



#### August 19, 2011

# **Modeling Plant Metabolism To Optimize Oil Production** *Computational studies aim to increase use of plant oils as renewable resource*

Scientists at BNL have developed a computational model for analyzing the metabolic processes in rapeseed plants — particularly those related to the production of oils in their seeds. Their goal is to find ways to optimize the production of plant oils that have widespread potential as renewable resources for fuel and industrial chemicals.

The model, described in two "featured articles" in the August 1, 2011, issue of the *Plant Journal*, may help to identify ways to maximize the conversion of carbon to biomass to improve the production of plant-derived biofuels. This work was supported by the DOE Office of Science.

"To make efficient use of all that plants have to offer in terms of alternative energy, replacing petrochemicals in industrial processes, and even nutrition, it's essential that we understand their metabolic processes and the factors that influence their composition," said Jorg Schwender Biology Department, who led the development of the model with postdoctoral research associate Jordan Hay, also of Biology.

In the case of plant oils, the scientists' focused attention on seeds, where oils are formed and accumulated during development.

"This oil represents the most energy-dense form of biologically stored sunlight, and its produc-



tion is controlled, in part, by the metabolic processes within developing seeds," Schwender said.

One way to study these metabolic pathways is to track the uptake and allotment of a form of carbon known as carbon-13 as it is incorporated into plant oil precursors and the oils themselves. But this method has limits in the analysis of largescale metabolic networks such as those involved in apportioning nutrients under variable physiological conditions.

"It's like trying to assess traffic flow on roads in the United States by measuring traffic flow only on the major highways," Schwender said.

To address these more complex situations, the Brookhaven team constructed



Developing embryos after being excised from a growing rapeseed plant. Embryos accumulate seed oils, which represent the most energy-dense form of biologically stored sunlight, and have great potential as renewable resources for fuel and industrial chemicals.

a computational model of a large-scale metabolic network of developing rapeseed (*Brassica napus*) embryos, based on information mined from biochemical literature, databases,... *See Plant Oils on p. 2* 

# North, South, East, West — Students Study What Rides the Wind Over Long Island

Five college students from around the country have traded the lazy, hazy days of summer for an opportunity to analyze the haze itself.

During their 10-week internship in programs administered by BNL's Office of Educational Programs, these students participated in a campaign to measure the concentration, chemical composition, size, shape, and optical properties of tiny particles in the atmosphere called aerosols. This work at BNL is supported by DOE's Atmospheric Radiation Measurement (ARM) program. Aerosols arrive in the atmosphere from many different starting points — both natural and anthropogenic. They come from the burning of fossil fuels, from ocean mist and desert dust, from factory emissions, and from volcanic activities. Some are formed directly in the atmosphere from plant and human emissions. "Aerosols are neither altogether good nor bad, but they're very important for environmental scientists to try and understand," says Danielle Weech, University of Illinois, a Science Undergraduate Laboratory Internship (SULI) stu-





Brookhaven physicists Stuart Wilkins (left) and John Hill at NSLS beamline X1A2, where their research was performed with a new soft x-ray scattering facility.

# Rare Coupling of Magnetic And Electric Properties In a Single Material

Researchers at BNL have observed a new way in which magnetic and electric properties — which have a long history of ignoring and counteracting each other — can coexist in a special class of metals. These materials, known as multiferroics, could serve as the basis for the next generation of faster and energy-efficient logic, memory, and sensing technology.

The researchers, who worked with colleagues at the Leibniz Institute for Solid State and Materials Research in Germany, published their findings online in *Physical Review Letters* on July 25, 2011. This work was supported by the DOE Office of Science.

Ferromagnets are materials that display a permanent magnetic moment, or magnetic direction, similar to how a compass needle always points north. They assist in a variety of daily tasks, from sticking a reminder to the fridge door to storing information on a computer's hard drive. Ferroelectrics are materials that display a permanent electric polarization — a set direction of charge — and respond to the application of an electric field by switching this direction. They New multiferroic mechanism could lead to next-generation memory and sensing devices

are commonly used in applications like sonar, medical imaging, and sensors.

"In principle, the coupling of an ordered magnetic material with an ordered electric material could lead to very useful devices," said one of the paper's authors, Stuart Wilkins of BNL's Condensed Matter Physics & Materials Science Department (CMPMS). "For instance, one could imagine a device in which information is written by application of an electric field and read by detecting its magnetic state. This would make a faster and much more energy-efficient data storage device than is available today."

See Multiferroic Device on p.2

# BSA Distinguished Lecture, 9/8 Using the Sun's Energy To Power the World

Students who studied aerosols and the environment with mentors Stephen Springston (second from left) and Art Sedlacek (right) are: (from left) Danielle Weech, Tony Aguirre, Erica Schreiber, Stephanie DeJong, and Agossa Segla.

dent. "On one hand, aerosols play a major role in causing cloud formation and reducing solar radiation, which helps provide an overall 'cooling' effect for our planet. But on the other, some types of aerosols contribute to global warming by absorbing the sun's heat rather than bouncing it back to space."

Currently, atmospheric scientists know a lot more about how greenhouse gases like carbon dioxide and methane affect the environment than they do about the role — that is, the many roles —aerosols play.

"Some aerosols act as direct influences on climate change by limiting or enhancing solar radiation, but others have a more indirect effect," says Erika Schreiber, a SULI student from Cornell University. "Aerosols provide particles for water droplets to cling to in the air, which is how clouds form, and clouds deflect sunlight. Then, if too many particles are concentrated in the same cloud, water molecules can't form droplets big enough to rain down. This... See Aerosol Study on p.3

Daniel Nocera, a Massachusetts Institute of Technology (MIT) professor whose recent research focuses on solar-powered fuels, will give a BSA Distinguished Lecture titled "Harnessing Energy from the Sun for Six

Billion People — One at a Time," on Thursday, September 8, at 4 p.m. in Berkner Hall. BSA Distinguished Lectures are sponsored by BSA, the company that manages BNL, to bring topics of general interest before the Lab community and the public. The lecture is free, and no preregistration is required. Visitors to the Lab 16 and older must bring a photo ID.

Nocera will explain that the world population is expected to double by 2050, increasing to about six billion people, mainly



from developing nations. Global energy consumption is expected to rise from 14 to 30 terawatts, or trillion watts.

Nocera suggests that building small, "personalized" energy systems that rely on the

sun's energy will be an economical, efficient, and environmentally friendly way to meet these ever-increasing energy needs.

He and his research team have found a way to harness solar energy through artificial photosynthesis — mimicking the way plants turn sunlight into energy. They have developed a device called an "artificial leaf" that can be used to power a home in the developing world. Made of nickel, silicon, and cobalt, the device is smaller than an oak leaf. *See BSA Lecture on p.3* 

#### The Bulletin

August 19, 2011

## CALENDAR

 The BERA Store in Berkner Hall is open weekdays from 9 a.m. to 3 p.m. For more information on BERA events, contact Andrea Dehler, Ext. 3347, or Christine Carter, Ext. 2873.

#### – REGULARLY –

Weekdays: Free English for Speakers Of Other Languages Classes Beginner, Intermed., Adv. classes, various times. All welcome. Learn English, make friends. See http://www.bnl.gov/esol/schedule. asp for schedule. Jen Lynch, Ext. 4894.

**Mondays & Thursdays: Kickboxing** \$5 per class. 12:15–1:15 p.m. in the gym (Bldg. 461). \$5 per class. Ext. 2873.

Mon., Tues., Thurs., & Fri.: Tai Chi Noon-1 p.m., B'haven Cntr (Bldg. 30), N. Rm. Adam Rusek, Ext. 5830, *rusek@bnl.goy*.

Tues.: Hospitality Welcome Coffee On hold until September.

Tuesdays: Zumba On hold until September

**Tuesdays: Knitting Class** On hold until September.

Tuesdays: Toastmasters Two monthly meetings: 1st & 3rd Tuesdays, 5:30 p.m., Bldg. 463, Room 160. Guests and visitors welcome. http://www.bnl.gov/ bera/activities/toastmsr/.

Tuesdays & Thursdays: Aerobic Fitness On hold until September.

**Tues., Wed., & Thurs.: Rec Hall Activities** 5:30–9:30 p.m. in Bldg. 317. General activities, TV, ping pong, chess, games, socializing. Christine Carter, Ext. 5090.

**Tuesday & Thursday: Aqua Aerobics** On hold until September.

Wednesdays: Ballroom Dance On hold until September.

Wednesdays: Pilates On hold until September

Wednesdays: Play Group On hold until September.

Wednesdays: Yoga Noon-1 p.m., B'haven Center (Bldg. 30). Free. Ila Campbell, Ext. 2206, *ila@bnl.gov*.

**1st Wednesday of month: LabVIEW** 1:30–3 p.m., Bldg. 515, 2nd fl. Seminar Rm. Free technical assistance from LabVIEW consultants. Ext. 5304, or Terry Stratoudakis, (347) 228-7379.

**Thursdays: BNL Cycletrons Club** 5 p.m., Brookhaven Center. First Thurs. of month. Andy Mingino, Ext. 5786.

Thursdays: Reiki Healing Class Noon–1 p.m., Call for location. Nicole Bernholc, Ext. 2027.

Thursdays: Postdoc Social Night 6:30 p.m. ASAP Lounge (Bldg. 462). www.bn. gov/asap.

Thursday: Judo Class 7:30 p.m. Gym (Bldg. 461). Tom Baldwin, Ext. 4556.

Fridays: Family Swim Night 5–8 p.m. Pool (Bldg. 478). \$5/family. Ext. 2873.

#### Multiferroic Device from p. 1

But multiferroics — magnetic materials with north and south poles that can be reversed with an electric field — are rare in nature. Ferroelectricity and magnetism tend to be mutually exclusive and interact weakly with each other when they coexist.

Most models used by physicists to describe this coupling are based on the idea of distorting the atomic arrangement, or crystal lattice, of a magnetic material, which can result in an electric polarization.



# **BNL's Most Recent Spotlight Award Honorees**

For extending extraordinary efforts in response to the needs of their departments or divisions, the following 239 BNL employees, including those pictured above, were among those honored with Spotlight Awards during 2010:

Basic Energy Sciences Directorate: Rita Nicholaides

Biology Department: Kathryn Folkers, James Jardine, Eileen Kasmarcik, Irene Rosati, Grace Shea-McCarthy, Tao Wang, Ke-Wei Zhang

**Budget Office:** Donna Chiossone, Shantilata Subudhi

**Center for Functional Nanomaterials:** Ed Baker, Lois Caligiuri, Pam Ciufo, Lorraine Davis, David Elling, Donald Elliott, Arthur Piper, Joann Tesoriero, Judith Thompson, Grace Webster

**Chemistry Department:** Linda Sallustio, Lee Walcott

#### **Collider Accelerator Department:**

John Addessi, Zeynep Altinbas, Edward Bajon, Oluwafemi Bamgbose, Jack Barry, Charles Bloxon, Tracv Blydenburgh, Steve Bubka, Patrick Bynum, Marty Candito, Richard Conte, Timothy Costanzo, Tony Curcio, Gary Danowski, Roger Davis, Joe DeCicco, Mitch DeLaVergne, Lynanne DiFilippo, Richard DiFranco, Anthony DiLieto, Frank Donato, Joseph Drozd, Bill Eisele, Arthur Fernando, Jesse Fite, Stephen Gill, Stefano Giorgio, Kenneth Hartmann, Marion Heimerle, Gregory Heppner, Terry Higgins, Robert Hulsart, Stephen Jao, Ben Johnson, Robert Karl, Kyle Kulmatycski, Ann Lamberti, Chuyu Liu, Dave Loughlin, Daniel McCafferty, Kevin Mernick, Christine Meyer, George Murdock, Frank Naase, David Nace II,

researchers' measurements show that this process is dependent upon the magnetic structure of the material, which in this case, causes the material to become ferroelectric. i.e. have an electric polarization. In other words, any change in the material's magnetic structure will result in a change in direction of its ferroelectric state. By definition, that makes the material a multiferroic. "What is especially exciting is that this result proves the existence of a new coupling mechanism and provides a tool to study it," Wilkins said. The researchers used a new instrument at NSLS designed to answer key questions about intriguing classes of materials such as multiferroics and high-temperature superconductors, which conduct electricity without resistance. The instrument, developed by Wilkins and engineers D. Scott Coburn, Photon Sciences, and William Leonhardt and William Schoenig, both of CMPMS, will ultimately be moved to the National Synchrotron Light Source II (NSLS-II), a state-of-the-art machine under construction. NSLS-II will produce x-rays 10,000 times brighter than at NSLS, for studies of materials' properties at even higher resolution.

Thomas Nolan, Pat O'Grady, Robert Olsen, John Pomaro, Al Ravenhall, Guillaume Robert-Demolaize, Erik Rydout, Steve Savatteri, Frank Scheifele, Vincent Schoefer, Robert Schoepfer, Kirk Sinclair, Ciro (Lee) Sirio, Charles Trabocchi, Vic Usack, Joel Vasquez, Jeffrey Wilke, Dan Wilson, Paul Ziminski, Christopher Zimmer, Peter Zimmerman

Community, Education, Government & Public Affairs Directorate: Rick Backofen, Nora Detweiler, Kahille Dorsinvil, John Galvin, Elaine Lowenstein, Catherine Osiecki, Kendra Snyder, Karen McNulty Walsh

Computational Science Center: Claire Lamberti

Condensed Matter Physics & Materials Science: Anthony Bollinger, Maxim Khodas, Jonathan Rameau, Arlene Rementer, William Schoenig, Jing Tao

**Director's Office:** Liz Flynn, Lillian Kouchinsky, Darcy Mallon, Doris Rueger

Energy Sciences & Technology Department: Lynda Fitz, Manuel Miranda, Damon Turney

Environmental Restoration Division: Sonya Kiss

Environmental Sciences Department: Larry Milian, William Robert Nettles

Environmental Services Division: Joy Haskins, Richard Lagattolla, Lawrence Lettieri, Robert Metz, James Milligan, Melanie Theisen, Susan Young

Facilities & Operations Directorate: Nelson Cause, Antonio Hammil, Claudia Hatton, Cheryl Ann Kuhn, Phyllis Lucas, Pamela Yerry

Finance Directorate: DJ Greco

#### Plant Oils from p.1

...and prior experimental results that set limits on certain variables. The model includes 572 biochemical reactions that play a role in the seed's central metabolism and/or seed oil production, and incorporates information on how those reactions are grouped together and interact.

The scientists first tested the validity of the model by comparing it to experimental results from carbon-tracing studies for a relatively simple reaction network — the big-picture view of the metabolic pathways analogous to the traffic on U.S. highways. At that big-picture level, results from the two methods were largely consistent, providing validation for both the computer model and the experimental technique, while identifying a few exceptions that merit further exploration. The scientists then used the model to simulate more complicated metabolic processes under varying conditions - for example, changes in oil production or the formation of oil precursors in response to changes in available nutrients (such as different sources of carbon and

Fiscal Services Division: Marge Desmond, Linda Jones, Sophia Marneris, Debra Pettit

Global & Regional Solutions Directorate: Louis Gerlach, Robert Lake, Jeanne Madaia, Lisa Morello, Maria Ohlsen

Human Resources & Occupational Medicine Division: Leesa Allen, Louisa Barone, Melissa Bittrolff, Peter Esposito, William Fortunato, Mary McGrath, Rick Morales, Starr Munson, Darlene Peragine, Christina Sanfillippo

Information Services Division: Lee Akras, Anastasia Kuczewski, Carmit Pelleg

Information Technology Division: Christine Caruso, David Cortijo

Instrumentation Division: Mary Brathwaite, Gene Von Achen

Laboratory Protection Division: Louis Figueroa

Legal Office: Carmen Alvarado

Maintenance & Fabrication Services Division: Joseph Stanisci

Medical Department: Angela Kim, Elena Shumay, Laura Thompson, Donald Warner

**Modernization Project Office:** William Bockelmann, Laurie Casarole, Thomas Sperry

National Synchrotron Light Source Department: Mary Anne Corwin, Christopher Danneil, Peter Davila, Joseph Papu, Mihai Radulescu, Wayne Rambo, Leonard Santangelo, Robert Scheuerer, Michael Schwarz, Anna Sweet

National Synchrotron Light Source Il Project: Mary Carlucci-Dayton, Joseph Cosentino, Michael Davidsaver, Christine Herbst, Barbara Moebes,

nitrogen), light conditions, and other variables.

"This large-scale model is a much more realistic network, like a map that represents almost every street," Schwender said, "with computational simulations to predict what's going on." Continuing the traffic analogy, he said, "We can now try to simulate the effect of 'road blocks' or where to add new roads to most effectively eliminate traffic congestion." The model also allows the researchers to assess the potential effects of genetic modifications (for example, inactivating particular genes that play a role in plant metabolism) in a simulated environment. These simulated "knock-out" experiments gave detailed insights into the potential function of alternative metabolic pathways — for example, those leading to the formation of precursors to plant oils, and those related to how plants respond to different sources of nitrogen.

Robert Petkus, Lydia Rogers, Bruno Semon, Yuke Tian, Patrick Zoccoli

Nonproliferation & National Security Department: Cheryll Christie, Donna Gill, Lori Happick, Thomas Roberts, Cindy Salwen, Josh Tackentien

Nuclear & Particle Physics Directorate: Elaine Zukowski

Physics Department: Maureen Anderson, Dmitry Arkhipkin, Babak Azmoun, Wayne Betts, Pamela Esposito, Bridget Geib, Christopher Hollowell, Jim La Bounty, Cynthia McQuilken, Jacqueline Mooney, Penka Novakova, Robert Pisani, Fern Simes, Kelly Smith

Procurement & Property

Management Division: Michelle Barsalone-Orlando, Phil Bernath, Jennifer Cafiero, Roseann Callister, Michael Canavan, Linda Commander, Cheryl Eleazer, Elise Forrette, Phil Gardner, Michelle Holbrook, Larissa Roupe, Janet Schlock

Quality Management Office: Joyce Fortunato, Sabine Kessler

Radiological Control: Gregory Condemi, Beth Lettieri, Pat Sullivan, Frank Zafonte

Safety & Health Services Division: Amber Aponte, Deborah Cubillo, Linda Greves

**Site Services Division:** Mel Bonanno, Martha Bryant, Joanne Rula

Superconducting Magnet Division: Raymond Ceruti, Sebastian Dimaiuta, William McKeon, Dan Oldham, Dan Sullivan

Waste Management Division: Dan Blakely, Edward Gavin, Allen Jones Steve Klerk, Holly Olsen, Joe Pavlak

Congratulations to all the honorees!

tions and pathways according to the efficiency by which the organism converts sugars into oils. So at this stage, we can enumerate, better than before, which genes and reactions are necessary for oil formation, and which make oil production most effective," Schwender said.

The researchers emphasize hat experimentation will still

Now, scientists have found a new way that electric and magnetic properties can be coupled in a material. The group used extremely bright beams of x-rays at the National Synchrotron Light Source (NSLS) to examine the electronic structure of a metal oxide made of yttrium, manganese, and oxygen. They determined that the magnetic-electric coupling is caused by the outer cloud of electrons surrounding the atom.

"Previously, this mechanism had only been predicted theoretically and its existence was hotly debated," Wilkins said.

In this particular material, the manganese and oxygen electrons mix atomic orbitals in a process that creates atomic bonds and keeps the material together. The

Kendra Snyder

"The model has helped us construct a fairly comprehensive overview of the many possible alternative routes involved in oil formation in rapeseed, and categorize particular reacbe essential to further elucidating the factors that can improve plant oil production.

"Any kind of model is a largely simplified representation of processes that occur in a living plant," Schwender said. "But it provides a way to rapidly assess the relative importance of multiple variables and further refine experimental studies. In fact, we see our model and experimental methods such as carbon tracing as complementary ways to improve our understanding of plants' metabolic pathways."

The scientists are already incorporating information from this study that will further refine the model to increase its predictive power, as well as ways to extend and adapt it for use in studying other plant systems.

— Karen McNulty Walsh

#### The Bulletin

# Meet Emily Ruppel, the Science-Writing Caricaturist DOE Launches

During the past three months, Emily Ruppel has been writing about BNL's ongoing science programs and many other aspects of life around BNL.

An intern in the Lab's Media & Communications Office through DOE's Graduate Research Internship Program (GRIP), which is administered by BNL's Office of Educational Programs - Ruppel's told the stories of students at the NASA Space Radiation Lab on site working toward solutions to protect astronauts from naturally occurring space radiation. She has also written about students training as International Atomic Energy Agency inspectors at BNL's decommissioned Medical Research Reactor, scientific breakthroughs made at DOE laboratories, and BNLers helping those less fortunate in the Town of Brookhaven and around the world.

And if you happen to see the cubicle where Ruppel has been churning out these articles for BNL's Bulletin and website, you'll see from a collection of drawings tacked to the wall that she is also a talented caricaturist. In fact, Ruppel has been drawing caricatures for seven years and even did it professionally before pursuing a master's program in science writing at Massachusetts Institute of Technology (MIT) in 2010.

"Many people have a misconception and think of caricaturists trying to bring out the worst in

Nocera will show a brief film

BSA Lecture from p.1



people by drawing them with big ears and huge noses," Ruppel said. "I don't do that. There's something unique and wonderful about every person's face. When I'm drawing someone, my intention is to make the drawing look more like they do than they do."

Hailing from Louisville, Kentucky, Ruppel has been drawing for most of her life, but she didn't start making caricatures until she worked as a cartoonist for her college newspaper at Bellarmine University. In someone's last minute scramble to find a caricaturist for a graduation celebration, she got that gig and many more after that.

"Whether I'm writing about science or drawing a caricature, I'm trying to represent something as truthfully and engagingly as

personalized energy to the developing world.

to demonstrate how the device A member of the American works. The artificial leaf is placed Academy of Sciences and the in a glass of water and is irradiated U.S. National Academy of Sciby the sun. A specially designed ences, Nocera was named in 2009 catalyst in the device enables as one of Time magazine's "100 it to split water into hydrogen Most Influential People in the and oxygen gases. The gases can World." He is a frequent guest then be combined in a fuel cell to on television and radio, and he create clean fuel and electricity. is regularly featured in popular Nocera says this simple method print publications. Nocera has can power a home in a developing been an organizer to and primary nation, using two bottles of water. author of the DOE Basic Research Nocera earned a B.S. in chem-Need workshops on hydrogen, istry from Rutgers University in solar energy, energy storage, and 1979 and a Ph.D. in chemistry catalysis. He was also the lead from the California Institute of author of several reports on en-Technology in 1984. He joined ergy for DOE and MIT. Nocera the faculty of Michigan State Unihas won numerous awards for his versity in 1983 and moved to MIT energy research, including, most as a chemistry professor in 1997. recently, the American Chemical He is currently MIT's Henry Drey-Society's Inorganic Chemistry Award (2009), the United Nations fus Professor of Energy, and the director of both the Solar Revolu-Science and Technology Award tions Project and the Eni Solar (2009), and the American Crystal-

> Wood Award (2010). — Diane Greenberg

possible, but the way I reach the finished product is different," Ruppel explained. "Once I know what the story is about when I write, I think about getting all the details right and then compile them into the whole. When I draw a caricature of someone's face, I start with the basic shapes and then work in the details."

As Ruppel's internship at BNL's Media & Communication Office draws to a close, she is on track to complete her master's program from MIT in October. She has accepted a job as a science writer for the American Scientific Affiliation, a nonprofit organization in Boston, Massachusetts, and will begin in September.

See more of her caricatures at her website: *http://smilelines.weebly.com/.* — Joe Gettler

### BERA Trips

Get tickets at BERA Store, Berkner Hall, weekdays, 9 a.m.-3 p.m. See also www.bnl.gov/bera/.

**Tue. 9/6**. US Open, Flushing. Men's Round/Women's Quarterfinal, \$70. Dep. 8:30 a.m.

**Sat. 9/10**. Cabela's, Hamburg, PA. \$20. Sports, outdoors shopping. Dep. 7 a.m.

**Sat. 10/1**. BIG E State Fair, W. Springfield, Mass. \$30 includes all but Midway carnival of rides and games, \$20. Early start.

**Sun. 10/2/** NASCAR Sprint Cup. Dover, Delaware. 40 tickets, \$100/ea. Dep. 5 a.m.

### **Pool Open and Free,** 8/29 – 9/2

The swimming pool (Bldg. 478) will be open for children and their parents to swim for free from 2 to 5 p.m. from August 29 until September 2. Parents must remain at the pool with their children.

# DOE Launches Updated Website: Energy.gov

The U.S. Department of Energy (DOE) has announced the next step of its comprehensive website reform, making *Energy.gov* a cutting-edge, interactive information platform and saving taxpayers more than \$10 million annually.

### Service Anniversaries

The following employees celebrated a service anniversary during March 2011:

– 40 Years – John Nicolellis .....C-AD

- 35 Years -

Cleveland Dodge	C-AD
Laurence Milian	Env. Scis
James Lemley	NNS
David Millener	Physics
Francine Donnelly.	Waste Mgmt

– 30 Years – Diane Cabelli.....Chemistry

Linda Hanlon	BES Dir.
Sharol Busby	Lab Prot.
Kathleen Walker	Lab Prot.
Ralph Vega	Lab Prot.
- 25 Years -	

Joseph Brennan C-AD
Barbara Carreras Bus. Ops.
Robert Lombardi Lab Prot.
Matthias Harrington Lab Prot.
Arthur Bamonte, Jr Lab Prot.
Leonard Butera Lab Prot.
Richard Ruggiero Physics
Michael Fulkerson Photon Scis
Scott Bud Photon Scis
Daniel CarneiroSite Srvcs

- 20 Years -

Wuzheng Meng	C-AD
Michael Hamilton	C-AD
Donald MacKay	Lab Prot.
Michiko Miura	Medical
Terrence Buck	HROM
Hyon-Joo Kehayias .	Physics
Charles Butehorn	Physics
Giuseppe Mondi	Site Srvcs
Joseph Nubile	Site Srvcs
Ulysses Tapley	Site Srvcs

— 10 Years —

Stephen Ferrone	Env. Prot.
Chris Ogeka	Mod. Proj.
Jerome Lauret	Physics
Marc Allaire	Photon Scis.
Catherine Connor	Rad. Contr.
Kenneth Caccavalla	Site Srvcs
Susan Santana	Staff Srvcs



### CALENDAR – WEEK OF 8/21 –

Wednesday, 8/24

#### \*BSA Noon Recital

Noon. Berkner Hall. Vocalist and Broadway star Melissa Errico will sing. Sponsored by Brookhaven Science Associates, the concert is free and open to the public. Visitors of 16 and older must carry a photo ID. See below.

#### - WEEK OF 8/29 -

#### Monday, 8/29

### **IBEW Meeting**

6 p.m. Centereach Knights of Columbus Hall, 41 Horseblock Rd., Centereach. A meeting for shift workers will be held at 3 p.m. in the union office. The agenda includes regular business, committee reports, and the president's report.

## — WEEK OF 9/5 —

#### Monday, 9/5

#### Labor Day, Lab Closed

The Lab will close today for the Labor Day holiday. No Bulletin will appear on Friday, 9/9.

#### Thursday, 9/8

\*BSA Distinguished Lecture 4 p.m. Berkner Hall. Daniel Nocera, Massachusetts Institute of Technology, will talk on "Harnessing Energy From the Sun for Six Billion People — One as a Time." The lecture, sponsored by BSA, the company that manages BNL, is free and open to the public. Visitors to the Lab 16 and older must carry a photo ID. See p.1.

Note: This calendar is updated continuously and will appear in the Bulletin whenever space permits. Submissions must be received by the preceding Friday at noon to appear in the following week's Bulletin. Enter information for each event in the order listed above (date, event name, description, and cost) and send it to *bulletin@bnl.gov*. Write "Bulletin Calendar" in the subject line.

# **Arrivals & Departures**

– Arrivais –	
David Biersach	ITD
David Brown	ES&T
Yan-Qing Ma	. Physics

#### - Departures -

Gabriella Carini ...... Photon Scis Christopher Dudley ...... C-AD Fanglei Lin ...... Physics Lisa Whitehead ..... Physics

# Pencils, Books, and Cans of Food

The back-to-school supply drive is running through August 25. Please donate notebooks, calculators, markers, etc., in the designated bins in Bldg. 400 lobby. Too many children of Brookhaven Town are in need of supplies.

Aerosol Study from p.1

...inability to precipitate increases cloud lifetime and brightness — good news for global warming — but it also disrupts the water cycle, which can have a major impact on the weather in urban environments and places with a lot of industry or volcanic activity."

Frontiers Center at MIT. In 2008,

Nocera founded Sun Catalytix, a

company committed to bringing

To test theories of how aerosols contribute to global climate change, researchers at BNL designed and built four mobile laboratories capable of conducting long-term measurements anywhere in the world. Three of these "SeaTainers" are deployed in BNL's meteorological field, part of a science measurement program and system "shake-out."

The ARM summer students are important players in a joint project between BNL and environmental researchers around the world, as they've been testing the equipment that will help scientists develop better models of how aerosols affect the environment. Since late June, they've maintained a wide variety of the instruments in the SeaTainers and collected and analyzed data on the aerosols in the atmosphere over BNL.

lographic Association's Elizabeth

"The point of putting all these instruments together in one place is to help scientists gather more of the puzzle pieces they need to see the bigger picture," says Tony Aguirre, an electrical engineering student from City College of New York, a Faculty & Student Team (FaST) program member. "We're looking at what's in the atmosphere, where it came from, and how it got there. This is a great study to do on Long Island because the air quality really changes based on the intensity of the wind and where it's coming from. Ocean aerosols have a lot of minerals, whereas wind from the city contains more carbon from emissions, and wind from the northeast brings biogenic material from plants and animals."

"Each student has been working on a different aspect of this project," says Arthur Sedlacek, a project supervisor. "They've been doing pretty much everything on their own and are well on their way to becoming real atmospheric scientists."

The students, who include SULI's Stephanie DeJong of Trinity Christian College and FaST's Agossa Segla of New York City College of Technology, used this data to help researchers at BNL characterize Long Island aerosols and test model robustness. Several plan to continue analyzing data they collected for their own projects when they return home. — Emily Ruppel

#### Vocalist Melissa Errico

Broadway vocalist Melissa Errico, fresh off an exciting summer playing opposite Jeremy Irons in *Camelot*, will sing on Wednesday, August 24, at noon in Berkner Hall. Sponsored by BSA, the concert is free and open to the public. Visitors to the Lab 16 and older must bring a photo ID.

Tony nominee Errico will be accompanied by her father, pianist Michael Errico, in a program that includes classical musical theater songs by Rodgers and Hammerstein, Irving Berlin, and Stephen Sondheim, as well as treasures by Michael Legrand from her upcoming recording Legrand Affair (produced by Phil Ramone, release date: October 18. 2011 on Ghostlight Records). Other songs will recall her starring roles in such Broadway musicals as Les Miserables and My Fair Lady. — Jane Koropsak The BNL Food Drive collects food all year round for Long Islanders in need. Bins are found in most major buildings on site.

## BNL Play Group Needs Volunteers

The BNL Children's Play Group, open to all children of BNL parents & grandparents, meets on Wednesdays from10 a.m. to noon. Helpers are needed to be part of the "team." If you are interested, please call Christine Carter, 344-5090.

## **Discounts Galore!**

BERA sponsors discounts to Splish Splash, Atlantis Marine World — now called the Long Island Aquarium and Exhibition Center — and various movies theaters. Find out more at http:// intranet.bnl.gov/bera/recreation/ or stop by the BERA Store in Berkner Hall, weekdays, 9 a.m.-3 p.m. ASSISTANT EDITOR, *Physical Review B* EOE M/F/D/V

The editors of Physical Review B seek a dynamic and personable colleague to join our group at the editorial offices in Ridge, New York, on Long Island near Brookhaven Lab and Stony Brook University. Our core responsibility is selection of manuscripts for publication, in the context of the peer review process. For this purpose, we aim to hire an Assistant Editor who has a Ph.D. and some postdoctoral experience in an area relevant to the journal (condensed matter or materials physics), and is familiar with research publication. An excellent command of written and spoken English is essential. In addition, we would welcome an interest in contributing to ongoing efforts by the APS journals to reach out to nonspecialist and general readers. No prior editorial experience is needed - we train all new editors to develop the necessary skills. With experience, an Assistant Editor assumes independent actions on submitted manuscripts. We offer career stability, a competitive salary, and an outstanding benefits package to a qualified individual ready to start a nontraditional career in physics. For general information about the American Physical Society and its journals, see w ww.aps.ord To apply, please send your resume plus cover letter containing salary requirements and timetable of availability to: Joseph Ignacio, Director of Human Resources, American Physical Society, One Research Road, Ridge, NY 11961. Email: edresumes@aps.org; Fax: 631-591-4155.

### Classified Advertisements

#### Placement Notices

The Lab's placement policy is to select the best-qualified candidate for an available position. Candidates are considered in the following order: (1) present benefits-eligible employees within the department/division and/or appropriate bargaining unit, with preference for those within the immediate work group; (2) present benefits-eligible employees within the Laboratory; and (3) outside applicants. In keeping with the Affirmative Action Plan, selections are made without regard to age, race, color, religion, national origin, sex, disability or veteran status, Each week, the Human Resources Division lists new placement notices, first, so employees may request consideration for themselves and, second, for open recruitment. Because of the priority policy stated above, each listing does not necessarily represent an opportunity for all people. Except when operational needs require otherwise, positions will be open for one week after publication. For more information, contact the Employment Manager, Ext. 2882. Access current job openings on the World Wide Web at www.bnl.gov/HR/jobs/

To apply for a position, go to <u>www.bnl.gov</u>. Select "Job Opportunities," then "Search Job List."

# OPEN RECRUITMENT – Opportunities for Laboratory employees and outside candidates.

ELECTRICIAN POSITION (LG- 10) - (Term Appointment) Under minimum supervision lays out, constructs, installs, maintains, repairs and operates (in accordance with the national electrical codes, or as otherwise directed) electrical systems, equipment, controls and related devices. May be required to perform similar duties on other than Maintenance Division equipment and facilities. Seven years of total experience composed of 5 years of apprenticeship, and 2 years of experience; or 7-9 years of total experienced composed of formal trade school plus minimum 2 years of experience or 9 years of experience preferred. Site Resources Division. Please apply to Job ID #15757.

Brookhaven National Laboratory is an equal opportunity employer committed to building and maintaining a diverse workforce.

#### Motor Vehicles & Supplies

08 YAMAHA WR250R – 4.5K mi. 6 spd, Fl dual sport/enduro, all upgraded, lg tank, new tires, 60 mpg, \$4,500 neg. shrey@bnl.gov.

81 DELOREAN GULLWING – 56K mi. orig dealer maintd, full records, driven regularly, v/gd cond. \$16,000 neg. 298-7821. CLASS III HITCH FOR HONDA CRV – new never installd 2" Curt Hitch no drillg req, blck, pic/specs, ask/\$145. Dominick, Ext. 5030.

RIMS W/TIRES – 4 RT6 Enkei 360 Rims; 6 lug; used on '99 Ddge Drngo 1 smmr, excel; 18"tires like new, ask/\$700, pd/\$1,800. 813-6583.

#### Marine Supplies

DEPTH FINDER – Hummingbird Model TCR 101, incls 2/ transducers, excel cond, \$30. Mark, Ext. 2599.

#### **Furnishings & Appliances**

ARMOIRE – \$375, like new, lt wood, w/ drawer & shelves 40"w x 21"d x 68"h, pics avail. 935-3777, lotusexp@yahoo.com.

BIKE – 9 spd/\$25, compact refri/\$15, desk/\$10, in gd cond, u-pic-up, eve & wkend. 751-6068.

CHILD'S CAR SEAT – \$15, cart/\$25, all in gd cond, call eve/wkend. 751-6068.

DESK CHAIR – black fabric upholstery, adj hght & dpth, lumbar support & arms 40. 935-3777 or lotusexp@yahoo.com.

DESK LAMP – sm w/flexible neck, gd for bdrm, college setting or hobby, \$10. Tom, Ext. 3085.

F. PRICE AQUARIUM SWING – w/water globe, chging lights, swimmg chars, mobile, 6/spd, 8/songs, 3/ocean snds, \$40, Ext. 3252. GIRL'S BEDRM ITEMs – dk pink, JC Penney curtns w/vlnces, dust rffle, jweld crtn rods, blk/pnk shoe chr, \$50/all. 612-4568. KITCHEN TABLE & CHAIRS – It Maple table w/leaf, 4 spindle back chrs, 60"x 36", excel cond, \$300. 678-3299.

OAK ENTERTAINMENT UNIT – for up to 36" TV, built in CD rack; glss displ.case w/light; 2 cabinets, pics, ask/\$175. Ext. 3102.

PATIO SET - 6 chairs w/cushions, oval shape table w/glass top and umbrella/ stand, gd cond, 325. 758-7002.

SLEIGH BED – q/size, iron, antique bronze finish, handpainted hd/ftbrd w/frame, hardware, \$275, pic avail. 395-9610.

STEREO CABINET – Black hvy duty audio component cabinet w/glass dr, excel cond/\$100. 678-3299, dgbdoug@gmail.com.

#### Audio, Video & Computers

BLACKBERRY CURVE SPRINT – purple/\$80. John, Ext. 5219, 602-614-6729 or rubinoj@bnl.gov.

CANON AE1 SLR FILM CAMERA – Sing. Lens Reflex Film Cmra, 3 Inses, 50MM F 1.4, more, \$150/all. brookhaven@optonline.net. LENOVO T60P 15.4 – 3 yr old laptop comput-

er w/blk ext, gd cond, Microsoft offc & antivirus installed, ask/\$800. Dr. Sun, Ext. 2559.

LG BLU-RAY PLAYER BD550 – new Network, Model# BD550, ask/\$90. Edward, Ext. 2278 or ebajon@bnl.gov.

TUBE TV – 13" JVC, white/\$15. Theresa, 935-3777 or lotusexp@yahoo.com.

#### Sports, Hobbies & Pets

EXERCISE BIKE – Stamina Recumbent, resistance \$70. Theresa, 935-3777 or lo-tusexp@yahoo.com.

JAYCO TRAVEL TRAILER – 2011, 29RLS loaded must sell, many opts, transferable 7 yr warr, pics avail. ask/22K. 872-5074. JET TICKETS – 2 for Aug 21 vs Bengals 7pm w/prkg; price/face value. Patrick, Ext. 8217, 872-8961 or brownep@bnl.gov. KOI FISH – 6" and up, starting at \$35, many color variations. Ray, 654-1970. WATER SKIS – youth, Obrien, excel cond, \$30. Mark, Ext. 2599.

#### Tools, House & Garden

KENMORE 50 PINT DEHUMIDIFIER – w/ auto-restart, Humidistat control/energy timer, more, \$75. Stuart, Ext. 2851, 741-6194. PATIO TABLE & CHAIRS – front gate Ig oval glass table and 6 blue mesh sling back chairs, white frames, \$125. 928-3205.

SLING BACK PATIO CHAIRS – 6/sling back Martha Stewart chairs, gd cond, brown, no table, \$85. 645-1349.

#### Miscellaneous

CHINESE VIOLIN - handmade, 8-yr., Evah

END OF SUMMER BASH - Hold the Friday, Sept. 23 date to join in the end of summer bash from 6 p. at Flaming Hearth, 756 Horseblock Rd., Farmingville. Tickets, \$10 ea. in advance, cover appetizers, DJ music. Cash bar, 50/50 raffle. Contact Charles Gardner, 219-284, chuckg@bnl.gov.

SHEN YUN PRESENTATION – The Renaissance of Chinese Culture presentation, Tues, Aug 23, 7-9pm Sachem Public Lib, 150 Holbrook Road Holbrook, NY adult room, free, all are welcome. George, Ext. 4033.

#### Free

CAT – black & white shorthair, well behaved, about 3yrs old, no papers. Warren, Ext. 2080 or wejappe@gmail.com.

PURE BREED JACK RUSSELL – 11 yr old female needs loving home, great w/kids and animals, unable to move w/owner. Sherilynne, 680-0456.

#### Wanted

ASSISTANCE – full/part time for retired couple and their two Golden Retreiver therapy dogs w/daily activities, flexible hrs, email for more info. sfrank@bnl.gov. FLOOR LAMP – for college dorm rm. Jay, Ext. 4994 or iadams@bnl.gov.

LAWN MOWER – inexpensive. Paul, Ext. 4689 or sparrow@bnl.gov.

OUTDOOR STORAGE SPACE – space needed, 30x9', fee/neg. leda05@aol.com. ROCK CLIMBING PARTNER – for indr climbing and light trad, I have several yrs of outdr experience, and want to return to climbing after a year off. Christina, cswinson@bnl.gov. SNOW MOBILE TRAILER – looking for a 2 sled open or closed trailer in gd cond. John, Ext. 4065.

VOLUNTEER ALGEBRA TUTOR – for 9th Grade, evenings, when school starts. Jill, Ext. 3173.

#### Found

FOUND KEYS ON A LANYARD – Found keys and brooktone light on black lanyard in the parking lot w. of ISB construction site. Claim them in Bldg 464 OMB Section. Ext. 3988 or ajanczew@bnl.gov.

#### For Rent or Sale

SPRING HILL, FL – priv ranch on Gulf, 70m Orlando, 45m Tampa, near beach, tennis, park, fly Islip direct, igp in Ianai, fruit trees, SW architecture, 3bdrm, 2bath, d/r, f/p, 2gar, see review.oktane. net/HouseTour/. \$950/mo. \$129,000 neg. 344-5537.

#### For Rent

LAKE RONKONKOMA – 1 bdrm apt, incl all, avail. 9/1. \$950/mo. dmcarthur@bnl.gov.

MANORVILLE – Ig studio in estate home on over 3 acres, priv, quiet, 1st flr, bright, kitchenette, full bath, pvt ent/prkg, 5 min to BNL, incl all utils & DirecTv. \$850/mo. Rick, Ext. 3005, 874-9639, rbuono@bnl.gov.

MASTIC – new 1/bdrm apt, attach full bath, fully equip new eik, new carpeting/ paint, priv ent, quiet, nice n'borhd, 8 min to BNL, walk to shop, util incl, no smkg/ pets, 1/mo sec. \$825/mo neg. 335-4907. MASTIC – 3 bdrm hse w/2 f/bath, formal *l*/r, *d*/r, f/p, fully equip new eik, new carpeting, quite & nice neighborhd 7 min to BNL, walkto McDs, Subway, KOHL's, 7/11, etc. \$2,100/mo neg. 335-4907.

MEDFORD – 2 bdrm, 2 bath, d/w, w/d, upstairs apt w/terrace in complex/gym/ pool and tennis courts, gd for couple. \$1,700/mo. Radek, 295-0859 or jpieniazek@bnl.gov.

MILLER PLACE – 1/bdrm, I/rm, kitch, bath, partcially furnd bsmt apt, all utils incl, no smkg/pets. \$900/mo. contact Sueanne or Gary, 681-9859.

PATCHOGUE – Small 2 bdrm cottage. Fenced in yard. Comes with washer & dryer. \$1,300/mo. Betty, 475-1961.

RIDGE – room, close to Lab, new paint/carpet, util/int incl. \$600/mo. 917-721-2277.

RIDGE – 1 bdrm, kitchenette, l/r, sep ent/prkg, utils incl, no smkg/pets, quiet neighborhhd, minutes to Lab. \$975/mo. Lynne, 924-0002.

ROCKY POINT – 1 B/R upper unit, Rocky Point co-ops, no smoking/pets, must meet board approval, \$1,050/mo + utilities (LIPA/Cable), heat incl. Pics avail. \$1,050/mo. 516-527-4902.

## Hurricane Preparedness: The Lab, Your Work, Your Family

By Michael Pena, Manager, Laboratory Protection Division

We're approaching the most active part of hurricane season this month and into September, so I encourage members of the Lab community to review the Office of Emergency Management's (OEM) preparedness website: *http://www.bnl.gov/lpd/oem/hurricane.asp*. The site features links to important information you can use to prepare yourself and your family for an emergency.

The last major hurricane to hit Long Island directly, a Category 1 storm called 'Gloria,' was in 1985. The last Category 2 storm to come our way was in 1938. Both storms caused significant damage to the area. Parts of the Lab were without power for nine days following Hurricane Gloria and many employees experienced significant damage and loss of important services in their communities. While these major storms don't target Long Island all that often, we must be prepared, or we could end up paying a heavy price in property damage and even human life.

Family preparedness can make all the difference during and after an event like a major hurricane. History has shown us that outside assistance is not immediate. In fact, local authorities usually recommend that residents plan to be self-sufficient for up to 72 hours following a disaster.

The first thing you need is a plan. Your family may not be together when disaster strikes, so it is important to plan in advance: How will you contact each other? How will you get back together? The OEM preparedness webpage provides guidance on how to prepare such a plan.

The links on the OEM website include checklists and forms to make it easier to gather the information you'll need. If you have children in your household, have them take ownership — families have had great success with their plans when the children are involved in their development. Also, the "Ready Kids" website linked from the OEM webpage can help parents and teachers educate children in grades 4-5 about emergencies and how they can help get their family prepared. OEM staff can assist with any questions you may have.

At Brookhaven Lab, we have a protocol to follow when a tropical storm or hurricane is predicted to be heading our way. If we do experience a major weather event, the Lab will help its staff prepare in the days and hours leading up to the storm. You will be instructed to secure information and equipment — and be ready to be away from the Lab site for many days, if necessary. Once a major storm has passed, we will focus on restoring full Lab functionality. In the case of a major weather event, we're counting on you to pay close attention to the communications you receive from OEM, as well as from the internal communications group.

We realize your first priority is your family and your home. Work on that plan for your family now to make sure they are prepared. If you know your family is safe, then you will be better able to support the Lab's efforts to restore full operation after a major weather event.

## Get Fit, Join BERA Classes

All the Lab community is encouraged to join in these classes. Advance registration is required. Classes cannot be pro-rated, because paid registrations are needed to secure instructors. You may try a fitness class for free during the week of October 24, when the Lab is expected to celebrate Healthfest.

When you register, please include the following information: name of activity (Zumba, etc.), the class day (e.g., Mondays, or Tuesdays and Thursdays), the number of weeks in the session, your name (printed, please), your BNL Life/Guest number, your Bldg. number, phone extension, email address, and an emergency contact name and phone number. Make checks payable to BERA and mail to: Recreation Office, Building 400A. Thank you.

The following classes are scheduled:

**PILATES** – 8-week session - \$40 for once a week

5:30-6:30 p.m. – Rec Hall, Bldg. 317

Monday: Sep. 12, 19, 26, Oct. 3, 10, 17, 24, and 31

**YOGALATES** – 8-week session – \$40 for once a week Noon to 1 p.m. – Rec Hall, Bldg. 317

Monday: Sep. 12, 19, 26, Oct 3, 10, 17, 24, and 31

ZUMBA – 8-week session - \$40 for once a week

03 VW JETTA GLS 1.8T – 127K mi. 5 spd, lthr, a/c, full pwr, c/c, tilt, htd seats, ABS, fr, sde airbgs, m/rf, orig ownr, \$5,250. Ext. 7768.

03 CHEVY CORVETTE – 20K mi. convertable, manual, blue w/blck rag-top, car cover incl, v/gd cond. \$24,575 neg. 793-0986.

02 CHEVY CAMARO – 37K mi. Convertible, 35th Anniv. Ed, Z28, V8, loaded, mint, blue w/tan soft top. \$10,800 neg. 275-0694.

00 MAZDA MIATA – 76K mi. orig ownr, all srvce recs. Silver w/tan leathr. Just passed NYS inspect. \$6,200 neg. 807-4933.

00 NISSAN MAXIMA – 135K mi. all standard equip, antilock brakes, p/s, windows, black, gd cond. \$3,800 neg. 821-4318.

99 VOLVO S80 TURBO 4 DOOR – 117 mi. a/t a/c htd sts, s/roof, 2 new tires, CD, nds some mech wrk, runs well. \$3,000 neg. 612-4568.

92 MERCEDES 300SL CONVERTABLE – 112.678K mi. 300 sl w/hd top, must sell, nice shape, b/o, new tires. \$5,200 neg. 875-9426. 83 MAZDA RX7 – 53K mi. 12A Rotary Classic, many new parts. \$6,700, 327-4687. Parazzi strings, carved woodcarved chin rest, Kun shldr rest, \$1300. jsun@bnl.gov. ACER ASPIRE ONE NETBOOK – about 1 yr old Acer netbook w/case ask/ \$250. Kellie, 487-3569.

BABY'S JUMPEROO, CRADLE – F.Price rainforest, excel, ask/\$30; wood cradle, waterprf mattress, v/gd cnd, ask/\$40. ylou@bnl.gov.

#### Community Involvement

SCIENCE & LANGUAGE SCHOOL @ SBU – Enrichment program for children 3-16 & adults. Classes on Sundays at Stony Brook U: Math, Physics, Art, Russian, English, French, Spanish, Italian. schoolplusstonybrook.org. 615-4215 or schoolplus\_sb@yahoo.com.

#### Happenings

ANNUAL GREEK FESTIVAL – Port Jeff Greek Church of Assumption 8/18-8/21, Food, music, rides, booths, fireworks Fri/ Sat, Raffles \$100 (cars/boat/trip, etc) 1 out of 15 wins. www.portjeffgreekfest.com. Maria, Ext. 7340 or mschmidt@bnl.gov. SHIRLEY – rm for rent/stove kitnette, l/r/ bdrm comb, prv ent, bath, near stores, beach, all mjor hwys, no smkg/pets, 15 min to lab, 1 mo/sec. \$650/mo. 804-8609.

SHOREHAM – spacious, 1 bdrm furnd studio apt, sep ent, full bath, kitch, patio; big yd, sep, thermostat, int, cable TV, no smkg/ pets, 7 min to Lab. \$750/mo. 821-4318.

#### For Sale

SHOREHAM – 3 bdrm, 1.5 bath Colonial on cul de sac, updated kitch w/stainless appli, updated bath, den w/f/p, new w/d, Ig wood shed, deck, low taxes, SWRSD, 10 min to Lab. \$364,000. Andrea, Ext. 3347, 744-8793 or dreashouse@aol.com.

WADING RIVER – SWRSD, 9 rm Col, Ige kitch & dinette w/granite counters, I/r, formal d/r, fam rm w/brick fpl, 5 bdrms, 2.5 baths, full b/ment, 2 car gar. pool, fenced bkyrd, sprinkler syst. call 631-929-6771. \$399,999. verbeeck@bnl.gov. or \$80 for twice a week Noon to 1 p.m. - Gym, Bldg. 461 Tuesday: Sep. 6, 13, 20, 27, Oct. 4, 11, 18 and 25 5:15-6:15 – Rec Hall - Bldg. 317 Wednesday: Sep. 7, 14, 21, 28, Oct. 5, 12, 19 & 26 AQUA AEROBICS – 8-week session - \$25 for once a week

or \$45 for twice a week 5:30-6:30 p.m. - Pool, Bldg. 478 Tuesday: Sep. 6, 13, 20, 27, Oct. 4, 11, 18 and 25 Thursday: Sep. 8, 15, 22, 29, Oct. 6, 13, 20 and 27

AQUA THERAPY for Seniors - 7-week (\$35)

or 14-week (\$70) sessions

9-10 a.m. - Pool, Bldg. 478, details at:

www.bnl.gov/bera/recreation/fitness.asp

Wednesday: Sep. 14 through Dec. 14

#### **POOL ~ GYMNASIUM ~ WEIGHT ROOM**

BERA Sports & Clubs ~ Volleyball/Soccer/Basketball www.bnl.gov/bera/recreation/clubs.asp

# **Bulletin**

Published weekly by the Media & Communications Office for the employees, facility users, and retirees of Brookhaven National Laboratory.

Liz Seubert, editor Joe Gettler, assistant editor Roger Stoutenburgh, photographer On the Web, the Bulletin is located at *www.bnl.gov/bnlweb/pubaf/bulletin.asp*. A calendar listing scientific and technical seminars and lectures is found at *www.bnl.gov/bnlweb/pubaf/calendar.asp*.

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