



# University of Alaska Fairbanks Physics Department

Volume 1, Fall 2004

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## Letter from the Department Chair

One year ago a fundraising effort was instituted to create within our department an endowed scholarship that could recognize the academic excellence of undergraduate students majoring in physics and could provide an incentive for High School students interested in physics. This effort was driven in part by then Chancellor Lind's offer to match fundraising activities that reached specific levels. I am delighted to report that we exceeded our goal of \$5,000 and that it and the matching \$5,000 now form the founding principle of an endowed Physics Scholarship Fund. More on this later in this newsletter.



In that initial solicitation, I promised that I would report yearly on activities of the scholarship fund, introduce you to our faculty and programs, and tell you how we are contributing to education at UAF. I am not being too ambitious in this first attempt, but will strive to build on this effort year by year.

It has not been easy to decide when in the year is optimum for writing such a newsletter, for the beginning of each academic year is filled with all the necessities for new classroom activities and the annual faculty drudgery of preparing individual Annual Activities Reports for the administration. However, once that is done, the past year's activities are or should be clear in each mind, so I have elected to do this in early October of the fall semester. However, this year seven of our faculty are up for some kind of higher-level review, such as four-year comprehensive pre-tenure review (2), promotion application (1), and post-tenure four-year review (4), so another month's delay has been inserted so the unfortunate seven could complete their review packages and the tenured faculty prepare peer reviews before sending them on to the college dean. Never let it be said that UAF faculty members are not reviewed for performance at all levels of our careers.

In my mind, the single most important faculty-wide activity of the 2003-2004 academic year was the beginning of a comprehensive review of our entire undergraduate degree program for majors in physics. The idea arose from a one-day retreat in May 2003 as we recognized the increasing difficulty in providing an adequately broad curriculum while retaining a base of necessary classical and modern physics fundamentals, all in a four-year program. This task has increasingly occupied faculty time as ideas and options are explored. We are not quite finished, but much to our collective surprise the outline of a viable option is coming into view and final decisions will be made in the 2004-2005 academic year. Following this we have our sights set on a similar review for our graduate programs.

As this newsletter is being written we, as a department and a faculty, are also beginning to prepare for the five-year review of all our academic programs. Our submission is due in December, with the review and delivery to the Provost by April 15, 2005. Yet another review.

## Highlights of the 2003-2004 Fundraising Effort

Through generous donations from 25 founding contributors, our initial effort yielded \$5575 and we were successful in creating the endowed fund with an initial principal in excess of \$10,000 plus a little extra in the cash account. The endowed fund will now create a return on the principal for use in meeting our scholarship objectives. I have appointed a Physics Scholarship Committee (comprising Assoc. Prof. David Newman, Assist. Prof. Renate Wackerbauer, and myself) that will draft a statement of eligibility for applications by students, a method for selection of awardees, and the plan for sustained yearly awards at a level to be determined by the size of the yearly earnings from the endowed funds. Final decisions will be based upon faculty approval.

## Founding Contributors to the UAF Physics Scholarship Fund

From every new endeavor there are those who first recognize the potential and are the first to volunteer and contribute. I wish here to give special recognition to those who have joined with us in this effort to create something new and forward looking for the Physics Department, something that will live on after us, and will contribute to the future of UAF, this our college, and this our department. I am personally indebted to all of you for your support.

Syun Akasofu, Fairbanks AK  
Warren Akers, Eugen AR  
Anonymous  
Robert Benson, Silver Spring MD  
Susan Broadston, Santa Cruz CA  
John and Anthea Craven, Fairbanks AK  
William Dambeck, New Creek WV  
John Dawson, Bala Cynwyd PA  
Barbara Day and Jim Dixon, Fairbanks AK  
Neil Davis, Fairbanks AK  
Will Harrison, Fairbanks, AK  
John Hughes, Fairbanks, AK  
Nettie LaBelle-Hamer, Fairbanks AK  
Harold Leinbach, Boulder CO  
Yu Lin, Auburn AL  
Craig Lingle, Fairbanks, AK  
David Newman, Fairbanks, AK  
Paul Perreault, Boulder CO  
Gerald Romick, Eugene OR

Lee Snyder, Orrington ME  
Roger Smith, Fairbanks, AK  
Guy Urban, Anchorage AK  
Renate Wackerbauer, Fairbanks, AK  
John Williams, Iowa City IA  
Stephen and Veronica Young, Rancho Palos Verdes CA

Please let me know if you had intended your gift to also be in your spouse's name.

## Introduction to the Faculty

The department currently comprises a faculty of 14 tenured or tenure-track members that includes one open position for which a search committee is now screening applicants. The full-time-equivalent (FTE) faculty number is 7.25. Two of our many emeritus faculty members remain active in department activities. It is a diverse faculty, with many holding joint appointments in the Geophysical Institute (GI). Currently, four are full time in the department, three hold half-time appointments in the department, and seven (including the open position) are quarter time. In addition, we are currently seeking a new half-time position in space physics through a funding proposal to the National Science Foundation, with the other half in the GI, and we are outlining the objectives for a quarter-time position in computational physics that would be joint with the Arctic Regional Supercomputer Center (ARSC). The objective is 8 FTE faculty (which does not count the emeritus faculty).

In this first newsletter, we present a very brief snapshot of the faculty with areas of research interest and academic courses taught in the last academic year. I have imposed on them further by asking for volunteer comments on exciting research activities in the year. My hope is that I can expand on this each year. Meanwhile, the alternate path is via our departmental website at [www.uaf.edu/physics](http://www.uaf.edu/physics), for which many faculty members have taken the time to be more expansive as to their efforts and interests.

## The Teaching Faculty

**Scott Bailey** (Univ of Colorado) Assistant Professor of Physics. Aeronomy and solar terrestrial physics. Last taught undergraduate College Physics.

**Ataur Chowdhury** (Clark Univ, Massachusetts) Associate Professor of Physics. Condensed matter physics, nanotechnology. Last taught undergraduate Advanced Laboratory, Introduction to Thermodynamics and Statistical Physics, and Introduction Solid State Physics.

**John Craven** (Univ of Iowa) Chair and Professor of Physics. Thermospheric composition, magnetospheric and auroral physics, rocket and spacecraft instrumentation. Last taught graduate Space Physics and undergraduate University Physics.

**David Newman** (Univ of Wisconsin) Associate Professor of Physics. Complex systems, turbulence, nonlinear dynamics, fusion plasma physics. Last taught graduate Geophysical Fluid Dynamics and undergraduate Energy and Society and College Physics.

**Hans Nielsen** (Royal Technical Univ of Denmark) Professor of Geophysics. Rocket investigation, high-speed imaging of the aurora. Last taught undergraduate Introduction to Astronomy.

**John Olson** (Univ of California Los Angeles) Professor of Physics. Plasma-wave propagation, atmospheric infrasound, digital signal processing, magnetospheric physics. Last taught graduate Time Series Analysis and undergraduate Elementary Modern Physics.

**Antonius Otto** (Ruhr-Universitaet Bochum) Professor of Physics. Space plasma theory and simulations. Last taught graduate Introduction to Plasma Physics.

**Channon Price** (Univ of California Santa Barbara) Associate Professor of Physics. Astrophysics, space plasma physics, nonlinear dynamics. Last taught graduate Classical Mechanics and Statistical Mechanics, and undergraduate Electricity and Magnetism.

**Davis Sentman** (Univ of Iowa) Professor of Physics. Space plasma physics, artificial heating of the ionosphere, atmospheric electricity. Last taught University Physics.

**Martin Truffer** (Univ of Alaska Fairbanks) Assistant Professor of Physics. Glacier dynamics, application of geophysical and borehole techniques to glaciology and numerical modeling of ice flow. Last taught Introduction to Physical Science.

**Renate Wackerbauer** (Max-Planck Institute for Extraterrestrial Physics) Assistant Professor of Physics. Complex systems, nonlinear dynamics and chaos, modeling of biological systems. Last taught Modern Physics and Mechanics.

**Brenton Watkins** (Univ of Alaska Fairbanks) Professor of Physics. Radar studies of the atmosphere and ionosphere. Last taught graduate Aeronomy.

### New Faculty

**Heinz Wiechen** (Ruhr-Universitaet Bochum) Assoc. Professor of Physics. Space plasma theory and simulation, dusty plasmas, astrophysics. Heinz joined us in January 2004, as the newest member of the faculty and immediately began teaching Magnetospheric Physics.

### Faculty in Transition

**Mark Conde** (Univ of Tasmania) Assistant Professor of Space Physics. Auroral processes, thermospheric winds, and space weather. Mark and his young family returned to the Southern Hemisphere in the summer of 2004, where he is now on the faculty at La Trobe University. He had just completed an exciting upgrade to our course in Optics for physics majors.

### Emeritus Faculty still drawn to the classroom

**Charles Deehr** (Univ of Alaska Fairbanks) Professor Emeritus of Physics. Spectrophotometric studies of atmospheric emissions. Teaches Auroral Physics in the odd-year spring semesters.

**John Morack** (Oregon State Univ) Professor Emeritus of Physics. Subsea permafrost, ice physics, distance education. Teaches an introductory physics course by distant delivery each spring, with a one-week residency at UAF at the end of the course to do all the lab experiments.

### Faculty now doing other things at UAF

Syun-Ichi Akasofu, Director, International Arctic Research Center  
Roger Smith, Director, Geophysics Institute, UAF

### Former Faculty

Albert Belon, Ester, AK  
Alfred Bork  
Neal Brown, Director, UAF Space Grant  
Neil Davis (emeritus), Fairbanks AK  
Vladimir Degen

Thomas Hallinan (emeritus), research at the GI  
 William Harrison (emeritus), research at the GI  
 Joseph Kan (emeritus), research at the GI  
 Lou-Chuang Lee, Dean of Science, Chung Li University, Taiwan  
 John Murry  
 Takeshi Ohtake  
 R. Parthasarathy  
 George Reed, Aeronomy Laboratory, NOAA, Boulder, CO  
 Manfred Rees (emeritus), Univ of Southampton, England  
 Juan Roederer (emeritus), active at the GI and around the world  
 Gerry Romick, Eugene, OR  
 Glenn Shaw (emeritus), research at the GI  
 Roger Sheridan  
 Knut Stamnes (emeritus), Stephens Institute of Technology, Hoboken, NJ  
 Abas Sivjee, Embry-Riddle Aeronautical University, FL  
 Daniel Swift (emeritus), research at the GI  
 Gerd Wendler (emeritus), research at the GI  
 Charles Wilson (emeritus), research at the GI

We would appreciate knowing of omissions and factual errors.

## Faculty News

**Martin Truffer ([truffer@gi.alaska.edu](mailto:truffer@gi.alaska.edu))**. I joined an Australian expedition to the sub-Antarctic Heard Island, which is a tiny (~40 km), ice-covered volcanic island in the middle of the Southern Indian Ocean. We had established a benchmark glacier in 2000, and re-measured its ice volume. Average thinning rate was about 3 meters per year (that's a lot). There are very few measurements of change in that area of the world, because it is almost exclusively ocean (and very stormy ocean at that...).



In August Martin Luethi and I measured the thickness of ice in the caldera of Mt. Wrangell (greater than about 900 m) with seismic techniques. This has been tried many times; we were the first to be successful. This is relevant for modeling ice flow in the caldera, which in turn is relevant for ice core research. We are working with a Japanese group, who extracted a ~200 m core last spring.

There is much ongoing field work in SE Alaska, including Mendenhall and Taku Glaciers near Juneau, and Hubbard Glacier near Yakutat. Hubbard and Taku Glaciers are both advancing (which is interesting because the vast majority of glaciers (like Mendenhall) do not). We are particularly interested in water-ice interaction.

**John Olson ([jvo@gi.alaska.edu](mailto:jvo@gi.alaska.edu))**. At the moment I am focused on the detection of acoustic waves at infrasonic frequencies. Most notable was the detection of acoustic waves radiated by the Alaska range during the Denali earthquake. This work has been published in the Geophysical Research Letters. I also developed a series of algorithms to identify and differentiate between the acoustical near-field and far-field acoustical signals, and developed several novel algorithms to identify the source locations of near-field sources, one of which is to be patented by UAF. I have continued work on the propagation of acoustic waves in the atmosphere in order to further the analysis of signals received from the shuttle disaster, and discovered a new infrasound signal that appears to be associated with pulsating aurorae. Lastly, I have been invited to write an article for a book on acoustic signal processing to be published by Springer Verlag. Meanwhile, a hobby of lens making has lead to the development of a display describing the process of making a telescope mirror. As a result six physics majors are joining me this year in making their own mirrors under my direction.



**Hans Nielsen ([hnielsen@gi.alaska.edu](mailto:hnielsen@gi.alaska.edu))**. The most exciting research activity of the year was obtaining millisecond spectra from sprites, the high altitude discharges from cloud tops to the E-region of the ionosphere. This was done in observations with the GI's (1963) TV spectrograph combined with my 1000 frame-per-second imager built for a DoD rocket program in 1999. The quality of the spectra are far better than anything available so far. I have a new graduate student working on this.



**Renate Wackerbauer**  
([ffraw1@uaf.edu](mailto:ffraw1@uaf.edu)).

Our research group in nonlinear dynamics focuses on the understanding of spatially and temporally varying complex systems at the interface of physics (nonlinear dynamics) and biology by using computational models and mathematical analyses. Two graduate students and one undergraduate student have been involved in these projects.



One graduate student is developing a computational model that describes the interaction of biological (circadian) clocks as it is reflected in the activity patterns of mice in food and light restriction experiments (data from Dr. Abel Bult-Ito, UAF Institute for Arctic Biology). An improved understanding of the timing system in a living being (chronobiology) has long-term consequences for medication efficacies (chronopharmacology) and the treatment of seasonal disorder.

We also focus on the understanding of a sudden collapse of spatiotemporal complexity, recently published in *Physical Review Letters*. In certain physical, chemical, biological, ecological dynamical systems spatially and temporally irregular behavior (like irregular chemical concentrations in surface reactions or irregular species distribution in ecological systems) can suddenly collapse to a very regular state or pattern. This collapse is a striking phenomenon, since it is a system-intrinsic process, so it happens without any perturbation from outside. Relevance of this phenomenon for species extinction in ecology will be explored in computational models.

## Introduction to our Staff

Our department is truly blessed with a fine staff of three, without whom we in the faculty would soon find ourselves mired in a muddle of our own making, unable to find forms (for students' needs), fit (where are we suppose to be for this meeting and why?), or function (just how does this experiment work?). Outside the lecture, these are the leaders who aid and assist students on a daily basis, semester after semester, and can be as memorable as the lecturer. Through the decades, we have been proud of our staff

and their contributions, and always look forward to the occasional return of a staff alum for a visit.

Today, we are guided by our administrative assistant (and PPA, or personnel payroll assistant), Mary Parsons, who in her spare time is working towards her degree in economics. In her charge are all fiscal issues (so I know when I have overspent the budget) and the care of the all undergraduates and graduates signed up for academic course with PHYS XXX as the course name/number.

The graduate students have yet another source of correct information in the person of Barbara Day, our administrative secretary. Barbara is in charge of the Graduate Program Office (located within the GI), which means that she is the interface between the Graduate School, the department, and all potential and actual graduate students from the first time they express an interest in joining our programs through graduation. In between there is the paperwork, scheduling of students' annual reviews, preparations for comprehensive exams, thesis and dissertation defenses, outcomes assessment forms, and everyone's favorite, the exit questionnaire/interview.

Certainly not least is the man who, on a daily basis, saves faculty members from the perils of the teaching laboratory. Mr. Robert Parsons is responsible for all lower-division teaching labs and guides the first-year graduate students through their required teaching assistant appointments. This begins weeks before the first class in the fall and is not over in the spring until the last lab grade is computed and the lab equipment repaired and made ready for the next fall. In addition, Robert is the instructor of record for the Honors Lab for students in the UAF Honors Program and for physics majors. We have been, are, and will forever, be in their debt.

## Staff News

Barbara Day followed her husband to Fairbanks in October 2001. She says: "I consider Alaska an adventure and an experience. I always wanted to know if I could survive in really cold weather, having coming from Virginia and Florida, and now heading into the fourth winter I know I can. In four years here I have had the privilege of seeing Denali, walking on a glacier, experiencing the 2002 earthquake and the 2004 fire season, and visiting the state."

**Scholarship Objectives for 2004-2005**

We begin now the 2004-2005 fund raising effort to increase the value of the endowed fund's principal to a level such that yearly awards of value can be sustained. I invite you, as a friend, alumnus, emeritus or active member faculty member, or our staff, to join the founding contributors by making a 2004-2005 donation to the Physics Scholarship

Fund. As always, while our efforts are focused on the scholarship fund, contributions for other needs will be gratefully accepted.

Additionally we are always available via the web for more information or to answer any questions. We will also enjoy hearing from you via email at [physics@uaf.edu](mailto:physics@uaf.edu), telephone (907-474-7339), or fax (907-474-6130).



University of Alaska Foundation  
ACH Debit Authorization Form

UAF Physics Scholarship Fund

I authorize the University of Alaska Foundation to deduct from my bank account a gift of \$\_\_\_\_\_ per month (\$25 minimum) on the (check one) \_\_\_1<sup>st</sup> or \_\_\_15<sup>th</sup> of each month for a total gift of \$\_\_\_\_\_ (optional). I have enclosed a voided check that contains my bank information.

Name\_\_\_\_\_

Address\_\_\_\_\_

City, State, Zip\_\_\_\_\_

**\*\*IMPORTANT** \_\_\_\_\_  
Signature Date

Please note that there could be a delay of up to one full month before the first transaction is processed due to pre-notification requirements to your bank.

**Please complete and mail with a voided check to:** UAF Development Office  
PO Box 757530  
Fairbanks, AK 99775

**From the UAF Physics Faculty, thanks for your support.**



# Contribution Form

The UAF Physics Scholarship Fund recognizes excellence in academic achievement for UAF students majoring in physics. Special awards may also be offered to winners of the Alaska State High School Science Symposium. Contributions for other needs are gratefully appreciated.



UAF Physics Scholarship Fund, College of Natural Science and Mathematics

My gift is for \$ \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

City, State \_\_\_\_\_

Phone \_\_\_\_\_ Email \_\_\_\_\_

Joint recognition for this gift should include \_\_\_\_\_ (name)

Pay by Check: \_\_\_\_\_ Check attached (payable to the UAF Physics Scholarship Fund)

By Credit Card: \_\_\_\_\_ Please charge my credit card \_\_\_\_\_ VISA \_\_\_\_\_ MasterCard

Card # \_\_\_\_\_ Expiration date \_\_\_\_\_

Signature \_\_\_\_\_ Name as it appears on the card \_\_\_\_\_

In Installments: \_\_\_\_\_ I pledge \$ \_\_\_\_\_ to be paid in \_\_\_\_\_ installments beginning \_\_\_\_\_

\_\_\_\_\_

please remind me

Electronic Funds Transfer: \_\_\_\_\_ (See the previous page: no more check writing or credit card issues)

Payroll deduction: \_\_\_\_\_ If you are UAF staff or faculty member you can fill out and attach a payroll deduction authorization form (at "Other Employee Selected Donations") available at <http://www.alaska.edu/giving/staffcontribution.pdf>

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OR give online at [www.uaf.edu/giving](http://www.uaf.edu/giving)