QIAN, PH.D. PHYSICS '88, joined the Department of Chemistry at Canada's University of Victoria as an Assistant Professor in 1992. In 1997, he was promoted to Associate Professor and is,

currently, on sabbatical in order to work in the Joint Institute for Laboratory Astrophysics at the University of Colorado, Boulder. His research interests are laser spectroscopy and reaction dynamics of molecules. Qian has an eleven year old daughter, Linda, and a four year old son, James. His wife works in the software industry.

#### MR. RON CARTER, M.S. PHYSICS

'89, is, currently, employed at Northrop Grumman in the Low Observables (LO) Research and Development Organization where he is involved in working to develop an imaging reflectometer, portable maintenance aid, and 3-D graphics visualization.

Dr. Jien-ping (J.P.) Jiang, Ph.D. PHYSICS '90, joined a start-up company in July 1997, named Quality Electro-optical Devices, LLC (QED). Specializing in low power diodepumped solid state (Nd:YVO4) lasers frequency doubled to green (532nm), Jiang's responsibility is to design new types of lasers, such as solid state lasers and external cavity stabilized diode lasers, developing a compact Raman spectrometer for medical and industrial applications. Furthermore, he is using, in collaboration with University Medical Center at the University of Arizona, functional MRI (Magnetic Resonance Imaging) to the study neural activities of patients undergoing acupuncture treatment.

## DR. PETER SAUNDRY, M.A. PHYSICS '90; Ph.D. PHYSICS '91, is

the Executive Director of a nonprofit environmental science organization called the Committee for the National Institute for the Environment. Rather than working on research, his work is, primarily, in the policy and information arena. To learn more about his current activities, please visit http://www.cnie.org. Saundry is married and lives in Germantown, Maryland, with his wife, Claire, and a two-year old son, Andrew.

#### University of Southern California

#### DR. KATRI HUITU, PH.D.

PHYSICS '92, is working on supersymmetric and extended gauge models of particle physics and is a particle theory and cosmology group leader in the Helsinki Institute of Physics, as well as a member of the Institute Board. Huitu writes, "On the personal side, my two and a half year old son is the apple of my eye."

#### Dr. Qiang Luo, Ph.D. Physics

'93, is teaching a one year course at Peking University in physics to sophomore psychology students covering mechanics, thermal physics, electricity and magnetism, optics, and modern physics. He is working with Professor Gao, Z.X. to investigate vortex dynamics in type-II superconductors and uses magnetooptic imaging techniques to observe flux motion in high temperature superconductors. Luo writes, "Currently, there is renewed interest in Bose-Einstein condensation (BEC) after the direct experimental observation of BEC for trapped atoms in 1995. BEC is relevant to high temperature superconductors, too. Most likely, high temperature superconductors lie in the crossover regime between weakcoupling BCS theory where Cooper pairs form below the superconducting transition temperature, and BEC of preexist bosons. Professor Han, R.S. and I are working on theoretical issues in this area."

#### DR. RUDO GRIMM, M.S. PHYSICS

**'94**, received his Ph.D. in Physics from the Max-Planck-Institut fur Biochemie in Germany in 1997. While there, his research focused on three-dimensional (tomographic) electron microscopy of whole bacterial cells. In December 1997, Grimm took a position as a business consultant with the Boston Consulting Group in Germany. He and his wife live in Munich.

DR. SHANG SONG, PH.D. PHYSICS '94, has worked for Chase

Manhattan Bank in Princeton, New Jersey in risk management advisory and Canadian Imperial Bank of Commerce in New York City in risk management education since her graduation from USC. She is, now, the Executive Director for Financial Products-Asia, Canadian Imperial Bank of Commerce. Song lives in Hong Kong and markets derivative financial products to banks and corporations in Mainland China.

#### DR. FEI YE, M.S. COMPUTER ENGINEERING '93; PH.D. PHYSICS

'95, is, presently, working with a design team on the next generation UltraSparc III processor which, he writes, "will beat Intel's Merced." Ye is in charge of the Memory Management Unit (MMU) design.

#### MR. MICHAEL BANKS, B.S. PHYSICS '95; B.A. EAST ASIAN LANGUAGES & CULTURES '95, is

happy to announce the birth of his first child, Katerina Sue Banks ("Katie"), who arrived on September 2, 1998. Banks writes, "She is happy and healthy, and even has her own website: http://www.pas.rochester.edu/~mbanks/katie/."

## MS. AMY (PANTIPA) BOONSIRISETH, B.S. ASTRONOMY '95; B.A. MATHEMATICS '95, is

working on her Ph.D thesis at UCLA's Department of Atmospheric Sciences. After finishing her Master's Degree in 1997, she has begun studying the Earth's inner magnetospheric response to geomagnetic storms. Her research includes creating a better convective electric field for the near-earth region and looking at oxygen (O+) injection and removal processes for the ring current during a geomagnetic storm. Boonsiriseth plans to graduate with her Ph.D. degree in 2000.

Ms. AMY C. FREDERICKS, B.S. ASTRONOMY '96, is in her third year of graduate school at the University of Maryland at College Park, where she is,

currently, researching lithium abundances in 2.4 Gyr open cluster IC 4651.

## DR. TETSU TAKEKOSHI, M.A. PHYSICS '94; PH.D. PHYSICS '97,

an NRC postdoc at the U.S. Air Force Academy, is working on extending atom cooling and trapping techniques to molecules.

### Dr. Gokhan Esirgen, M.A. Physics '95; Ph.D. Physics '97.

has begun doing postdoctoral research at the Center for Simulational Physics at the University of Georgia with Professor Bernd Schuttler. Presently, he is working on strongly correlated electron systems and particularly high temperature superconductors and has just finished a research project on long-range Coulomb interactions in collaboration with our own Professor Gene Bickers.

## MS. RACHEL MASTRAPA, B.S. ASTRONOMY '97; B.S.

#### GEOLOGICAL SCIENCES '97, is

beginning her second year in the University of Arizona Ph.D. program in Planetary Sciences. Her research interests include Kuiper Belt Objects and organics in outer solar system bodies, and she is actively studying the processes leading to isotopic fractionation in ices.

#### MR. ALEX SMALL, B.S. PHYSICS

'98, is attending graduate school at University of California, Santa Barbara where he is working toward a Ph.D. in Condensed Matter Physics under the direction of his principal advisor, Atac Imamoglu, from the Electrical and Computer Engineering Department. Small's research focuses on quantum dots in microcavities with the hopes of realizing a practical quantum computation scheme ⋄

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**EDITOR: DANIELLE SWEARENGIN** 

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