The Dilated Times

The Newsletter of the Drew University Society of Physics Students

Spring 2011 Volume 21 Number 2 Editor: Ashish Shah

Drew Physics Bids Farewell to Professor David McGee

By Dr. Bob Fenstermacher

After twelve enormously productive years at Drew, Dave McGee has accepted a position in the physics department of The College of New Jersey beginning September 2011. There he will join a significantly larger cadre of faculty and students with ample laboratory space to support his ever expanding research program.

Dr. McGee was hired at Drew in 1999 to bring experimental research to our department after establishing a strong program in teaching and research at Moravian College. And he didn't disappoint us. His photonics laboratory was up and running in a few months. He established a vigorous, funded, and interdisciplinary laboratory in non-linear optics that brought significant experience to our students including those from chemistry, physics, and computer science. He was quick to establish collaborations with other scientists at Lucent Bell Laboratories which have now led to connections at Johns Hopkins and the University of Wisconsin. These collaborations led to the bringing of visitors to Drew and taking our students to other research locations during the summer.

Dave was the Director of the Drew Summer Science Institute (DSSI) for many years, establishing important on-going procedures for its well being and stability. DSSI now has approximately 40 students every summer doing research work with Drew faculty members and RISE fellows. Funding limitations for student stipends keep the number from being even higher.

As perhaps the most successful researcher in the Hall of Sciences, in terms of publishing and funding success, Dave became a role model for junior faculty members. He became the go-to guy for questions about grantsmanship and how to navigate the world of NSF. He believed strongly in undergraduate research as an important component of good teaching, and became an active member of the Council of Undergraduate Research (CUR), spreading Drew's name across the land. He currently serves as a physics councilor on the governing council of CUR.

Most recently, Dave has brought an international presence to Drew. In the last several years four German students from Berlin participated in an exchange program with Drew, doing research in Dave's lab, teaching German language skills in the college, and sharing their student lives with us here in the department.

Dave has been a solid supporter for all of Drew's laboratory work. He was my partner in the teaching of the Advanced Laboratory for many years, and we learned a lot from each other during those classes. He has been a good friend and colleague, and we talked regularly about physics, family, politics, and house projects.

Our collective thanks go to Professor McGee for his many contributions to Drew over the years, and we wish him well as he moves on to his next adventures in physics. May they be stimulating and optically interesting.

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A Thank-You (and a farewell)

By Dr. David J. McGee

After 12 wonderful years at Drew, I will be leaving to take a new position in the physics department at the College of New Jersey. My time at Drew has been incredibly satisfying thanks to my colleagues in the department, our very capable staff, and of course, the students. When I arrived at Drew in 1999, Bob Fenstermacher was chair, and the department consisted of Jim Supplee, Pat Boeshaar, and Ashley Carter. We have seen many changes since then, but throughout them all, the department remained a warm and inviting community dedicated to educating students from all backgrounds and majors. Jim Supplee and veteran staffers Jackie Cress and Stephen Takacs have been a major part of this community, and will carry the department forward with the help of our outstanding up-and-coming faculty members Minjoon Kouh and Robert Murawski. Bob Fenstermacher will continue to teach How Things Work and provide his invaluable perspective and experience as the department continues to evolve in scope and mission at Drew. In closing, many thanks go out to the students and graduates of the physics department who I have taught in class, mentored in my lab, or worked with as part of our extensive alumni network. You are the reason physics at Drew has always been an integral part of a liberal arts education, and your continued support of the department will help continue this tradition.

Faculty Thoughts…

Dave! Dave! Dave! We miss you! Although it has been a long while since you started at Drew, I remember your interview and arrival vividly. The physics department was somehow sure that your arrival would take us to a new and higher level. It did. Drew was better, stronger, and more fun with you here. Activity and enthusiasm burst to a qualitatively better place. The entire sense of purpose on your hallway was palpably richer. Your grant money helped - it is cool to have paid students working on real physics. But the money alone was not the point; your group spanned majors, class-year, and even international boundaries. I am happy for you that you've found a new place for yourself, but … wow … do we miss you! Good luck at TCNJ. Stay well. Everyone who worked with you will remember you always.

- Jim Supplee

You have been, and will continue to be, a great colleague, mentor, and friend. I will try to follow your example of excellence in teaching and research. Thank you for your support and guidance as I was settling in and trying out new programs at Drew. We all appreciate your hard work for the physics department, and you will be greatly missed by the students and your colleagues here. At the same time, this will be the beginning of a close relationship between Drew and TCNJ!

- Minjoon Kouh

Dave, I will miss our physics discussions. I wish you the best of luck at TCNJ. I know you will do great physics there as you have done at Drew. Cheers.

- Robert Murawski

SPS Banquet

By Melissa Hoffman '13

Drew's chapter of Sigma Pi Sigma held its annual awards banquet at the end of Spring Semester. The SPS Banquet is an annual event for members of the physics department to come together and celebrate each other's accomplishments for the year, reminisce about highlights of the year, and induct new members into Sigma Pi Sigma, the national physics honors society. Sigma Pi Sigma inductees for 2011 were juniors John Bone and Andrew Bryar. Additionally, departmental prizes were awarded to outstanding students for the year. The Ollom Prize in Physics was awarded to Mary Lamont '14, the Boxer Memorial Prize was given to Aaron Loether, '11, and John Bone '12, received the Novartis Award, to be presented at a college wide event. SPS officers also presented traditional awards to the entire department, ranging from "The Draftsman Award" for excellent lab diagrams, to the "Most Aerodynamic Hair" for hair that *almost* seems to defy the laws of physics. The evening included a bitter sweet moment, as Dr. David McGee announced that he would be leaving Drew to take a position at TCNJ, a wonderful opportunity, though the Drew Physics department will sorely miss him.

Liberty Science Center

By Melissa Hoffman ‘13

On Sunday April 10, a handful of SPS members trekked their way to Jersey City to visit the Liberty Science Center. Accompanied by Dr. Murawski and Dr. Sauer, SPSer’s explored the four floors of science including everything from the science of energy, exhibits full of dangerous predators, to the dark and mysterious touch tunnel. “It was a lot of fun. We went with a small group, so we all got to hang out together and enjoy ourselves” said Drew Bryar ’12, our current VP. Aaron Loether ‘11, our president, said “It’s nice to have the department get off campus for events.” “The Liberty Science Center was a fantastic experience for me. I was able to learn more about alternative sources of energy while having tons of fun. The IMAX movie about the Hubble telescope was incredibly vivid and intriguing,” said SPS member Erinn O’Neill. The IMAX movie highlighted some of the great information gathered about the universe from the Hubble telescope including a ‘tour’ of the Orion Nebula. The movie also tracked the 2009 NASA team that administered Hubble’s last repairs. Among some other attractions were interactive events like a fake skyscraper beam walk where students wore a harness and walked on a beam just like construction workers. The exhibit featured some of the physics of skyscrapers – such as dealing with problems of structural integrity and relieving pressure through proper weight distribution. Another popular exhibit was the Eat or be Eaten, which featured exotic predators like the viper, the everything-but-shoe-proof cockroach, and the monitor lizard. Overall, SPS enjoyed a relaxing and fun day.

Supermoon

By Drew Bryar ‘12

On March 19th the observatory opened its doors to the public to the Supermoon, which is a rare event when a full moon coincides with the moon being closest to the Earth. The last time such an event happened was in 1983. What makes it so super? When the moon is at perigee, or the point closest to Earth in its orbit, its size in the night sky increases by 14%. Observatory goers were able to look through the Drew University telescope and individual Questars at this rare event. Astronomy students, physics students, and people who were simply enticed by the full and enchanting moon, came to the roof of the Hall of Sciences to get a gander at Earth’s lone satellite. Did you miss it? Don’t worry. Although the last one was 18 years ago, the next anticipated Supermoon can be expected in November, 2016.

Spring Saturday Pix

“The right-hand rule....”

A very early prospective student...

American Museum of Natural History: Field Trip

By Dr. Minjoon Kouh

PHYS/NEURO-111 (Computational Modeling of Neural Systems) is an interdisciplinary course where students learn to use a scientific computing tool (Octave or Matlab) and build models of neural networks. So far in the course, we have studied the models of gill-withdrawal reflex of Aplysia, vestibulo-ocular reflex, lateral inhibition in vision, auto-associative memory, and more. During the remaining semester, we will discuss self-organizing map and biophysics of action-potential generation, while students continue to work on their individual term projects to be presented during the last week of the class. This year's project topics include: neural network models of visual object recognition or Sudoku puzzle solver, mathematical analysis of the cable equation for an axon, and simple a Q&A system (like IBM's Watson that plays Jeopardy!).

On Saturday, March 19, the class took a field trip to the American Museum of Natural History (AMNH) in NYC to see a special exhibit on "Brain: The Inside Story." The exhibit is organized into five themes: Sensing Brain, Emotional Brain, Thinking Brain, Changing Brain, and 21st Century Brain, showcasing what is known and unknown about this small, complex organ. The afternoon of taking the train together and roaming the museum in a group made this field trip a great learning and bonding experience. The activity was generously supported by Drew's Experiential Learning Grant.

Here are some comments from the students:

Ashish: "The field trip to the museum was a great opportunity for a student like me, who has never been to AMNH, to go and explore. I mainly went to the earth and atmosphere exhibit and the underwater exhibit. I saw some of the most amazing and beautiful creatures there. I really like that all of the animals there were inanimate yet they seemed alive. The Brain exhibit was something special. I have been to many museums but none of them had a brain exhibit like AMNH including the famous body exhibit. This exhibit connected both computational ideas and the biological systems of neuroscience. All of the demonstrations and the models were also very descriptive and informative. I definitely recommend this field trip again for next year."

Emilyn: "I found our PHYS 111 trip to the American Museum of Natural History to be very successful. It was exciting to go to an exhibit on the brain with people who were also studying the brain. While I wished there were more interactive activities and more coverage of advanced topics, there were a lot of things that I really enjoyed. For example, it was nice to see some tried and true references in the field of neuroscience, such as the homunculus, the mirror tracing activity, and the Stroop test. Visually, the neural network art installation was especially stimulating. Where I learned most was at the end in the 21st Century Brain section. I watched a video about epileptic patients that had computer implants in the brains to monitor their brain activity. With these implants the computers were able to simulate moving animated hands just as the patients were moving them, and decode certain words just as the patients were thinking them. It was interesting to see where the world of neuroscience is headed. Overall, I really enjoyed my time there and my time with our class. It was a great bonding moment for all of us."

Matthew: "The exhibit was very interesting. The wires and lights simulating neuron action potentials at the beginning of the exhibit was particularly impressive. As a neuroscience student, it was nice to revisit classic demonstrations in neuroscience, such as the Stroop effect, and the Homunculus. Along with the classic demonstrations, there were others that were new to me, such as using imagery of falling rain to give a mistaken perception that frying bacon sounds are the sound of falling rain. Unfortunately many of the demonstrations seemed somewhat unconnected to each other, reflecting the lack of an established general theory of brains in the exhibit itself."

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Melissa: "The PHYS 111 trip was a spectacular excursion. The AMNH's exhibition on the brain was extremely rich and full of information, demonstrations, and interactive events to illustrate some of the leading concepts in neuroscience. It was beautifully complementary to the course, seeing that much of our course subject was displayed at the exhibit – models of memory we just started looking at, and the study of the aplysia to understand habituation. The exhibit highlighted many 'strange' things that happen in the brain, from simple oddities like synesthesia and color blindness to extreme diseases like epilepsy and Alzheimer's. Particularly interesting was technology developed for the brain such as cochlear implants and even deep brain stimulations."

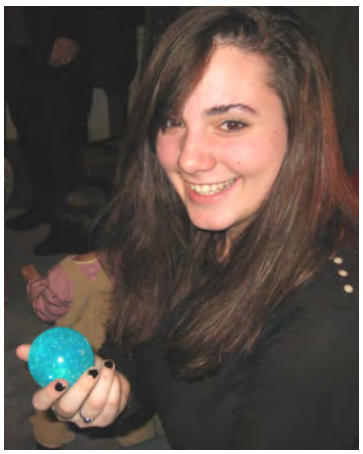
SPS Pizza Lunch Talks: Spring 2011

By Melissa Hoffman '13

Drew's Society of Physics Students was graced with many interesting and varied speakers for this semester's pizza lunch series. Two RISE fellows and two Drew Alumni came to speak to the current SPS members. Dr. Ron Doll gave a presentation on organic chemistry in nanotechnology showcasing the chemistry of carbon nanotubes. Dr. James McKenna, whose impressive resume includes applied mathematics and applied physics, gave a presentation on his recent research in neurobiology, showing the physics behind the bio, much like Dr. Kouh's Computational Modeling of Neural Systems class. We got a little glimpse of what happens inside the brain including an in-depth explanation of PET (Positron Emission Tomography). Elizabeth Bannon, Drew alum of '06 came to share her professional experience in medical physics. Bannon explained various scanning techniques, such as MRI's, fMRI's, and PET scans, that all require a physicist on hand in a hospital setting. Bannon presented the basics of each machine's operation, and explained the various areas that someone with a physics degree could find themselves involved with in a hospital – caring for the machines, monitoring radiation, administering treatment, to name a few. "I'm lucky because when people ask me what my job is, I get to say 'I'm curing cancer, what are you doing?'"; Bannon clearly loves her work in the field. Last but certainly not least was recent alum Laura Barclay '08, who is studying at University of Delaware and has recently found herself working in research involving solar panels. Barclay's research focuses on a new technique to make panels more efficient while retaining low cost. The solution? Quantum dots! Quantum dots allow for more efficient solar panels without the extra price tag that usually accompanies more efficient models. SPS members also watched the NOVA series "Making Things Smarter" (And Stronger, and Smaller), and as usual, enjoyed a excellent slice of buffalo chicken pizza.

SPS Taco Party

Courtesy of John Bone '12



Organic Chemical Aspects of Nanotechnology

By Ashish Shah '13

Recently Dr. Ronald Doll, Drew University's newest RISE Fellow, gave a presentation on his research during one of the SPS lunchtime gatherings. Dr. Doll has 32 years of pharmaceutical drug discovery and leadership experience in the pharmaceutical industries. Dr. Doll was a director of chemical research, infectious disease and tumor biology at Schering-Plough research institute prior to the merge with Merck research laboratories. Dr. Doll's research interests are synthetic organic chemistry, synthetic methods, and preparing compounds with interesting biological, chemical and physical properties. Dr. Doll has also had experience in engineering, physics and electronics. In addition he holds an amateur radio license and is very interested in astronomy. Dr. Doll was recently awarded $20,000 by the Camille and Henry Dreyfus Foundation Senior Scientist Mentor Program for 2011. He anticipates that the money will likely support the students working with him during the Drew Summer Science Institute (DSSI).

Dr. Doll's lunchtime presentation was on organic chemical aspects of nanotechnology. The chemical aspect of nanotechnology provides a different perspective from that of physics. The world of chemistry is about atomic orbitals and molecular bonding, and molecular bonding is a key feature in learning more about the behavior of one particularly area of nanotechnology, that of carbon nanotubes. As Dr. Doll explained, carbon nanotubes have fascinating electrical conductivity properties, which can be understood to some extent through a combination of molecular bonding theory, quantum mechanics, and solid state theory. As quantum mechanics suggests, a photon of correct energy is required to excite an electron to an excited state. In other words, a photon of correct energy is required to excite an electron across the band gap from the valence band to conduction band. So the band gap is a major factor determining the electrical conductivity of a solid. Conductors have no band gap, thus an electron cannot jump to the conduction band; semiconductors have a small band gap, and insulators have a large band gap. The band gap of the molecule is determined by its molecular properties. Electrons in a conjugated double bond system are free to move around; they are delocalized, and are easily excited to higher energy states. The conjugation in the system can change the optical properties of a polymer. These types of polymers are widely used in the industry today to create different kinds of glasses and fibers that can change color depending on the structure of the molecule used. Some of the polycyclic aromatic hydrocarbons are highly conjugated molecules. The pi electrons are delocalized over the entire molecule making them very stable. Some of these polycyclic aromatic hydrocarbons are used in carbon nanotubes; carbon nanotubes can be used as conductors or semiconductors depending on the environment. The discovery of graphene is one of the most important discoveries of modern science. Graphene is a one atom thick layer of graphite. The delocalized cloud of pi electrons above and below the plane makes it either a conductor or semiconductor depending on the environment. The potential for graphene in nanotechnology applications seems very high, and research on nanotechnology in general is growing exponentially. Dr. Doll's presentation was extremely interesting, and helped SPS move out of our physics cocoon; he connected both physics and chemistry through nanotechnology to paint a bigger picture.

Off To Delaware

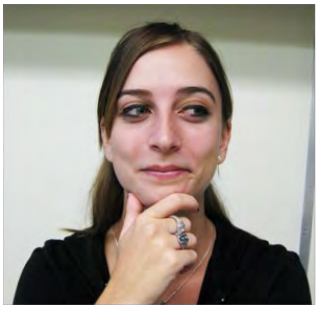
By Aaron Loether '11

As my final year at Drew comes to a close, I am obliged to look forward as well as back. While I enjoyed my time here in the physics department very much, I knew that it could not satisfy me forever. Having finally exhausted all the course offerings that Drew has in both math and physics, it is time to move on. I will be continuing my education in the fall at the University of Delaware, or as it is known to by some "Drew South." Currently there are 3 recent Drew alumni studying in the graduate school at Delaware: Evan Kimberly, Laura Barclay, and Brian Kelly. All three are studying physics and enjoying it very much. I have every expectation that my time spent in the Ph.D. program there will be fruitful and pleasant.

I would like to thank all of my professors here at Drew for the quality education they so happily bestowed upon me. It is with their help that I was able to pursue my passion for science. I will miss them greatly.

DSSI — Summer 2011

Erinn O'Neill '13



This summer I will be working with Dr. Hinrichs in the field of atmospheric chemistry in the Drew Summer Science Institute (DSSI). In the past we have studied the effects of reacting potassium iodide with nitrogen dioxide. This research involved placing solid potassium iodide in a diffuse reflectance infrared fourier transform spectroscopy (DRIFTS) chamber where nitrogen is the carrier gas. We then opened the gaseous nitrogen dioxide flow and recorded spectra while recording pressures at different times to calculate the concentration of nitrogen dioxide in parts per billion. Reactions were run with various concentrations of NO_2 and at various relative humidities. For our research this summer, we will continue our study while now also studying the effect of ozonolysis of potassium iodide coated with benzophenone, using infrared and ultraviolet spectroscopy.

Mary Lamont '14

This summer I will be working with Dr. Kouh on his research involving wiimotes. We will be using the accelerometer contained in the wiimote in order to measure wave motion of longitudinal waves. For example, the wiimotes may be attached to a spring. The spring could then be compressed and released to create a longitudinal wave. As this wave travels down the spring, the attached wiimotes would move and record the wave motion as it passed by them. Another part of this experiment will be to create boundaries (e.g., different mass density) in the spring to create a model for how longitudinal waves behave at boundaries.

Ashish Shah '13

I am currently a physics major and chemistry/mathematics minor at Drew University. This summer I plan on working with Dr. Robert Murawski. Previously I have worked with Dr. David McGee in his lab. I did independent study with Dr. McGee to learn about laser optics and optical properties of different polymers. Dr. Murawski works on quantum optics, femtosecond lasers, and optical effects of coherent Raman spectroscopy on molecules such as Disperse Red 1 (DR 1). DR 1 is a highly conjugated molecule that exhibits nonlinear optical effects and is also commercially available. Raman spectroscopy is a spectroscopic technique used to study vibrational, rotational, and other low-frequency modes in a molecular system. The laser light interacts with molecular vibrations, phonons or other excitations in the system, resulting in the energy of the laser photons being shifted up or down. The shift in energy gives information about the phonon modes in the system. This makes Raman spectroscopy a very powerful technique. It is used by chemists and physicists to analyze the behavior of the molecules. Usually Raman spectroscopy is used to determine the identity of an unknown compound, but it could also give a great amount of information on the behavior of the molecules such as the amount of energy electrons could absorb, poling effects, and crystallographic orientation, etc. We would like to use Raman spectroscopy as an analytical technique to measure optical effects of the DR1 molecules. This includes analyzing their degree of spatial ordering when dissolved in a polymer host. This ordering is achieved through an electrical process called poling, in which an external electric field is used to align the DR 1. Raman spectroscopy could be used to analyze the orientation of the chromophore by comparing the Raman signal from poled and unpoled regions of the polymer.

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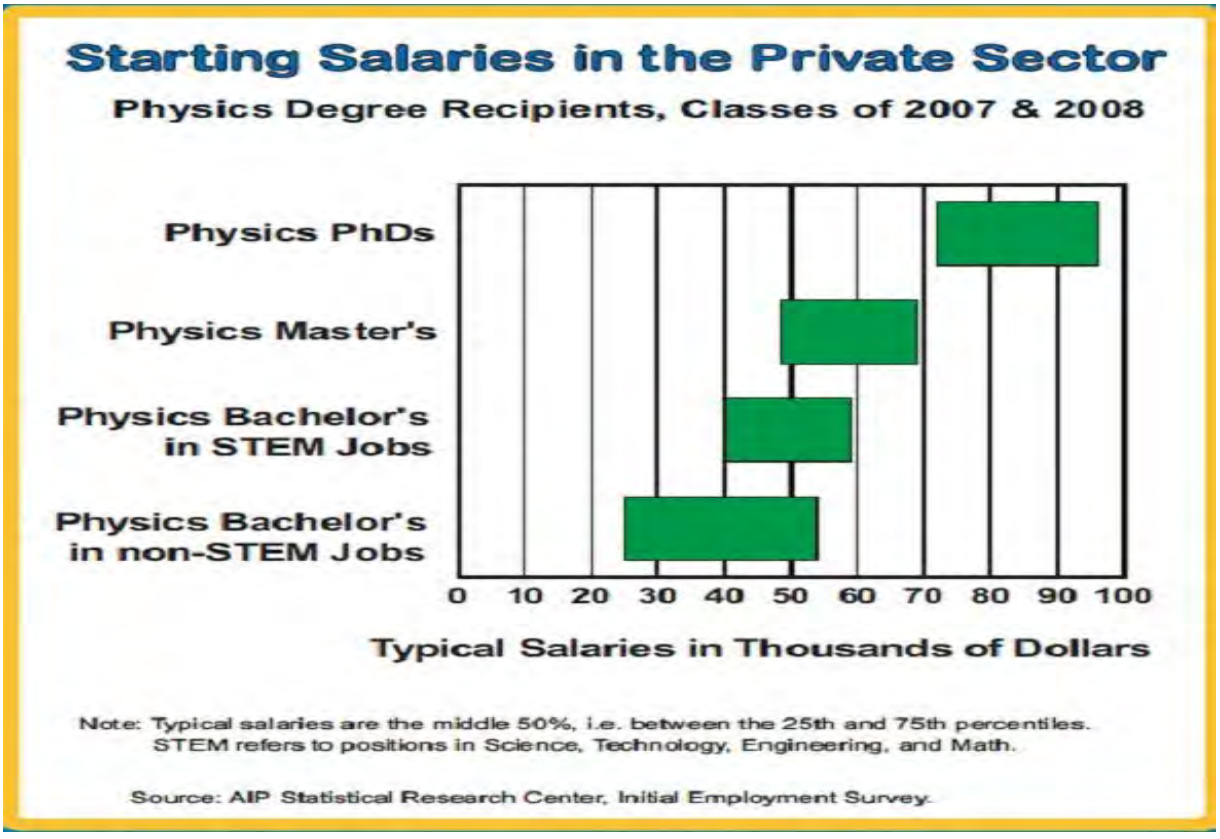
Previously, students have started building a Raman setup in Dr. Murawski's lab. However, I would like to start from scratch and build the setup myself so I can better understand the optics behind the technique. After building a more permanent and user-friendly setup, I can use it on known molecules such as methanol or/and ethanol to confirm that we can reproduce the Raman spectrum from these well known reference materials. After that, I can use the same setup on DR 1 molecules to look at the alignment of the chromophore and the poling of the molecules. Our goal is to see the effect of poling on the Raman signal and to use this information to help us better understand the optical properties of poled chromophores.

Melissa Hoffman '13

This summer my DSSI project was a study of Eclipsing Binary stars. I began by making a light curve of a well known variable star to calibrate magnitude and period. I used Y Leo, a binary with magnitudes well within the range of detection of the telescope. My main star subject was ZZ Cygnus, a semi-detached binary with a relatively fast period (on the order of hours) and at least one magnitude change in luminosity. I employed a technique of analysis of light curves called 'folding'. Folding data requires plotting flux in intensity vs. phase, and because it did not require chronological data, allowed me to work around bad weather and cloudy nights. In addition to eclipsing binaries, I had interest in studying cataclysmic varaiables. Both the AAVSO and the CBA are organizations devoted to collecting data on stars and archiving it so that analytical research can be conducted using a vast amount of data. Cataclysmic variables have irregular periods and are still not completely understood. Future and present plans include continuing utilizing the folding technique to develop a collection of light curves of periodic binaries, as well as studying cataclysmic variables, as they happen, such as the supernova that just recently burst (September) in M101.

Career Corner...



Picture of the Ring Nebula in Lyra from the observatory, courtesy of Melissa Hoffman

"This is Math 104 not math 1.04"

Dr. Christopher Apelian

Picture of whirlpool galaxy from the observatory, courtesy of Melissa Hoffman

GOT PRE-OWNED LAB EQUIPMENT/INSTRUMENTATION??

The department asks that alums remember us and our continuing need for laboratory instrumentation and equipment. If you have a particular item that is no longer useful to you and could find a new home at Drew, we would be very happy to hear from you at any time. While not limited to these, some current needs include:

If you have equipment you would like to donate, please contact:
Dr. Robert K. Murawski
Department of Physics
Drew University
Madison, NJ 07940
E-mail: rmurawsk@drew.edu

General Lab Instrumentation
- Digital scopes
- Function/pulse generators
- Meters

Gas handling – regulators
Microscopes
Optomechanics (e.g. Newport, Thorlabs, etc)
Power Supplies
- High voltage power supplies – 5 to 10 kV (e.g. Bertan)
- Low voltage, general-purpose

Vacuum pumps – general purpose roughing pumps and diaphragm/oil free pumps (for use with small vacuum ovens)

More specific research equipment:

Electronics – Stanford Research SR280 NIM bin, SR250 Integrator, SR645/535 digital delay
Fiber optic equipment – fiber cleaver, fiber optic switches
LASERS – NdYAG, Argon Ion, Diode-pumped solid state, fiber-coupled, HeNe
Microscope hot stage

Send The Physics Department Your Business Cards!

Let the physics department know what you are up to and where you are working. Send us your business cards and we will display them in the department. Please send your card or cards to Dr. Robert Murawski at the address listed above in the laboratory equipment announcement.

Upcoming Events:

May 14, 2011

Commencement. Join us at the Physics Table after the ceremonies.

May 29, 2011

DSSI begins. Keep an eye out for cutting edge physics research opportunities.

September 19, 2011

SPS/Physics Fall Barbeque. Welcome back for new and old SPSer's.

November 11, 2011

Science Day at Drew. Prospective students on campus. All DSSI students present their research.

Watch For:

Lunchtime Pizza Talks on Thursdays (want to give a talk? Contact Dr. Robert Murawski)

Remember:

The observatory is open to the public on clear Friday nights!

The Dilated Times

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Madison, NJ,
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Address Correction Requested

Visit the NEW physics department website at:

http://depts.drew.edu/phys/

Inside...

Contributors…

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