GUSTAVUS
GUSTAVUS ADOLPHUS COLLEGE

PHYSICS DEPARTMENT NEWSLETTER

SEPTEMBER 2006 ON-CAMPUS EDITION

Dr. Paul Saulnier Wins the Carlson Award

At Gustavus' 144th annual Commencement exercises held on May 28, the Edgar M. Carlson Award for Distinguished Teaching was awarded to physics professor **Paul Saulnier**. The Edgar M. Carlson Award was established in 1971 by the Gustavus Board of Trustees to honor former president Edgar Carlson for his years of distinguished leadership and in recognition of his commitment to academic excellence. Each year at commencement, a member of the Gustavus faculty is selected by a committee of faculty, administrators, and students for exceptional skill and effectiveness as an instructor.

PAUL SAULNIER

This year's award was presented by the 2005 award recipient, Professor Robert Gardner of the Department of Theatre and Dance. Here is the award citation:

'Choosing the Carlson winner is a difficult task, because there are many worthy teachers at Gustavus. However, there is no doubt that this year's winner is a deserving one, regarded as exceptionally skilled and exceptionally effective by students and colleagues alike. Here are some comments from students:

"A wonderful teacher."

"An excellent teacher."

"The most competent and creative teacher I have had so far at Gustavus."

"The best teacher I ever had."

And comments from colleagues:

"Admired and respected by students and colleagues alike."

"A remarkable record of excellence as a teacher, researcher, and faculty leader."

"One of the best teachers I have ever known."

What makes this person an excellent teacher? Comments from students, colleagues and the man himself (it is a

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Dr. Amihan Huesmann Joins the Department

The department is very pleased that Dr. Amihan Huesmann will join us this fall as a Visiting Assistant Professor during Chuck Niederriter's sabbatical leave. She will be teaching General Physics I and Quantum Mechanics in the fall. She has taught Physical Science at the high school level as well as General Physics at the college level (as a teaching assistant). Amihan also has experience training teachers at both the high school and college levels.

She comes to us from the University of Wisconsin-Madison (UW), where she has been doing postdoctoral research in atmospheric dynamics and training physics majors to tutor fellow students. She received a B.A. in Chemical Physics from Grinnell College, an M.S. in Atmospheric and Oceanic Sciences from

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FALL SEMESTER 2006

DATES TO REMEMBER

- Sept. 6 Classes Begin
- Oct. 3-4 Nobel Conference
- Oct. 21-24 Reading Days
- Oct. 30-Nov. 2 January Term Registration
- Nov. 5-16 Spring Registration
- Nov. 23-26 Thanksgiving Recess
- Dec. 15-19 Final Exams

INSIDE THIS ISSUE:

Department Says "Farewell" to the Class of 2006

The graduating class of 2006 posed for this picture at the department's farewell reception for graduates and their families held immediately after the commencement exercises on Sunday, May 28. Left-to-right: (back row) Prof. Henry, Prof. Mellema, Prof. Huber, Mike Phillips, Mr. Miller, Mark Elias Kersten, Matt Wiebold, Matt Royer, Prof. Saulnier, and Prof. Niederriter; (front row) Jeff Pearson, Josh Jacobson, Erika Galazen, Joni Nordberg, Sharon Jaffe, and Dorea Ruggles. Not in the picture: Meghan Brummer.

Although the graduating class size of 11 was below the department's average of about 14 majors per year, the fact that five of our graduates were women was a record and, perhaps, a sign of things to come. The graduates' future plans involve work, graduate studies, or both.

Meghan Brummer writes, "I am in Iowa; I just moved in this past weekend. I am actually waiting to hear back from a professor on an assistantship possibility. I interviewed with him today. If I get it I will be working in a genetics lab. I also will be applying to the physics department to try to get a TA position. I will be getting my Master of Arts in Science Education from the University of Iowa. For the past seven months I have been a substitute teacher in the Twin Cities and I also was the Lead Instructor at the Maple Grove Mathnasium."

Erika Galazen writes from her hometown of Duluth, "I am working two jobs, non-physics related, unfortunately. I work full time at the St. Louis County Courthouse in the criminal office and I work about 50 hours a month at a hospital in the billing office. But right now my main hobby is applying to every forensic-science certification program and graduate program I can find in the country. After working with police officers and investigators in the criminal office, I have realized that that is what I want to do, without a doubt. I am hoping to start school for that in the fall of 2007. I will be going to the University of Wisconsin Superior this fall to take a full year of biology and chemistry classes to get ready forensic science or, if it comes to my back-up plan, nursing."

Josh Jacobson writes, "I started graduate school this summer (June 19) at UW Madison in Medical Physics. I have a Research Assistantship with Dr. Wally Block. My research work involves modifying/developing scanning techniques for MR imaging of cartilage tissue (separating the cartilage signal from bone and synovial fluid signal), which could be used for the early detection of arthritis and for non-invasive evaluation of arthritis treatments. Most of my work involves

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2006 Graduates' Future Plans

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programming in EPIC (which is based on C++) and testing my pulse sequences by performing MRI scans (I get to scan with both a 1.5 T and 3 T magnets!). My first 2 weeks here I also helped get a grant proposal submitted to the NIH, I have newfound respect for all the professors who get the grants to pay for their researchers. My eventual goal is to obtain a PhD in Medical Physics and hopefully this should lead me to a career in medical imaging and research. Madison is a wonderful city, and the Medical Physics Department at UW is great.

"Recommendations to other physics majors: 1. Learn how to program in as many languages as possible or at least familiarize yourself with not only programming, but working with other people's programs 2. Physics is an excellent degree to have to go into medicine, I would also advise taking a few biology, chemistry, and anatomy courses to supplement it. With physics you can still get an MD or go into BME (biomechanical engineering), Medical Physics, Radiology, Biophysics, or any of the other multi-disciplinary medical fields. 3. Doing research is not only key to getting into grad school, but also for helping you to find out what real research is like and to find what areas of physics you find most interesting. 4. Get to know your fellow physics majors, both in your year and those above and below you. Do homework together, go to SPS events, don't be afraid to ask upperclassmen for assistance. The physics major is hard enough that you shouldn't try to accomplish it alone. 5. Have a good time; undergrad at Gustavus was four of my most enjoyable years. Feel free to have physics majors wondering about medical physics e-mail me (`jjjacobson@wisc.edu`)."

Sharon Jaffe will be attending the University of Wisconsin-Madison, pursuing a PhD in atmospheric and oceanic sciences. She has a research assistantship working with Professors Jon Martin and Dan Vimont, studying subtropical cyclone dynamics and other related issues." (Sharon asked that we clarify, "No, she will not be a TV forecaster", because, she says, "that is the most frequently asked question that I receive about my future").

Mark Kersten writes, "I'm currently in Mysore, India at the Infosys development center. I'm going through their 6 month long training program to become a software engineer. The training program is pretty intense but I'm having a lot of fun. There are a little over 100 Americans here and some 4000+ Indians. Living on campus is basically a mix between a resort and a college campus, but with a lot more rules and work all day. The campus has a resort-esque swimming pool complete with waterfalls, rock climbing wall, badminton courts, countless ping-pong tables, bowling alley, tennis courts, and the list goes on. I can also get my dress shirts washed and pressed for about 10 cents a piece, which isn't too bad. My room is cleaned everyday and I have air conditioning in my room, so I'm not exactly roughing it here. The campus is about 20 minutes outside of town and the town is truly remarkable. Over 1 million people live here and it is considered a small town. The center of town is thriving with

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New Sigma Pi Sigma Members

ΣΠΣ, the national physics honor society, was founded in 1921 and is a member honor society of the Association of College Honor Societies. Nomination and election are by the faculty, based on a combination of student achievement in course work and research, and participation in department and SPS activities.

Sigma Pi Sigma is a member of the American Institute of Physics and "exists to honor outstanding scholarship in physics; to encourage interest in physics among students at all levels; to promote an attitude of service of its members towards their fellow students, colleagues, and the public; to provide a fellowship of persons who have excelled in physics."

The following members of the Class of 2006 were elected to lifetime membership in Sigma Pi Sigma:

Joshua Jacobson

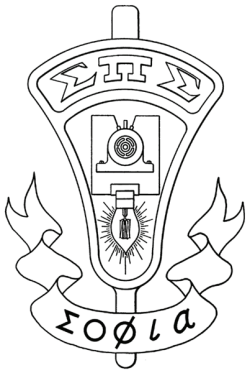
Sharon Jaffe

Joni Nordberg

Michael Phillips

Dorea Ruggles

Matthew Wiebold



Graduates' Future Plans

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life. Sidewalks are packed with people, cows walk around at their leisure, and lots and lots of small shops pack the streets. The driving here is incredibly intense. From campus you can either take a rickshaw or rent a cab for 4 hours for roughly $10. I have never seen a police car or a speed limit sign. Most cars don't have side mirrors, and the ones that do are turned inwards, because traffic is so dense that mirrors get in the way (or get knocked out of the way). Cars are constantly honking their horns and flashing their brights at the other cars and pretty much anything goes. When I first arrived in India and asked an Indian about driving and walking the streets, he failed to allay my fears when he said that in India, it is basically survival of the fittest. However, everyone I have met here has been incredibly nice and almost everyone knows English. I have also done some traveling around here and it is very scenic. However, in India there are three seasons: winter, summer and monsoon. I'm currently experiencing my first monsoon season, and while I have yet to experience any heavy rains, there's usually an overcast and it can rain at almost any time. All in all, I am really enjoying my stay here. Everyone I have met has been great and I love experiencing the very diverse and *different* Indian culture. A quick example of a subtlety of the Indian culture: Indians don't nod their heads; they have a headshake similar to our "no" headshake, which, as far as I can tell, is basically an acknowledgment that some sort of communication is going on between the two of you and it can stand for a number of things beyond that. I was trying to clarify a concept with one of my teachers here and he was profusely shaking his head and I thought I was way off base, but he was actually totally agreeing with me. It certainly takes awhile to get used to.

"I REALLY DIDN'T KNOW WHAT TO EXPECT WHEN I LEFT FOR INDIA, BUT IT REALLY HAS BEEN AN AMAZING EXPERIENCE AND I'M VERY GLAD I DECIDED TO GO."

"As for my future plans, I will be coming back to America in late January and will be moving out to Fremont, California to begin actual work as a software engineer for Infosys. Beyond that, hopefully coming back to the Midwest at some point!

"Advice for future physics grads: don't be afraid to try something new or different, and if there is a paycheck in it for you, all the better. I really didn't know what to expect when I left for India, but it really has been an amazing experience and I'm very glad I decided to go."

Joni Nordberg will attend graduate school in physics at the University of Minnesota. She writes, "This summer I have been working with a couple of research groups and getting a taste for the department here at the U. There is an experiment run in a dilution refrigerator that has been dormant for a while here (run by a theoretical group), so I have been piecing together the experiment. I have been mostly fixing things, getting in contact with old grad students, building a few new parts for the experimental cell and working on some of the electronics for the data acquisition. (We are shooting ions of He through superfluid He and collecting them on the other side to see what happened). The other group I am working with (CDMS in Soudan) wants to test some bolometers in the dilution fridge at the same time as the other experiment is running, so I have been putting that together too. This summer I have not learned a lot of physics, but I have taken away a ton of practical experience like metal working, soldering, and other common experimental practices. I think that will all come in handy.

"This fall I will be taking classes and TAing a class as most people do their first year. I have found that the U of M is very interdepartmental with departments working with other departments etc., so it looks like there are a lot of options for me to explore here."

Jeff Pearson writes**: "**I am attending William Mitchell College of Law where I plan on concentrating on Intellectual Property Law. I have received a Trustee's Scholarship here, and so am not paying a cent for school (always a good thing). My advice to future grads is to drop the Gustavus name around. I was truly surprised on the number of alumni out there (who are usually willing to help fellow Gusties) and the number of people who recognize and respect that you went to (and graduated from) Gustavus."

Mike Phillips has a graduate teaching assistantship in physics at the University of Wisconsin—Madison. He writes, "I'm planning on moving to Madison this Sunday. Josh, our roommate Todd, and I found a 3-bedroom apartment. The three of us are planning to take a trip up to the Boundary Waters the week of August 20th, so hopefully our trail wasn't

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2006 Physics Graduates

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affected by the fires up there. After that, I get back to Madison and start TA training the following week, and then classes start shortly after that. I'm signed up to take Introduction to Atomic Structure and the graduate level Quantum Mechanics course in the fall. I haven't found out yet what classes I'll be TA-ing, but I'm looking forward to that experience quite a bit."

Matt Royer will be attending the University of Minnesota this fall and pursuing a master's degree in their Mechanical Engineering department. Throughout this past spring and into this summer he has been working with Dr. Kim Stelson to set up a Research Assistantship within the University's new Energy Research Center for Compact and Efficient Fluid Power. The new research center was just approved by NSF in June.

Dorea Ruggles will be at Rensselaer Polytechnic Institute (RPI) in Troy, NY, and will be studying for a PhD in Architectural Sciences with a concentration in acoustics. She received an RPI Graduate Fellowship, which is a prestigious award offered to only a few first year graduate students throughout the university. She says, "I'm thinking I would like to do my research in computer modeling of rooms and their acoustics, but am really open to a wide variety of research areas and will be designing my research this semester. After graduating, I am planning to work as a consultant for awhile but am thinking it would also be fun to teach after I have some 'real world' experience."

Matt Wiebold writes, "This summer I worked for the City of Eden Prairie Utilities Department as an equipment operator, enjoying my last summer of freedom before grad school starts. I will be going to University of Wisconsin – Madison for Electrical Engineering next year as a department fellow. I am really looking forward to it and will be moving to Madison in a few days.

"My advice to future physics grads: start applying and doing research early. Not wanting to break from my own tradition, I waited until the last moment (mid/late December) to start seriously looking and writing essays, and I wish I would have had more time. I really enjoyed visiting grad schools; apply to as many as you can so you can get a good feel for different programs."

National Standing of Gustavus' Physics Program

Two recent statistical studies from different sources help to give a clearer picture of where our physics program stands in comparison to other programs, both locally and nationally.

The Statistical Research Center at the American Institute of Physics (AIP) issued a report on Enrollments and Degrees in undergraduate physics departments. In a list of bachelor's-granting departments averaging 10 or more physics bachelor's degrees per year for the graduating classes of 2001, 2002 and 2003, Gustavus ranked 13th in the nation with an average of 14 physics graduates in each of those years. Among liberal arts colleges, the top schools nationally (with the annual number of physics majors in parentheses) were Carleton (19), Colorado College(17), Reed College(17), Bates College (16), Grinnell College (15), Bowdoin College(14) and Gustavus Adolphus College(14). Besides Carleton and Gustavus, the other Minnesota schools to make the list were Bethel College(11) and St. Olaf College (11). The full report is available from the AIP website at `http://www.aip.org/statistics/trends/reports/ed.pdf`

Another national study by the National Science Foundation provided numbers on the baccalaureate origins of physics PhD's granted over the five-year period from 1999-2004. During that period of time, 16 Gustavus alumni earned a PhD in physics. In terms of raw numbers among all private colleges, this put Gustavus at 20th in the nation. **Among liberal arts colleges Gustavus was second in the nation, as only Carleton, (with 23) had more alumni PhDs during this time period.**

The study also computed a "physics PhD production rank" for all private colleges in the country, by dividing the number of PhDs by each college's undergraduate enrollment. In comparison with nearby schools, this ranking put Gustavus at 19th in the nation, behind Carleton (5th) and Grinnell (15th), but ahead of St. John's (32nd), St. Olaf (56th) and Macalester (57th). The full study is available online through the NSF's WebCASPAR database, `http://webcaspar.nsf.gov`

Gustavus' SPS Chapter Garners National Recognition

The Gustavus chapter of the Society of Physics Students (SPS) was selected as one of the nation's "Outstanding SPS Chapters" for 2004-2005. The award letter from the national SPS office is reproduced below. For more information on SPS activities, see the article on page 7.

"THE SELECTION IS BASED ON THE DEPTH AND BREADTH OF SPS ACTIVITIES CONDUCTED BY YOUR CHAPTER."

SOCIETY OF PHYSICS STUDENTS

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E-mail: sps@aip.org

January, 2006

Dr. Charles Niederriter
SPS Advisor
Gustavus Adolphus College
Department of Physics
St. Peter, MN 56082

Dear Dr. Niederriter:

I am writing to inform you that the Gustavus Adolphus College chapter of the Society of Physics Students has been selected as an Outstanding SPS Chapter for the 2004-2005 school year. Congratulations on this notable accomplishment---less than 10% of the SPS chapters nationwide are so honored, about one per state.

A certificate for display in your department in enclosed.

The selection is based on the depth and breadth of SPS activities conducted by your chapter in such areas as physics research, public science outreach, physics tutoring programs, hosting and representation at physics meetings, and providing social interaction for chapter members. If you would like to see what some other chapters are doing, the SPS website at www.spsnational.org has many examples and ideas.

Thank you for the time and energy you devote to the students and to their betterment. This award is a testament to your personal leadership skills as much as it is an acknowledgment of your chapter's superior performance. Once again, congratulations!

Please do not hesitate to contact me if I can be of any assistance. I look forward to working with you in the coming year.

Sincerely,

Gary White
SPS Director

Enclosure

cc: Dr. James L. Peterson, President
Dr. Dennis Henry, Department Chair
Office of Public Relations

AMERICAN INSTITUTE OF PHYSICS SPS IS AN ORGANIZATION OF THE AMERICAN INSTITUTE OF PHYSICS

Society of Physics Students Has Another Busy Year

After being named an Outstanding SPS Chapter for 2004-2005 (see the award letter shown on page 6), 2005-2006 was equally busy.

We sent a contingent of students to the Acoustical Society of America meeting in Minneapolis in October. Twelve students presented summer and academic year research at SPS meetings. We also had six outside speakers and an alumni panel of physics careers. The SPS club also met weekly for social/athletic events, such as football, softball, ultimate Frisbee, etc. They hosted two picnics and two end-of-semester parties. SPS also had a float in the Homecoming Parade, winning third prize.

The SPS club helped organize "Science Saturday" and hosted approximately 100 grade-school aged children for demonstrations. The club has also arranged to take the demonstration show "on the road" to local grade schools. They helped judge several local science fairs and visited with students taking AP physics at local high schools. The club participated in several work days with the local Habitat for Humanity chapter, helping build a house and shed. They also raised funds to help support an alumnus who is in Teach For America in inner-city Baltimore and attempting to revitalize his school's physics and chemistry courses.

SPS Chapter Officers for 2006-2007 are:

President: **Nate Souther ('07)**

Vice President: **Kristen Burson ('08)**

Treasurer: **Collin Meierbachtol ('07)**

Activities Coordinator: **Kathleen DeWahl ('08)**

Sophomore Rep: **Erik Johnson ('09)**

The first SPS meeting will occur early in the fall semester, at which time the new officers will outline their plans for fall activities. The faculty will also make brief presentations about opportunities for student collaborations in research and course development projects. As should be clear from this article, the SPS club at Gustavus forms a hub for both academic and social activities within the physics department. All students are encouraged to participate in SPS and everyone is invited to attend SPS activities.

This fall, **Tom Huber** will be taking over as the SPS (physics club) advisor, and will be working with the officers to come up with fun activities and talks. If you have any ideas, please talk to Tom or one of the SPS officers.

And Now He's "Professor" Saulnier, Too!

Please join his colleagues in a hearty wish of congratulations to **Paul Saulnier** who, in addition to being this year's recipient of the College's Edgar M. Carlson Award for Distinguished Teaching (see the article on page 1), has been promoted to "Professor".

For faculty members possessing the terminal degree in their discipline, there are three ranks at Gustavus: Assistant Professor, Associate Professor and Professor. Promotion from one rank to another involves a year-long process of evaluation by the Faculty Personnel Committee.

As prescribed in the Gustavus Faculty Manual, promotion to the rank of Professor is based upon "continuing excellence and growth as a teacher; an established record of professional accomplishments; and an established record of leadership in the governance of the College, the department, in the faculty and its committees."

We can think of no one more deserving of promotion than Paul. The Personnel Committee, the Dean and the President have unanimously concurred!

Visiting Speakers Enhance the Physics Program

The 2005 Nobel Conference on "The Legacy of Einstein", brought us compelling presentations from a group of distinguished scholars. These included:

- "Bose-Einstein Condensates and Other New Forms of Matter Close to Absolute Zero," by Dr. Wolfgang Ketterle, John D. MacArthur Professor of Physics Massachusetts Institute of Technology, 2001 Nobel laureate in physics
- "The Education of Albert Einstein," by Dr. Thomas Levenson, Associate Professor of Science Writing, Massachusetts Institute of Technology
- "Warped Spacetime: Einstein's General Relativity Legacy," by Dr. Kip S. Thorne, Feynman Professor of Theoretical Physics California Institute of Technology
- "Is Cosmic Concordance in Concomitance with Superstring/M-Theory?," by Dr. Sylvester James Gates Jr., John S. Toll Professor of Physics Department of Physics University of Maryland, College Park
- "The Legacy of Albert Einstein for Cosmology," by Dr. Wendy Freedman, Crawford H. Greenewalt Chair and Director, Carnegie Observatories
- "The Existence of Life in the Universe and the Crucial Issue of Ethics," by Dr. George F. R. Ellis Distinguished Professor of Complex Systems University of Cape Town, South Africa

During the 2005-2006 school year, the physics program was further enriched by a number of colloquia from other visiting scientists. A remarkable feature of this past year's colloquium program was the number of speakers who were Gustavus alumni. The list of talks included:

"A REMARKABLE FEATURE OF THIS PAST YEAR'S COLLOQUIUM PROGRAM WAS THE NUMBER OF SPEAKERS WHO WERE GUSTAVUS ALUMNI."

- "From Gustavus Physics to Environmental Engineering in Africa," by **Ms. Lauren Fry ('00)**, Ph.D. candidate, International Sustainable Engineering Initiative, Department of Environmental Engineering, Michigan Technological University
- "Organic (a.k.a. Plastic) Electronics: Applications, Devices, and Materials Challenges," by **Dr. Debra Lightly Mascaro ('95)**, Research Assistant Professor, Mechanical Engineering, University of Utah
- "Electronic Mayonnaise: Uniting the Sciences of 'Hard' and 'Soft' Matter," by Dr. Joerg Schmalian, Associate Professor of Physics, Iowa State University
- "The Search for Extra-Terrestrial Life," by Dr. Wendy Hagen-Bauer, Harlow-Shapley Visiting Lecturer, Professor of Astronomy, Wellesley College
- "The Physics of Arms Control," by **Dr. Chad Olinger ('85)**, Safeguard Systems Group, Los Alamos National Laboratories
- "Finding Success in Science at the Microscale," by **Dr. Glennys Mensing ('89)**, Research Project Coordinator, Department of Mechanical and Industrial Engineering, University of Illinois at Urbana-Champaign
- "The History of the Manhattan Project," by **Dr. Richard Fuller**, Professor Emeritus of Physics at Gustavus.

The speakers program will be an active one again this year. While all of the speakers and dates were not set by the time this newsletter was printed, mark your calendars for Monday evening, November 13, at 7:30 pm, when our guest speaker will be Dr. Paul Crowell, Associate Professor of Physics at the University of Minnesota, whose research involves spin dynamics and transport in ferromagnets and ferromagnet-semiconductor heterostructures.

Other potential speakers for the 2006-2007 academic year include:

- **Dr. Adam Green ('94)** Assistant Professor of Physics at the University of St. Thomas, whose research has considered possible connections between fundamental mirror asymmetries in physics and biochemistry.
- Dr. H. Ali Jaafar, Chairman, Minnesota Medical Physics corporation. After a long career in applied nuclear physics, Dr. Jaafar founded this innovative company that designs medical devices incorporating x-ray sources.
- **Mark Nechanicky ('95)**, who made the transition from being an automotive engineer in Detroit to becoming a high-school science teacher in Albert Lea.

Announcements regarding the scheduled speakers will be posted on department bulletin boards, are available online in the College Calendar, and are sent via email to all students taking a class in the department.

Alumni Panel Discusses Career Choices

This past spring, in what has become a popular event held every few years, the department and SPS hosted a panel of Gustavus physics alumni living in the region who have gone on to careers in different fields. This year's panel included (left to right in the photograph above): **Dr. Eric Montei ('89)**, engineer, Seagate Corporation, Bloomington; **Dr. Greg Haugstad ('85)**, Director and Senior Research Associate, Institute of Technology Characterization Facility, University of Minnesota, Minneapolis; **Matt Cunningham ('01)**, engineer, Minnetronix Corporation, St. Paul; **Kris Frederick ('96)**, intellectual property counsel, Honeywell Corporation, Minneapolis; **Dr. Peter Eckman ('96)**, resident in cardiology, University of Minnesota Hospital, Minneapolis; **Aaron Schmidt ('96)**, engineer, Seagate Corporation, Bloomington; **Brent Harrold ('96)**, engineer, Red Devil Equipment Corporation, Plymouth; and **Karl Erickson ('96)**, engineer, IBM, Rochester. The group represents a cross section of alumni career choices, and hold a variety of post-graduate degrees from Master's degrees in electrical and mechanical engineering to PhD's in physics plus one MD and a JD. Their careers include law, medicine, physics, and biomedical, electrical and mechanical engineering.

The panel discussion, entitled "What Can I Do With a Physics Major?", drew a large, interested audience. A suggestion for current students was that they be proactive and early in examining, along with their faculty advisor, the myriad of career choices that are available to a graduate with a physics major.

Wind Power Update

Gustavus continues to move forward in an effort to purchase and install wind turbines for the generation of electrical power for the campus. A group of faculty and administrators including President Peterson, and spearheaded by professors **Chuck Niederriter** (physics) and Jeff Jeremiason (chemistry and environmental studies), has been working throughout the past year sorting out engineering, siting, legal and financial matters.

The hope is that the College may have two 2.5-Megawatt wind turbines in place, on the western edge of the campus' arboretum, to be dedicated at the time of the Fall 2007 Nobel Conference on "Our Energy Future". These turbines would provide clean, renewable energy with enough power to supply about half of the College's annual electrical energy needs. As yet unresolved is the issue of what to do with the excess power that would be generated on very windy days in the late winter or early spring. Stay tuned for new developments!

Students Receive Departmental Achievement Awards

At the end of the 2005-2006 academic year, the department recognized a number of our continuing physics majors with awards.

Ben Olson ('07) has been selected as the winner of the Milward T. Rodine Memorial Physics Award for the 2006-2007 academic year. This prize is named for the longtime Gustavus professor of physics (who taught here from 1933-1969) and is awarded annually to a junior physics major on the basis of interests and scholarly achievements.

Collin Meierbachtol ('07) received the Gerald and Julia Swanson Scholarship in Physics for 2006-2007. This scholarship was established to honor the work of the physics department faculty who provided Gerald Swanson with a background that prepared him for graduate study in physics and for a career with the Bendix Corporation. The scholarship is to encourage physics students of promise who are enrolled full-time at the College.

Andrea Olson ('07) was awarded the John Chindvall Scholarship in Physics for 2006-2007. This endowed scholarship was established in memory of 1970 Gustavus graduate John Chindvall by his parents and friends. It is awarded annually to a student majoring in physics.

Nate Souther ('07) was selected to receive the 2006-2007 Julian A. Crawford Memorial Prize in Physics. This prize consists of a check equivalent in value to a one-year membership in the American Association of Physics Teachers (AAPT). The prize is named in memory of the former chair of the Gustavus physics department (1967-69) and awarded to the student with "the greatest potential for contributing to physics and society".

In consultation with the Physics Department, the Department of Mathematics/Computer Science has chosen **D. Peter Overholser ('07)** as the winner of the 2006-2007 John Borneman Prize Par Excellence in Mathematics. This award is named in memory of John Borneman, a 1955 Gustavus graduate, by his family. It is presented annually to an outstanding student in the fields of mathematics and physics.

Kristen Burson ('08) received the Positive Derivative Award for a rising junior, and **Kristy Tupy ('09)** received the Positive Derivative Award for a rising sophomore. These awards are given to students in honor of their improvement in physics and promise of future achievements. The award consists of a check adequate to pay for a one-year student membership in AAPT, SPS, IEEE, ASME or a similar organization

Kyle Friend ('09) received the Harold Q Fuller Memorial Award in Physics, which is given to the first-year student who has the highest overall record in Classical Physics I and II.

In addition, **Matt Bergman ('07)** and **Scott Hagemeyer ('07)** have been named Physics Departmental Assistants for Fall Semester, 2006. This position has a nominal expectation of four hours per week in research, course development or other activities that will assist in the work of the department.

New Visiting Professor

(Continued from page 1)

the UW, and an M.A. and Ph.D. in Physics from the UW. Her research is in the field of atmospheric dynamics; she studies global atmospheric dynamics with an eye towards climate, long-term oscillations and trends, and chemical transport. Although not a part of her formal scientific education, Amihan has a keen interest in environmental issues and politics and plans to teach a January Term course on current climate issues. Amihan has lived in Madison for over a decade but has traveled the world, first as a "foreign service brat" (she was born in a thatched-roof hut in Uganda) and later as a Peace Corps Volunteer in Gabon. She is pleased to double the physics department's Returned Peace Corps Volunteer population. Amihan is a "DIY" person and enjoys cooking, canning, sewing, carpentry, and other crafts, and is looking forward to adapting her car-free lifestyle to St. Peter.

DR. AMIHAN HUESMANN

Carlson Award Citation

(Continued from page 1)

man) suggest four things:

First, preparation. As one of his colleagues attests, "his preparation for class is characterized by long hours of work, lectures impeccably written and delivered, and an appropriately assigned and promptly graded body of homework."

Second, organization. Student after student comments on this teacher's remarkable ability, in lectures, research projects and conversations, to take complex tasks and subjects and break them into clear sequences and comprehensible elements. According to one, "He has a remarkable talent for being able to make difficult problems manageable."

Third, inspiration. This is clearly a teacher who loves his subject and loves teaching it—and his enthusiasm is infectious. Listen again to his students: "It is easy to tell even after only one lecture that he has a deep love for what he teaches and teaching itself." "His lectures are always interesting, thought provoking—they make you want to learn." "He inspires you…in new and innovative ways that allow you to connect the specific knowledge to general principles." "He taught us to think, to learn, to be better students."

Fourth, mentoring. Gustavus, he says, is truly about the students. And his attitude is readily apparent to them and to his colleagues. Says one colleague, "Students are eager to take a course from him, not because they think it will be easy, but because they know they will learn a great deal from a mentor who is extremely knowledgeable, who will hold them accountable to learn and to achieve, and who will be there for them whenever and however they need help."

Prepared, organized, enthusiastic, caring—and a pretty funny guy—these are the characteristics of Professor of Physics, Paul Saulnier.

Paul received his bachelor of science in physics and electrical engineering from the University of Hartford, graduating in three years, Magna Cum Laude. After working for two years in the Aerospace division of General Electric, where at the age of 21 he served as lead project engineer for a 2 million dollar research and development program, he returned to academia and has never looked back. He received his M.S. and Ph.D. from the University of Delaware, then spent two years at Carroll College in Wisconsin before joining the Gustavus faculty in 1993.

At Gustavus he has taught nearly all the courses in the Physics Department, ranging from General Physics to Quantum Mechanics, as well as a January Term course on the History and Art of Science Fiction Film and a First Term Seminar that explores the relationship between science and science fiction.

His research program is described by colleague Chuck Niederriter as "incredible and awesome." Since obtaining external funding to implement an advanced optics teaching laboratory, he has developed three research programs, one concerned with the study of light propagation in highly scattering media, another with investigations into Riccati differential systems, and a third, in collaboration with biologists, on the subject of swarms in nature. In carrying out these programs, Paul has worked with over 30 different undergraduate research associates, many of whom have gone on to successful careers of their own. Listen again to Professor Niederitter: "Always the teacher, Paul uses the research lab experiences of his students to teach them about the life of a scientist (and life in general)."

"PREPARED, ORGANIZED, ENTHUSIASTIC, CARING – AND A PRETTY FUNNY GUY – THESE ARE THE CHARACTERISTICS OF PROFESSOR OF PHYSICS, PAUL SAULNIER."

Paul himself has said, "If I just wanted to 'do physics' or 'earn money' Gustavus is not where I would be, for I certainly could have chosen other career paths that would have offered me more of each of these. I am at Gustavus because I feel a strong personal sense of service. Here I have the opportunity to serve students, colleagues (both inside and outside of the physics department), my profession, and my own curiosity."

President Peterson, members of the Board, faculty, guests, and, most of all, seniors of the Class of 2006: it gives me great pleasure to introduce the winner of this year's Edgar Carlson Award for Distinguished Teaching: Professor of Physics, Dr. Paul Saulnier.'

Student Summer Internships Are All Over the Map

This year nine returning Gustavus physics majors participated in summer research internships in physics-related disciplines either on or off campus.

Eva Cornell ('08) spent the summer at the University of Minnesota's Nanotechnology program. She tells us, "I'm studying the effects of gold and silver nanoparticles on mast cells using a TEM (Transmission Electron Microscope), an AFM (Atomic Force Microscopy), and amperommetry. Basically, I'm trying to figure out if all this new nanotechnology stuff is really as safe as everyone keeps saying it is. At the moment, it appears that nanoparticles do have some adverse effects on mast cells (a type of immune cell found in connective tissue of the body) from mice. Now, I'm trying to see where in the cells the nanoparticles go to try to figure out why they seem to be harming the mast cells."

Kathleen DeWahl ('08) had an internship at the University of Wisconsin Synchrotron Research Center just outside Madison, WI. She says, "I am working with my mentor and his graduate student on characterizing the electronic structure of pentacene thin films. The reason we want to study this is that there are a lot of potential applications, like plastic transistors, spray-on solar cells and flexible displays, that pentacene's electronic structure might lend itself to. We have been using angle resolved photoemission spectroscopy (ARPES) to direct UV photons at samples and collect data on the numbers, emission angles and kinetic energies of the electrons ejected from the film. Early on we found out that pentacene is very susceptible to radiation damage from the photons we use for ARPES, so a lot of time has been spent just trying to figure out what energy photons do the least damage and how to prolong sample life. We have also been looking at temperature effects, which has been pretty interesting. We usually take data at 300K because it is convenient. By lowering the temperature at which we took samples we were hoping to get a sharper peak for the highest occupied molecular orbital because one would expect vibrations and interactions between electrons would go down with temperature. However, we found that the peaks tend to broaden and drop in intensity as the temperature goes down. A lot of the peaks disappear entirely once we get down below 75K. Madison itself is great and I am liking the university a lot. Here's a picture of me transferring a sample into the analyzer chamber."

Scott Hagemeyer ('07) and **Eric Ofstad ('08)** worked on experimental acoustics research with Gustavus Professor Tom Huber under the auspices of a National Science Foundation Research at Undergraduate Institution grant. Scott writes: "How did I spend my summer? Well, so far I've spent it with Eric locked in the basement of Olin Hall. For the last 4 weeks Eric and I have been working with LabVIEW, Visual C++, and Visual Basic attempting to turn Tom's 'Bargain-Basement' Polytec vibrometer into the equivalent of a scanning vibrometer. At first, our best efforts were futile, with results varying from random and unexpected behavior to total computer crashes. Gradually we became more adept at the interfacing of these languages and have since created *LabVIEW* VI's and SubVI's that are capable of calling VB and VC++ Dynamic-Link Libraries. By interfacing Lab VIEW with the other languages in this manner we have been able to nearly duplicate the abilities of a scanning vibrometer. Our programs can currently calibrate transducers, scan a vibrating object and save the spectra, adjust the laser position to yield quality signal, sweep a variety of parameters including phase, amplitude, and frequency. We discovered early on, to our misfortune, that the transducers change in impedance as a function of frequency. Currently Eric and I are devising algorithms that should combat this by altering the waveform amplitude frequency by frequency in a fully automated process that will create and store an array of multiplicative gains (for each transducer in use) that can simply be loaded at a later date. Within a few weeks, and certainly by the end of the month, we should have ourselves a very fancy scanning vibrometer capable of measuring the different vibrational modes of any object we can place on our table. Once all the data are taken, we import it into *ME' Scope*, a program that allows us to construct a 3D model of the structure and animate it's motion at any of the resonant

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Student Summer Research Experiences

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frequencies. Tom has talked about how this research extends into biomedical applications of tumor location, and also the possibility of sharing our software with Hutchinson Technologies Inc, which still uses a mechanical shaker to test all of their hard drive suspensions. The goal is to be able to see vibrational modes in a non-contact testing environment. I really enjoy what we've doing so far, with much credit to the Fortran/C++ J-Term class I took that really showed me how much I like programming and the challenge of communication with a computer."

Collin Meierbachtol ('07) spent the summer in an NSF Research Experiences for Undergraduates (REU) program in the University of Minnesota's Electrical and Computer Engineering program. He writes: "I am having a great time in the University of Minnesota's ECE department and am learning a lot. Specifically, I am working in their optoelectrical engineering department on observing radially polarized surface plasmon resonance (SPR) using thin gold films. In doing so, I have had some clean room training and have worked in their Nano Fabrication Center as well.

"As advice to other undergraduates, I would tell them to definitely spend a summer in an REU program like mine. It's a great way to experience research at a different institution than your own, you learn a great deal from all of the hands on training, and you have a blast with the other kids in your program, too."

Ben Olson ('07) had a summer position at the University of Nevada Las Vegas. Ben says: "I have been doing kind of a hodgepodge of materials and high-pressure physics. I have spent many an hour seating and aligning diamonds in the diamond anvil cells (DAC for short). This lab primarily does research on energetic materials (a technical term for explosives) at high pressure so I have traveled to Argonne National Lab to work at the Advanced Photon Site where I helped the graduate students and post-docs with their experiments. I've also been helping design a laser drilling machine to drill holes (10-100 microns in diameter) in gaskets. I have primarily been working with a UV/visible absorption spectrometer. We are looking at depleted Uranium 238 and are in the midst of data collection. The plan is to see how the absorption spectrum changes as we go up in pressure (we should be able to hit 80 GPa). All-in-all it has been a good experience so far and I continue to learn a lot."

Peter Overholser ('07) spent the summer at the California Polytechnic Institute San Luis Obispo as part of an NSF REU program in mathematics. Peter writes: "I send you my greetings from the Cal Poly math REU in that warmer end of paradise, California. I'm a stranger in this strange land of pleasant things so that I may apply my mind to the mysteries of Coxeter groups (abstract groups which are generalizations of geometrical reflections), specifically as member of an intrepid team which dares foray into the rarefied realm of the automorphism. My duties consist of sitting and thinking whenever not occupied with the unavoidable necessities of existence: tossing the disc, eating, running, and visiting the beach (thinking all the while, of course). Not nearly so often as I'd hope, I have been lucky to produce occasional lemmas which serve as stepping stones toward that theorem of my dreams-- a characterization of the geodesic representations of the inner automorphisms of right-angled Coxeter systems. The experience has been incredible thus far, a chance to be surrounded by like-minded people sharing a beautiful pursuit."

"IT'S A GREAT WAY TO EXPERIENCE RESEARCH AT A DIFFERENT INSTITUTION THAN YOUR OWN, YOU LEARN A GREAT DEAL FROM ALL OF THE HANDS ON TRAINING, AND YOU HAVE A BLAST WITH THE OTHER KIDS IN YOUR PROGRAM,"

Jared Sieling ('08) worked at Gustavus with Professor **Chuck Niederriter** on energy research related to Gustavus' imminent purchase of wind turbines to provide energy for the campus. The work was done under the auspices of a Gustavus Presidential Faculty/Student Research Collaboration grant. **Danielle Berg ('08)** was also involved in some of the work. Jared writes: "With the growing popularity of wind and solar power production systems, mass storage of energy is gaining interest. A fair amount of research has been conducted on large scale systems; unfortunately, medium scale systems have not seen much study. The project that I worked on this summer looked into the feasibility of a medium scale system at the Gustavus campus. Excess energy produced by wind turbines on campus would be stored, in

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Faculty Enjoy the Summer and Look Forward to the Fall Semester

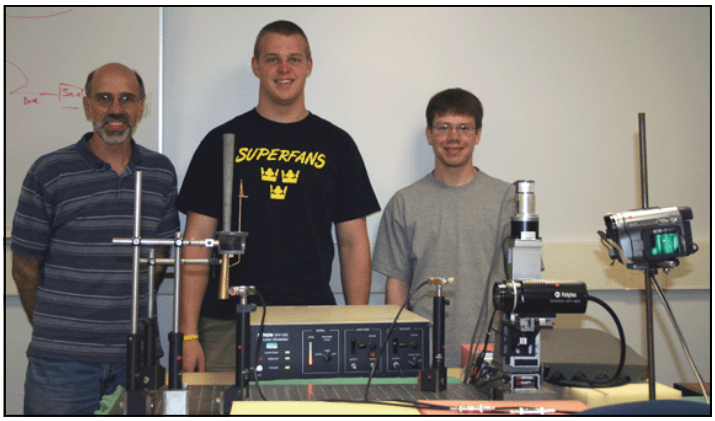
Dennis Henry began the summer by attending the Conference for Physics Department Chairs that was held jointly by the American Physical Society (APS) and the American Association of Physics Teachers (AAPT) at the Center for Physics in College Park, Maryland. The theme of this year's biannual gathering was "Responding to the Gathering Storm", which addressed the growing body of evidence that, although the U.S. is still doing well in science and technology in absolute terms, all of the important domestic trends are in the wrong direction. Gustavus and the University of Minnesota were the only schools from Minnesota among the 112 registrants. Dennis says, "It was fun to talk informally with university chairs from all over the U.S. and to compare notes about the many of our students who have done well in their graduate studies at those places."

In July "DC" completed an invited review for the Quarterly of the Lexington Group in Transportation History on the 300-page book *Minneapolis and the Age of Railways*. In other railroad history projects, he edited and narrated film footage for the two successor DVD's to last year's commercial disc *Indiana, Minnesota, and Early Amtrak: Railroad Memories: 1964-72*. He is looking forward to the publication next spring of his article on the physics of gravity-retarder railroad yards in *The Encyclopedia of North American Railroads* from Indiana University Press.

He continued his activity in the area of electromagnetic interference as an occasional consultant for Teltech and attended the July meeting of the Twin Cities Chapter of the IEEE-EMC Society, with a bonus tour of the TUV Testing Facility in New Brighton. Vacation travel wasn't in this summer's plans, but there was a memorable family wedding trip to Pittsburgh in late July.

Dennis will be teaching Classical Physics III and two lab sections again this fall. He is revising the lab manual to reflect the arrival of ten new oscilloscopes for use in the introductory courses. (See the article on page 19.) He concludes his fifth term and 14th year as department chair in 2007 and will be taking a sabbatical leave during the 2007-08 academic year. His campus committee service this year is lighter than normal, which should, in principle, leave a bit more time for reviewing manuscripts for physics and engineering journals. He encourages his major advisees not to be strangers, and is looking forward to working with students on research projects of mutual interest.

It was a very productive summer for **Tom Huber**. Tom worked this summer with **Scott Hagemeyer ('07)** and **Eric Ofstad ('08)** on the first year of a three-year NSF funded



research program. The focus of the project is to study the use of the interference of ultrasound beams for exciting vibrations in small structures. The major goal for this year was to design, build and program the acquisition system for the experiment. Scott and Eric did a fantastic job of building the functional equivalent of a $150,000 scanning vibrometer from existing equipment such as a single point vibrometer, video camera, and translation stages purchased on eBay. All this took was many thousands of lines of VisualBasic, LabVIEW and C++ code to get all of the hardware and software to talk to each other! Having a scanning vibrometer on campus opens up a wide range of faculty-student research projects in mechanical engineering and acoustics; any students who are interested should see Tom. Some of Tom's other major projects this summer included writing software to set up the new Yokogawa oscilloscopes, and to update many of the advanced labs to use the latest version of LabVIEW.

Tom will be teaching Experimental Modern Physics, Thermal and Statistical Physics, and the Physics Senior Seminar this fall. He continues as the department's coordinator of summer internships, and will serve on the faculty's International and Experiential Education committee

Aside from editing this newsletter, **Steve Mellema** spent the largest part of the summer on home improvement, the biggest project being the remodeling of the Mellemas' family room into a home theater. Lots of applied physics took

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Faculty Summer Activities

(Continued from page 14)

place, from carpentry to electrical wiring and, of course, seemingly endless hours of applying microlayers of pigmented thin films. Thanks in part to the influence of Paul Saulnier, the Mellemas now have movie nights with a new projector and 92" screen in their redecorated space. The family also traveled to the East coast for two weeks, first for a family reunion in Boston, and then to visit an old Peace Corps friend in Princeton, NJ. That trip and the rest of the summer afforded time for son Dan (who's a senior at St. Peter High School this fall) to make some preliminary college visits.

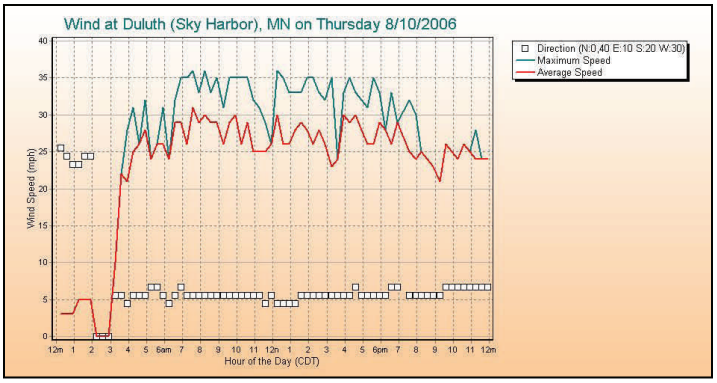
Steve will teach Classical Physics I and the Curriculum II Natural World course this fall, and is looking forward to a spring -semester collaboration with Rydell Visiting Professor Jim Gates (see the article on page 20). In addition to coordinating the department's outside speakers' program, Steve will serve on both the Faculty Compensation Committee and the College Budget Committee this year. He is looking for students interested in working on research projects, especially in the areas of optical scattering and measurements of room acoustics.

Jim Miller had a true Minnesota summer, by which we mean that most activities were based around water and lakes. Jim writes, "We had two notable windsurfing adventures starting with the Worthington Windsurfing Regatta and Unvarnished Music Festival at Lake Okabena. Worthington was host to the 2003 windsurfing nationals, so you know it can be windy there. There's further evidence of wind in the wind turbines visible from Lake Okabena. Later in the summer we made it up to Mille Lacs for the "Gathering" event near Malmo. This event is a mix of windsurfers and kite boarders. The lake and wind cooperated and provides some of my longest fresh-water rides ever. Wind was strengthened and smoothed by its path over 17 miles of lake; way too much fun.

"In support of windsurfing adventures, I've re-launched a web-based wind charting application (`http://physics.gac.edu/waconia/`) that I developed during my years in Washington State. It's now running on the Physics Department's web server and has a Minnesota twist, collecting data from airports across our state.

"Chuck and I attended the AAPT meeting in Syracuse, NY in July. There were several presentations by colleges trying to change traditional physics labs to reduce their procedural nature and foster more investigative learning. We also saw many ingenious equipment-related presentations; one of my favorites being a low-cost way to illustrate color mixing with 3 LEDs and a ping-pong ball.

"Our family took a hodgepodge of trips during the summer including time in the Twin Cities, southern MN, and western WI. We timed our trip to Duluth to see a strong northeaster coming across Superior (see wind chart below). The strong



wind made for huge waves at Park Point and fun swimming and body surfing (no the water wasn't cold, but the 63°F air temperature was motivation to stay in the water). We saw undertow and rip tide, just like in the ocean."

"When does your leave start?" seemed to be a common question for **Chuck Niederriter** this summer. It was a busy time, from the graduation of son Robert from St. Peter High, and all that entails, to summer research and trips to Washington, DC and Vermont. Chuck worked with **Jared Sieling ('08)** and **Danielle Berg ('08)** on a study to determine the feasibility of various energy storage schemes to complement production from a pair of wind turbines. Although the project, funded through a Presidential Collaboration grant, was mostly theoretical, it did involve some construction of demonstration units. They made a couple of trips to visit the wind-to-hydrogen facility at the University of Minnesota, Morris and the flywheel lab at the U of M, Twin Cities. Of course, Chuck also spent a substantial amount of time pushing the wind project ahead. Many meetings with our attorney and City and SMMPA officials have resulted in small, but measurable, progress toward our goal of having two turbines to dedicate at the 2007 Nobel Con-

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Faculty Activities

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ference on energy.

Chuck spent a couple of days in Washington, DC, reviewing grant proposals for the NSF – Course Curriculum and Laboratory Improvement (CCLI) program. In late July Chuck attended the AAPT meeting in Syracuse, New York, serving as Minnesota section representative, learning what is new in physics and astronomy education, and visiting with alumni and colleagues from across the country. Chuck combined the Syracuse trip with a visit to Pennsylvania and a camping trip in Vermont.

There was also a little time this summer to help out with the two Habitat for Humanity houses and to build a shed for the house built last year. Habitat has a goal of finishing both houses by the end of November, so there will be plenty of projects for SPS and other groups to help with this fall.

Although Chuck will be on leave for the academic year, he will mostly be on campus doing research with students. In addition to the new projects spawned by this summer's energy research, he will need help with surface science, acoustics, and astrophysics projects. Maybe, with a little help, the giant trebuchet will finally be completed, too.

The summer of 2006 was a "lower-key" summer for **Paul Saulnier** than usual in that for the first time in many years he did not have summer research students. Nevertheless the summer was filled with research, class prep, reading, working on the house, and a family vacation. The research consisted primarily of the use of radial distribution functions as a means to study swarming behavior in nature. A manuscript describing experiments, related to this topic, was conditionally accepted for publication by the Journal of Limnology and Oceanography Methods. Revisions to this manuscript were undertaken. Paul also did a fair amount of reading on such topics as mathematical methods in ecology, poetry, film history, and film genre studies.

This year Paul continues to serve as the pre-engineering advisor in the physics department. His service outside of physics includes the Provost search committee, the faculty Personnel committee, and as coordinator/host of faculty Shop Talks. Paul will once again be looking for students to conduct research with him during the upcoming academic year. His research projects consist of sonoluminescence, speckle statistics, and the use of radial distribution functions as a means to study swarming behavior in nature. Sonoluminescence involves the production of light from sound waves, speckle statistics entails measuring speckle intensity statistics as a function of polarization, and the bio-physics project involves using radial distribution functions to investigate the organizational structure of zooplankton swarms in response to different experimental conditions.

Gustavus Physics Graduate Awarded NSF Research Fellowship

Cory Christenson ('05) was recently awarded a National Science Foundation Graduate Research Fellowship. While about 1000 such awardees are selected each year from a pool of around 10,000 applicants in all the science disciplines, this year only 50 students nationwide received an award in physics. The aim of the NSF Graduate Research Fellowship Program is to "invest in graduate education for a cadre of diverse individuals who demonstrate their potential to successfully complete graduate degree programs in disciplines relevant to the mission of the National Science Foundation".

Cory is about to begin his second year of physics graduate study at the University of Arizona. He writes, "My research proposal is on 'Climbing the Jaynes-Cummings Ladder,' in the Cavity QED subdiscipline of Quantum Optics. Our group is called Quantum NanoOptics of Semiconductors, which gives you an idea of the fields involved. My advisor is Dr. Hyatt M. Gibbs in the College of Optical Sciences (though I am technically a student in Physics)."

CORY CHRISTENSON ('05)

The award of $40,000 a year will enable Cory to pursue this exciting research, and he cites his previous undergraduate research experience at Gustavus (with **Paul Saulnier**) and a summer internship at the University of Wyoming as key factors in obtaining it. Congratulations, Cory!

Summer Internships

(Continued from page 13)

one form or another, and then used during peak consumption times. This summer I completed a cost-benefit analysis on six storage systems: batteries, compressed air, hydrogen, flywheel, pumped hydroelectric, and superconducting magnetic energy storage. I also helped build small models of some of the systems. The hydrogen and battery systems showed the most promise. With continued improvements in hydrogen storage technology, a fuel cell based system would be a good fit. The vanadium redox batteries are a newer technology which would fit a medium scale project very well. It is expected that these systems should become more affordable in the next few years."

Nate Souther ('07) was in the undergraduate summer research program in the physics department at the University of North Dakota. Nate writes: "I've been busy. The project I'm working on is entitled Negative Index of Refraction. One of the requirements for an object to have a negative index of refraction is for it to have a negative permittivity; that's where I come in. I have designed and built a photonic crystal with a plasma frequency at 15 GHz. Thus the propagation constants for frequencies above 15 GHz are real and those below are imaginary. I will try to experimentally verify this by sending microwaves through a photonic crystal and measuring the attenuation of the waves. My summer included a lot of reading and time sitting at a computer; however, I am also now getting to do hands on experiments. I also had great opportunities not related to my project. These included tours of facilities such as Argonne National labs, the Energy and Environmental Research Center and we will soon be going to the Soudan Mines particle-detector laboratory. These trips as well as numerous lectures offered a very broad learning experience."

"THESE TRIPS AS WELL AS NUMEROUS LECTURES OFFERED A VERY BROAD LEARNING EXPERIENCE."

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A large percentage of Gustavus physics majors complete at least one summer research internship before they graduate. These experiences usually take place in the summers following the sophomore or junior years, although some programs do accept first-year students.

Such an experience is valuable, both as a resume builder in applications for jobs and graduate schools, and as an opportunity to experience the realities of a potential research career in various disciplines. Some students use multiple research internships in different disciplines to help decide, for example, between pursuing post-graduate opportunities in physics versus those in engineering.

For more information on obtaining a summer internship in the coming year, students are urged to contact **Tom Huber**, who is the department's coordinator of internship opportunities. The department also maintains a bulletin board of internship opportunities on the wall outside Olin Hall rooms 206 and 207 (a.k.a. the sophomore and junior student offices).

Study Abroad Opportunities

Gustavus has one of the highest percentages in the country of students who choose to study abroad during their college career. For physics majors, careful planning for a study abroad experience is essential, given the highly sequential nature of the courses required for the major and for adequate graduate-school or career preparation. There are several study- abroad programs available that can integrate more easily with our major.

The semester- or year-long program with the physics department at the University of Wollongong in Australia allows students to take a full range of physics courses. There are also programs at the University of Lancaster, England, and the Gustavus exchange program with the Science University of Malaysia. None of these programs requires any knowledge of a foreign language, and courses may be taken to fulfill both physics-major and general-education requirements.

Students interested in studying abroad should talk with their academic advisors. For more information contact the Office of International Education,

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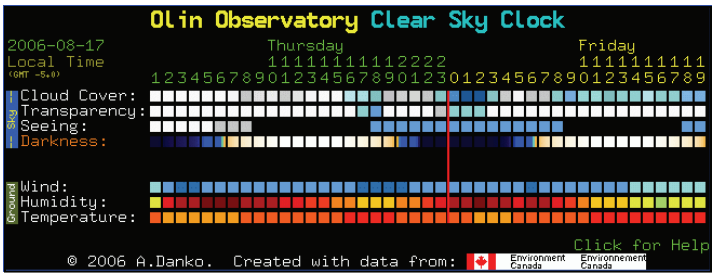
Olin Observatory

Located on the 4th-floor roof of Olin Hall, and accessible from either the elevator in the main lobby or the east staircase, the Olin Observatory will be open Sunday, Tuesday and Thursday evenings throughout the fall semester (weather permitting) and Sunday through Thursday evenings in the spring semester. Observatory assistants are available to help students, faculty, staff and members of the general public to view astronomical objects through the physics department's binoculars and telescopes.

The observatory is equipped with six computer-controlled Meade LX-200 10" telescopes which can be deployed on the Olin roof platform, and a 3-meter Observadome on the roof houses a computer-controlled Meade LX-200 16" scope for viewing deep-sky objects.

Everyone is invited to take a break from studying in the evenings and to come view the Moon, planets, and a host of nebulae and galaxies. If you bring your digital camera, you may even take pictures through the scopes.

As weather and cloud conditions are variable and often unpredictable, you are advised to check the website: `http://physics.gac.edu/~chuck/astro/` for up-to-date opening/closing information. That site will also provide a link to our latest tool, a "clear sky clock", which uses current



meteorological forecasts to predict the quality of visibility over the next two days. Check it out, and plan your next trip to the observatory soon!

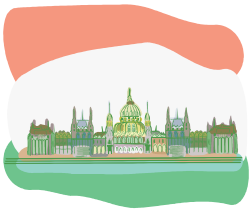
Studying Abroad

(Continued from page 17)

located in the International Center next door to Olin Hall. Their study-abroad coordinator is April Valentine (x7546).

This past spring, physics and math double major **Peter Overholser ('07)** spent the semester in Hungary. Peter writes, "The word 'Budapest' is more and less than a place name to me: It means more because of the subtle enormity of Budapest's impact on my thought, and less because I saw enough of it to realize I know nothing of it. The city itself is ideal in its foreignness. From an American point of view, it is strange enough to provoke some genuine consideration, while sufficiently familiar to be at least mildly accessible. Taken as objectively as possible, Budapest is quite a pleasant city. It is a sparkling gem of outstanding architecture and attractive natural surroundings. It is also well suited for the student: prices are dirt cheap but on the rapid increase, the location in Europe is ideal for travel, and public transit is exceptional. I found people to be kind, generous and dour as a general rule. Hungarian culture is quite unique and has survived unaccountably well throughout the trials of the past century.

Budapest Semesters in Mathematics, the reason for my stay in that foreign capital, is notable in its instructional effectiveness. Professors are exceptional, classmates gifted, and topic material adequately challenging as a general rule. However, the academic rigor was made possible at the price of relative cultural isolation so as to not overly upset our fragile equilibria (we are aspiring mathematicians, after all). That said, I feel that I can recommend the program without reservation for what it is: an opportunity for the development of intuition and maturity, mathematical and otherwise. Because of the fact that BSM course material may be difficult to apply in undergraduate level physics, the decision to attend the program is one which should be carefully considered. However, I found it to be a good one."



January Term 2007 Courses

Physics department faculty will teach three very different courses in the coming January Term.

Dennis Henry will teach PHY310, Electronics and Instrumentation II. This is our capstone course in electronics and instrumentation, which requires successful completion of courses in experimental modern physics (PHY305) and analog and digital electronics (PHY270/271). This course is built around a core of experiments in sequential logic, active filters, phase-locked loops, and interference mitigation, as well as a significant student-originated project. The thematic emphasis this year will be on the physics of communications electronics and the practice of electromagnetic compatibility in a research environment.

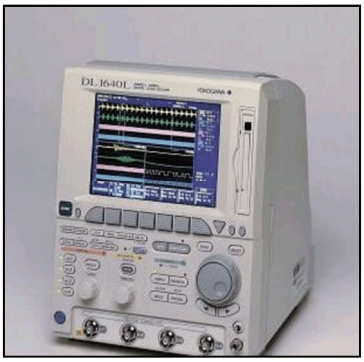
Tom Huber will teach PHY235, Robotics Workshop. Students will work in teams to design, build, and program robots. At the end of this hands-on course, these robots will compete in a public tournament. The students will design and construct the robots from provided parts (Legos), will choose appropriate sensors and effectors, interface them to on-board computers, and program the robots to compete effectively in the course tournament. All students are expected to have some background in lego construction, electronics, or computer programming. One third of the places in the course will be reserved for students with significant experience with computer programming. These places will require instructor's permission for registration.

Amihan Huesmann (introduced in the article on page 1) will teach an Introduction to Climate Science. The goal for this course is two-fold: first, for students to be able to understand current climate-related discussions in popular media and books (the scientific process, the distinction between weather and climate, the general circulation of the planet, climate forcings, the ozone hole, El Niño/La Niña, radiative transfer and the greenhouse effect, etc.); second, for students to be comfortable seeking out reliable information for themselves. Although the main goal of the course is to discuss current climate science in a more qualitative fashion, the discussion necessarily requires understanding basic mathematical concepts such as time rates of change, algebra, and (ideally) calculus Some homework assignments may require the use of a spreadsheet program, such as Excel.

January Term registration will take place from October 30-November 2. Please talk to the instructor if you have further questions about any of these courses. And, be sure to meet with your academic advisor to discuss J-Term options before the registration period begins.

New Lab and Classroom Equipment Purchased

The department has received ten new Yokogawa DL1620 digital dual-channel oscilloscopes for use primarily in introductory laboratories and in classroom demonstrations. These units will largely replace the Tektronix 2215 series analog CRT scopes which have given yeoman service for over 24 years. The investment of about $23,000 was made possible by a special allocation of $10,000 from the Dean of Faculty Office, combined with alumni gifts and various departmental budget lines, spread over two fiscal years. **Tom Huber** led the department in reviewing all options for the demanding needs of our instructional labs, and in securing a very substantial academic discount for these normally $4,000 units. **Dennis Henry** and **Jim Miller** are revising the relevant lab experiments to take advantage of the new capabilities offered by these outstanding instruments. Among their new features are the ability to connect directly to any VGA display, as well as to the Ethernet, printers, and USB devices.



Students will see other changes in the second-floor labs and in the Olin 216 classroom, which is now equipped for video projection from a PC or various media. The computers in the 217, 221 and 224 labs have seen the replacement of 15" CRT monitors with new 17" LCD displays. After years of waiting for the technology of the liquid crystal displays to reach the level of viewing angle, brightness, contrast and speed needed for our labs, we have taken the plunge. However, they do have the liability that pixels are easily damaged, so we will be cautioning users **not to touch the screens**. The costs for these two projects were shared with the College's Instructional Infrastructure Advisory Committee.

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Editor's Note: This Newsletter is issued at the beginning of the fall semester for the benefit of current and prospective students, alumni, faculty and others interested in the physics program.

Students enrolled in the major course sequence will also be receiving copies of the current physics curriculum and advising guide and a users' guide to the physics software on the department's computer network. This fall Juniors and Seniors will receive copies of the AAPT brochure "Planning for Graduate Studies in Physics and Related Fields", written by Dennis Henry.

All students are reminded to make an appointment to visit with their faculty advisor early in the fall semester, to discuss study abroad, January and Spring registration, or any other items of mutual interest.

Gates to Spend Spring 2007 as Rydell Professor

Dr. Sylvester James Gates, Jr., who is the John S. Toll Professor of Physics at the University of Maryland, has agreed to come to Gustavus during spring semester 2007 under the auspices of the Robert E. and Susan T. Rydell Professorship .

The Rydell Professorship at Gustavus Adolphus College is funded by Drs. Robert E. and Susan T. Rydell and aims to bring Nobel laureates and Nobel Conference presenters to the College for extended residencies.

DR. SYLVESTER JAMES GATES, JR.

Professor Gates combines a passion for education with an expertise in theoretical physics and, in particular, "superstring theory".

Dr. Gates completed both his undergraduate education (two B.Sc. Degrees: one in mathematics, the other in physics) and graduate education at the Massachusetts Institute of Technology. His Ph.D. (physics, 1977) was conferred for studies of elementary particle physics and quantum field theory. Thus began his research into the topic known as "supersymmetry". His postgraduate studies included positions at Harvard and Caltech. Faculty appointments began at MIT and later continued at the University of Maryland at College Park (1984-present). From 1991-1993, he was on leave of absence and served as Physics Professor and Departmental Chair at Howard University. In July, 1998 he was named the first John S. Toll Professor of Physics and thus the first African-American to hold an endowed chair in physics at a major research university in the U.S.

His research, in the areas of the mathematical and theoretical physics of supersymmetric particles, fields and strings, covers topics such as the physics of quarks, leptons, gravity, super and heterotic strings and unified field theories of the type first envisioned by Albert Einstein. Dr. Gates travels widely, speaking at national and international scientific meetings.

His visit to Gustavus as a participant in the 2005 Nobel Conference (see page 8) electrified and energized the audience, and we look forward to the exciting opportunities his spring 2007 visit will bring to our campus. Current plans are for Professor Gates to team-teach a course entitled "Superstring/M-theory: The DNA of Reality?" He says, "My idea is that this really is a course for non-physicists, principally, that would use the example of string theory to give the students insights into how fundamental theoretical science works."

Stay tuned this fall as details of Professor Gates' Spring 2007 course are finalized.

"MY IDEA IS THAT THIS REALLY IS A COURSE FOR NON-PHYSICISTS, PRINCIPALLY, THAT WOULD USE THE EXAMPLE OF STRING THEORY TO GIVE THE STUDENTS INSIGHTS INTO HOW FUNDAMENTAL THEORETICAL SCIENCE WORKS."

WE'RE ON THE WEB!
HTTP://PHYSICS.GAC.EDU