

Physics



Old Dominion UNIVERSITY

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Welcome from the Chair



I would like to take the opportunity in this very first edition of our alumni newsletter to greet each of you and reacquaint you with the Department of Physics at Old Dominion University. Things are changing so rapidly on campus that even if you graduated last year, you would see big differences if

you were to visit. If it has been several years since you were here, you most certainly would not recognize it as the same place! Of course the physical changes are easily noticeable, but you would have to visit to really see what we have become, and I cordially invite you to do so.

Gail Dodge

Earth Day was celebrated by a joint open house with the Department of Ocean, Earth and Atmospheric Sciences. Several hundred visitors toured our facilities, including kids of all ages!



About this Newsletter

This newsletter will be published three times per year. Its purpose is to establish and maintain a line of communication with our alumni and friends. Lots of great things are happening in physics at ODU and we want to help make you a part of them. We would also like to hear from you. In each issue we will feature an alumnus in addition to a current student and a faculty member and we invite you to submit your name for inclusion.

News/ What's Happening

The most obvious thing happening is that construction has begun for the addition of the new physical sciences building (shown below) which will finally allow all of our department to be together under one roof. The Nuclear Experimental Group will be housed there along with AMO Experimental labs. The building will also provide space for a central large instrumentation facility, chemistry and biology research space, and offices for the Dean.



Artist's rendition of PS building as attached to existing OCNPS on the right. Note bridge walkover to MGB on the left.

Recent Faculty Awards A Great Year for Physics!

Charles Hyde-Wright was elected as an APS Fellow. With his election we now have nine APS Fellows! (see more on the next page) Charles also received the Gene W. Hirschfeld Faculty Excellence award this year.

Rocco Schiavilla has just received the distinction of Eminent Scholar; Rocco was also selected as the recipient of the 22nd Faculty Research Achievement Award.

Des Cook has been appointed University Professor for his outstanding contribution to teaching.

Mark Havey was named Arfken Scholar in Residence at Miami (Ohio) University.

Gary Copeland received the prestigious Tonelson Award for Educational Excellence.

Larry Weinstein received the Distinguished Teaching Award from the College of Sciences.

Alumnus in the Spotlight

Dr. Linda L. Vahala, Ph.D. in Physics, 1983



The Department of Physics recently celebrated the 25th anniversary of the inauguration of the Ph.D. program in physics (1980) at Old Dominion University. Dr. Linda L. Vahala was the first graduate from the new doctoral program, and so it is fitting that she is the first alumnus featured in the inaugural issue of the Physics Department Alumni Newsletter. Dr. Vahala is a 1979

bachelor of science graduate from the University of Illinois. After earning an M.S. degree from the University of Iowa, Dr. Vahala joined the Old Dominion physics department. Her dissertation research in atomic physics focused on a theoretical description of how laser light can be used to control atomic or molecular collisions. Dr. Vahala's research mentor was Dr. Mark Havey of the ODU physics department; they collaborated with Dr. Paul Julienne at the National Institute of Standards and Technology.

Dr. Vahala is presently an associate professor of electrical and computer engineering at Old Dominion University, and serves as an associate dean in the Frank Batten College of Engineering and Technology. As an associate dean, she is responsible for oversight of graduate and undergraduate student and academic affairs.

In addition to her administrative duties as Associate Dean, Professor Vahala maintains a dynamic program of research in theoretical plasma and atomic physics. Her program involves a number of graduate and undergraduate students, and many collaborators from Old Dominion and other institutions around the world. On the practical side of her research, Dr. Vahala is involved in applied engineering studies of how wireless computers and cell phones can interfere with safe aircraft operation. In a more futuristic part of her scientific efforts, Dr. Vahala is part of a team concerned with development of specialized computer codes for next-generation quantum computing machines.

Answers to Physics on the Back of an Envelope:

- 1) Yes. There are about 6 billion (6×10^9) people in the world. At about 5 people in a square meter, we need 10^9 m² or 10^3 km². That's the area of Virginia Beach!
- 2) The continent has a volume $V = 4000 \text{ km} \times 5000 \text{ km} \times 50 \text{ km} = 10^9 \text{ km}^3 = 10^{18} \text{ m}^3$. Earth has a density between 1 (water) and 10 (iron) tons/m³ so the mass is $M = 3 \times 10^3 \text{ kg/m}^3 \times 10^{18} \text{ m}^3 = 3 \times 10^{21}$ kg. The speed is only $v = 1 \text{ cm/year} \times (1 \text{ year} / 3 \times 10^7 \text{ s}) = 3 \times 10^{-10} \text{ m/s}$. Thus $KE = \frac{1}{2}mv^2 = \frac{1}{2} \times 3 \times 10^{21} \text{ kg} \times (3 \times 10^{-10} \text{ m/s})^2 = 150 \text{ J}$. That's only a few seconds of output from a light bulb. Not much.
- 3) At 2000 food calories/day (and 4000 J/food calorie), we eat 3×10^9 J/year. Our cars use about 750 gallons/year = 3000 l/year. At 3×10^7 J/liter, each car uses 10^{11} J/year. Thus cars use 30 times more energy than people. We won't need 30 times more cropland for cars since we have to include animal feed too, but we would certainly need several times more cropland than we already use. Consider the environmental impact of that!

Featured Faculty

Professor Charles Hyde-Wright

Charles Hyde-Wright, professor of physics at Old Dominion University and a researcher at the Thomas Jefferson National Accelerator Facility in Newport News, has been elected a **Fellow of the American Physical Society**.

No more than one-half of 1 percent of the APS membership become Fellows each year. Nine of ODU's 25-member physics faculty are Fellows.

Hyde-Wright's work involves a new way of studying matter at its fundamental level. The fellowship citation notes his development of virtual Compton scattering as a probe of the structure of the nucleon. Experiments he has coordinated at the Jefferson Lab atom smasher involve high-energy photon-on-proton collisions that reveal what he describes as "the wiggling internal structure" of the proton. Protons and neutrons—the building blocks of the atomic nucleus—are nucleons composed of three quarks each.

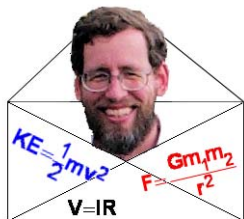
Hyde-Wright joins these other APS Fellows from the ODU physics department: Mark Havey, professor and eminent scholar; Anatoly Radyushkin, professor and eminent scholar; Rocco Schiavilla, professor and eminent scholar; Jay Wallace Van Orden, professor and eminent scholar; Lepsha Vuskovic, professor; Lawrence Weinstein, professor; Colm Whelan, professor and eminent scholar; and Bernard Mecking, Jefferson Lab professor of physics.



Professor Charles Hyde-Wright (center) with Dr. Kees de Jager (left) and Dr. Larry Weinstein (background), at a wine and cheese reception in Hyde-Wright's honor.

Course Attraction

Physics 309, Physics on the Back of an Envelope



- *Would the world's population fit into Virginia Beach?
- *How much kinetic energy does a drifting continent have?
- *How much extra cropland would be needed to replace all our gasoline with ethanol?

These and other questions are answered in **Physics 309, Physics on the Back of an Envelope**. Ten students and Professor Weinstein brainstorm real-world questions that require real-world inputs. We try to get an answer within an order-of-magnitude without using calculators. In the process we develop physical intuition and an understanding of large numbers.

These questions will also be the subject of a forthcoming book by Larry Weinstein and John Adam, published by Princeton University Press.

(Answers are located on the preceding page.)

Research Highlights

Members of the ODU Nuclear Physics Group (Dr. G. Dodge, Dr. S. Kuhn, Dr. S. Bültmann, graduate students Jixie Zhang and Slava Tkachenko, and undergraduate student Peter Bradshaw) are collaborating on a Jefferson Lab experiment named "BoNuS" that recently took data with a novel slow proton detector (a "radial time projection chamber"). This RTPC was built, tested and commissioned with strong ODU involvement. The detector and the experiment are featured in a recent JLab newsletter, On Target. For more JLab info see: http://www.jlab.org/news/news_letter/2006/20060322/index.html#pocket

Professor Desmond Cook recently expanded his research program involving conservation of the two Civil War vessels, USS Monitor and CSS Hunley. In addition to his corrosion research on wrought and cast iron artifacts, he is now working with organic materials, particularly waterlogged wood contaminated with sulfur and chlorine. He travels regularly to perform X-ray Absorption Near Edge Spectroscopy (XAFS/XANES) at the synchrotron facilities at SPring8 (Osaka), and Photon Factory (Tokyo), and Stanford Synchrotron Radiation Laboratory, (California), to identify and study the iron and sulfur compounds formed due to prolonged deep ocean exposure. For more information see: <http://www.physics.odu.edu/dcook/dcook.htm>

Student Activities

SPS trip to NRAO Green Bank

Society of Physics Students Peter Bradshaw, Jan Drake, Jim McGhee, Carolyn Wall, Eric Stauffer and Jessica Sapiro accompanied by Dr. Paul Ulmer and Lab Technician Tom Hartlove, visited the National Radio Astronomy Observatory in Green Bank, W.Va. During their visit they

learned about radio astronomy by engaging in a variety of activities ranging from observing with optical telescopes to taking data using the 40-foot student radio telescope and touring



the facility, which is located in the nation's only Radio Quiet zone (the facility regulates all man-made signals within the area, including cellular phone towers, radio stations and even personal appliances). Students received instruction on operating and collecting data with the 40 foot telescope and took data by measuring the intensity of the neutral hydrogen from various sources. Neutral hydrogen emits radio waves at 1420.4 MHz. By selecting different slices of the 60 MHz passband in 10 kHz steps, a spectrum was generated for each object. The idea is similar to recreating an apple by combining individual slices of the fruit. From the Doppler shift of these frequencies, the speed at which the object is moving away from or toward the Earth can be deduced. By analyzing such data we can determine the "rotation curve" of the galaxy: the rotational velocity as a function of distance from the galactic center. The rotation curve is directly related to the distribution of matter within the galaxy. It is from such data that physicists speculated that there is invisible matter, so called "dark matter," which is needed to restore agreement between the data and Einstein's theory of gravity.

Jack Mills was selected as Outstanding Senior for 2005-06.

Robert Horn received the Lillian and Clifford Adams Scholarship.

Peter Bradshaw received honorable mention for his poster at the Annual Research Exposition.

The **Physics Graduate Student Association** was established this year to foster interaction and a sense of community among graduate students. Its first president is Mike Shaffer. The PGSA was a co-sponsor, with fellow associations in biology and bio-medical sciences, of the first Spring Symposium.

Sharon Careccia was awarded the best overall paper.

Jan Drake was awarded the best physics presentation.