The Dilated Times

The Newsletter of the Drew University Society of Physics Students

Fall 2010 Volume 21 Number 1 Editor: Erinn O'Neill

Summer Research Reaches All Time High

By Erinn O'Neill '13

Every summer, students have the opportunity to perform research alongside a professor as part of the Drew Summer Science Institute (DSSI) . This allows students to work in a lab, learning how research is conducted both in graduate school and in industry, while also being a part of an intellectual yet relaxed setting. In the fall, students present their research at the DSSI Fall Poster Session, giving them both experience writing up their results and presenting their research orally. This summer, a record-high 13 students from the physics department participated in research, including 2 international visiting students. Their stories can be found on pages 7-8.

International Connections

By Dr. David J. McGee

Since April 2010, the physics department has hosted two visiting physics students from the Beuth University of Applied Sciences in Berlin, Germany. Bastian Braeuer and Johannes Schleusener are here working on their Master thesis under the guidance of Prof. David McGee. Their research is partially funded by the German Academic Exchange Service and the National Science Foundation, and follows up on the work of Jonas Foleski, who was a visiting student from Technical University of Berlin during Summer 2009. Bastian and Johannes quickly integrated with the physics department, and have brought a wonderful international perspective to our students. They will return to Germany in December, and we wish them the best of luck on their graduation. More details on their Drew experience can be found on page 2.

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Thank You!

The physics department extends a heartfelt "thank you" to everyone who participated in Bob Fenstermacher's retirement celebration in May. It was wonderful to see so many generations of physics graduates and friends of the department join us for the event. Contributions to the *Robert L. Fenstermacher Summer Research Fellowship* stand at over $110,000 and we look forward to awarding the first fellowship this summer. Again, thanks to everyone who contributed to this very worthy fund, and please continue to spread the word- we want to support as many students as possible with this Fellowship, which we can do with continued contributions. Please contact dmcgee@drew.edu if you can help us.

"What do you get when you cross a lion and a zebra?
Lion zebra sine theta"
-Dr. Murawski

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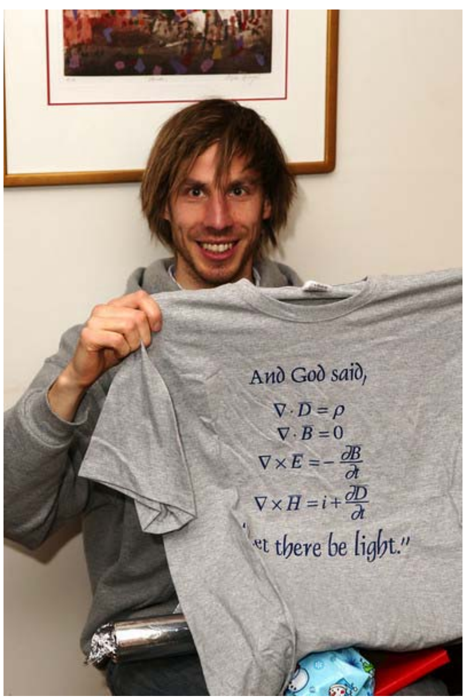
International Connections

By Aaron Loether '11

Starting in summer 2009, the Drew physics department was graced with an international presence. It began when Jonas Folesky, an undergraduate physics major from Berlin, Germany joined Dr. David McGee for a research project. The department was happy to welcome yet another research student, especially an international one. This became a gateway to further international collaboration. While visiting Jonas in Berlin, McGee met Professsor Kay Kasch, of the physics department at Beuth University of Applied Science. Kasch invited McGee to speak at Beuth about Jonas' project, and to meet Beuth students interested in international exchange. During this visit McGee met Bastian Bräuer, a student looking for a potential research mentor in the US.

Bastian Braüer

As a result, Drew welcomed two more German researchers. In April Bastian came to Drew joined by his colleague Johannes Schleusener. They are completing their masters degree in medical biophysics. For their Diploma, (under the previous EU degree system) they spent a year at the University of Toronto doing cancer research. Bastian studied photo-active chemical treatments, and Johannes studied total reflectance spectroscopy diagnosis. While Drew does not offer a master's degree, it does offer research projects involving collaborators at graduate institutions, particularly in fields with applications to medical biophysics. This gave Bastian and Johannes the chance to do full-time research for a 9 month visit, while also integrating with the life and culture of a small college physics department. Both are working in Prof. McGee's lab on topics related to nonlinear optics.



Johannes Schleusener

Bastian is studying electro optic effects in dye-doped polymers. He studied these as a function of dye concentration and found that highly doped polymers will experience aggregation effects that limit electro-optic performance. Having nearly completed his thesis work, Bastian remarks, "It was a good experience. The opportunity to work in a lab where I was responsible for everything was great and the people in the environment made the working time interesting and exciting. My personal experience being at Drew was awesome, meeting new people, not only the professors but the students and seeing the completely different student life in the US rather than in Germany. This was something you have to see for yourself and I really enjoyed it. So overall, I have to say that the decision to come here was a good one."

Johannes is studying second-harmonic generation in hybrid silicon-organic materials doped with azo dyes. This technique, also called frequency doubling, can be used to determine the degree of dye alignment and assess the effectiveness of a material for nonlinear optical applications. This has applications in biomedical physics for imaging purposes.

Johannes and Bastian also ran discussion groups with students taking German at Drew, and played a key role in helping several physics majors complete their fall semester independent study projects. They return to Berlin on December 14th, and will defend their thesis in early 2011. We wish them the best of luck!

Dr. Bartholomew: A Brief Introduction

By Drew Bryar '12

Dr. John Bartholomew has been a wonderful addition to our adjunct staff at Drew and is currently teaching Thermodynamics this fall. He began studying math and music at Kalamazoo College in Michigan, and then transferred to the University of Michigan in the same programs. Having always had interests in physics, he enrolled at the University of Chicago graduate school for physics, particularly condensed matter and particle physics involving lattice gauge theory. His post-grad work was done at Columbia University in Physical Chemistry using lattice gauge theory. Dr. Bartholomew then worked at Bell Labs for a number of years, followed by a career in teaching at the Morristown Beard School. Presently he teaches physics, philosophy, and he also has recently been involved in choreography. Welcome to Drew, Dr. Bartholomew!

The Place of Science in the Life of an Educated Citizen

By Dr. Bob Fenstermacher

The following article is reproduced from remarks made at the Drew University Phi Beta Kappa Induction Ceremony on April 17, 2010.

I would like to extend my heartiest congratulations to this year's inductees to Phi Beta Kappa. To be included among you is a very distinct honor, made even more special by the fact that one of my last student advisees at Drew is among you as well [Michael Jokubaitus '10]. I always read the list each year of current inductees, and find pleasure in the fact that I associate those whom I know on the list with some of the finest students I have worked with, both in and out of my classes. You all have worked hard across the disciplines for this honor, and represent the very best of Drew.

You have studied many subjects at Drew. Some of you are science majors, but many are not. But presumably everyone has had a little science along the way. Since I'm a scientist, and someone told me that I could talk about a topic of my choice, science somehow came to mind. So for a few minutes this afternoon I would like to reflect on the question of "What is the place of science in the life of an educated citizen?" To some of us, it is a passion that will drive the major activities of our life. For some struggling with those required science courses along the way, it may be an experience not unlike going to the dentist. And I suspect for many, it becomes sort of invisible as we seamlessly enjoy the many benefits brought by scientific discovery. But I would maintain today that no matter our personal feelings about science, it is and will be a dominating component of our lives in the broadest sense whether we think much about it or not.

Let me give you a few quick examples, some from very recent news stories.

1. Many of us are alive today and will live longer and healthier as a result of medical and biological science. Think about what medicines or procedures you may already have experienced that were not available to your grandparents.

2. You are the first generation to live in a world of total connectivity as evidenced by our umbilical attachment to our phones, ipods, and computers. Where did the magic of Facebook come from?

3. Our climate is changing in ways that will affect our lives with unimagined outcomes and will require an understanding that we are only just beginning to grasp.

4. If the lights are not going to go out, with our cars parked permanently in the garage, a solution to our energy needs has to be found.

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5. Television and CSI tell us how science will solve crimes and protect innocents from false accusations, while Toyota's cars and future transportation will become ever more technical, and yet their operation more invisible to the end user.

6. Weapons become ever more technical and terrifying, and nuclear weapons still number in the thousands.

So is there a common thread to some of these examples? Some of them are clearly making our lives better, more efficient, and more fun, but some are also challenging us with daunting problems. And that's where you come in. If we want to keep making the world a better place for humankind, there's a role for all of us, not just scientists, in this story.

Biological research will continue to bring us new and amazing understanding of our bodies, and ways to treat them for disease and injury. We will live longer. But we already know that this is coming at great cost to our health care system. How will we be able to afford these wonders?

And this research brings a different kind of problem. Last week I read that a measles outbreak is occurring in Vancouver, Canada, with multiple people in one family affected. We have largely forgotten about measles because we have a vaccine that almost eradicated it. Younger doctors don't even recognize its symptoms. But we now have some citizens refusing to vaccinate their children for fear of causing autism. And so, some may die of measles again. Here is a science question that begs for an answer, and all of us have to believe that answer for the common good.

The world of physical science, physics, chemistry, and engineering, brings us new technical discoveries and products that help drive the economic engine of our country, providing us with the income to afford the discoveries of those biologists. Consider that more than 700K Apple I-Pads have been sold in the last two weeks at $500 or more a pop. When British Chancellor of the Exchequer Willliam Gladstone met Michael Faraday, the father of the electrical generator in the 1850's, Gladstone asked Faraday whether his work in electricity would be of any use. "Yes sir," answered Faraday with prescience, "Someday you will tax it." But many technical discoveries also bring ethical and moral questions, or affect us socially in ways that happen almost too fast to absorb. How about tex-ting and driving?

Large numbers of our citizenry are having real difficulty knowing whether the climate is changing or not. If it is, there can be serious consequences for all of us. What should we be doing about this? This again is a science question. Why is it so difficult to know the answer to this?

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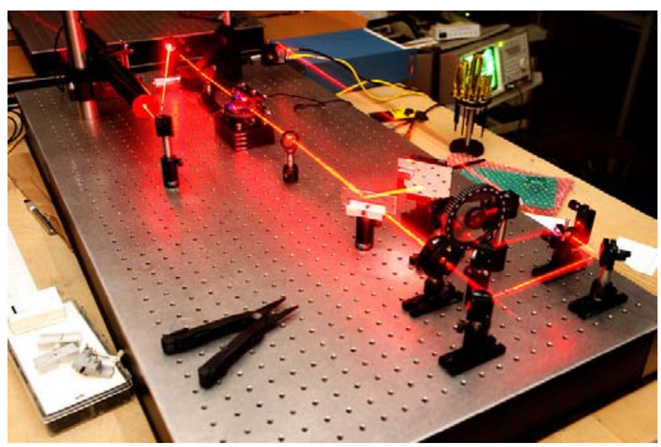
Photos from A-Lab

Courtesy of John Bone '12



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Nuclear energy could largely solve our energy needs for the foreseeable future, but we're not sure if it's safe or not. And yet we're willing to continue to let miners work in very dangerous conditions to bring us our electricity. How can we find out what's really true about this?

This week our world leaders met to talk about minimizing the number of nuclear weapons and the amount of weapons-grade uranium loose in the world. My hope is that these leaders and their aids actually understand the basic science of these issues, and that their other political, social, and economic skills help to bring us good solutions to these dangerous conditions.

My point today is that we are living in a world that requires all of us to have some understanding of these complex scientific issues, and in a way that allows us to assist in finding good answers to these challenging questions. We need lawyers, politicians, artists, social scientists, economists, business persons, and those in the media who are wise, skeptical, and yes, capable of understanding the issues in terms of the basic scientific principles involved. That's our job in a democracy.

So why is this so hard? One reason is that scientists are not very good at explaining what they do, or what their work means to you and me. They retreat to their laboratories and leave the explanations of what they do to others, or no one. Of if they do talk with the public, it's in a language that quickly puts many of us to sleep. Einstein once said, "You do not really understand something unless you can explain it to your grandmother." Without a grandmother, I usually practice on my long-suffering wife, who has learned how to nod approvingly at the right moments. Einstein also explained the wireless telegraph once in the following way: "The wireless telegraph is not difficult to understand. The ordinary telegraph is like a very long cat. You pull the tail in New York, and it meows in Los Angeles. The wireless is the same, only without the cat." If scientists were better at explaining their work to their grandmothers or spouses, or could present good illustrative analogies for their research, we would all be better informed about what they do, and more clearly understand their journey. There may be hope. My daughter, early in her scientific career in grad school, told me yesterday that she has been invited to a workshop to help scientists and the media work better together.

Another related reason for our difficulty is that the scientific process relies on repeatable results from experiments to convince us of the way nature and the world around us works. But some experiments are very hard indeed, especially if they involve large numbers of people, as with drug studies; or also with very complex systems like our atmosphere, or volcanos in Iceland. We are naturally confused when the media tells us on one day that coffee is wonderful for us, and cancer-producing a few months later. What's wrong with those scientists? Why can't they get it right? Anything they say is up for interpretation and may well be wrong. But what the reporters don't tell us is that this IS the scientific process of struggling to find answers, and we may go down many wrong paths before we get to the truth. I believe our educational system does a poor job of helping us understand that iterative, and sometimes long, scientific process. As citizens, we must be skeptical to avoid being fooled by incomplete or wrong scientific research. But ultimately scientists home in on right answers, answers that correctly describe how the universe works. Depending on the problem, it can take lifetimes of work. But when the answer is known, we have increased our human knowledge for all, and that answer is not open to interpretation depending on politics or religion.

And finally, we live in a world of capitalism where everyone is free to market goods and services to make a profit. But it's also a world where fanciful pseudoscientific claims are made which can be confused with legitimate scientific results, especially if we are vulnerable by being uninformed. These claims are frequently cloaked in scientific jargon, and cannot be backed up or verified by rigorous scientific experiment, and they often violate well-understood scientific principles. Products range from health cures, to unlimited energy devices, even to magnets that will make our wine taste better. They may be harmless diversions in the marketplace, or cause you to make a serious financial or medical mistake in your life.

So to end this story today, I'd like to ask you to let science dwell in your life, along with art and music, literature, language and cultures. Enjoy its benefits and discoveries, and revel in the wonder and beauty that is revealed in our understanding of nature. Bring a child's curiosity to your observation of the world around you. But perhaps most importantly, use your intelligence and education to be a skeptical and informed citizen. Help debunk false claims and share, from your particular perspective, in finding solutions to the many faceted scientific challenges that society faces today. Given your talents and potential, you are going to be called upon often to take on any number of responsibilities going forward. I ask you to save a little room for science! I wish you immense success as you go on to ever more exciting adventures.

NOTES FROM THE OUTSIDE

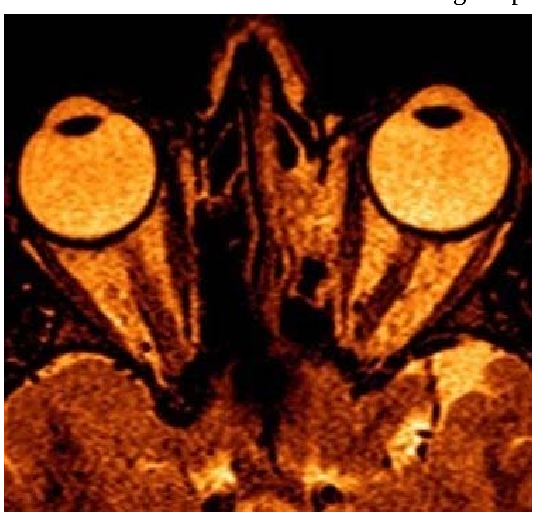
By Liz Bannon '06

When we last met our hero…

I have to admit, when Dr. McGee asked me to update the Dilated Times community on where life has taken me, I had to go back and read the last article that I wrote, waaaaaay back in the Spring of 2007. (Volume 17 Number2) To sum up, at that point my husband and I were living in India and I had applied to Georgia Tech's distance learning masters program in medical physics. Since then, I was accepted to the program, we've moved back to the states, we had a daughter named Leela, I've completed my master's degree and I found a job as a medical physics resident in the radiation oncology department of UMASS Memorial Hospital in Worcester, MA.

Medical physics is the field of physics as applied to medicine, specifically the use of radiation to diagnose and treat. Medical physicists are part of the team in the departments of diagnostic imaging, nuclear medicine and radiation oncology. Similar to physicians a medical physicist specializes, after graduating with a masters or doctoral degree, by entering into a two or three year residency focusing on one specialty, with a board certification process that includes two written exams and an oral exam spread out over a period of approximately 3-5 years.

In radiation oncology, where approximately 90% of medical physicists find themselves, our goal is to work as part of a team of physicians, dosimetrists, therapists and nurses to design radiotherapy treatment plans to improve the quality of life for our patients. The role of the medical physicist is multifold. We must ensure that the equipment is working properly to avoid both over- and under-dosing. We help design the treatment plans to maximize dose to the target volume while minimizing dose to the surrounding healthy tissue. In some cases we are required to be in the treatment room (or close by) in order to oversee the procedure. The vast majority of patients have cancer but radiotherapy can also be used in place of traditional neurosurgery in order to reduce the invasiveness of a surgical procedure.



An MRI of Liz's eyeballs

Medical physics drew me in for a few reasons. Clearly, I like physics. (Would anyone get a physics degree if they didn't like it??) But I also like biology and it's necessary to understand exactly what is happening biologically within a patient. I've always enjoyed working in hospital settings and the idea that I may be able to help make someone's life a little better, even if only for a few weeks, is worthy of my life's work. After four months of work, I am finding my new career challenging and inspiring. There are cases that are difficult emotionally, such as the 12 year old girl we gave a palliative treatment to last week, but each and every patient chart I work on is a person who I have helped, even if only tangentially.

BIO: Liz Bannon graduated in 2006. After a slight delay that involved a move overseas, she enrolled as a masters student in medical physics at GA Tech, graduating in May of 2010. She is currently working as a medical physics resident and hopes to sit for Part I of her boards in the summer of 2011. She lives in Maynard MA with her husband, Brad, a comparative theology student at Harvard University, their daughter Leela and the new life burgeoning in her abdomen, affectionately known as Cashew and expected into this world some time in late March or early April of 2011. She will be a guest speaker for the Society of Physics Students in February.

Summer Research

By Dan Clement '12

This summer, I worked at University of Wisconsin at Madison for ten weeks in an organic synthesis lab. I applied for the program through Dr. McGee. I synthesized a donor segment of a conjugated polymer. This research is involved in applications of photovoltaics and electrochromics. In addition to my work, I attended research seminars where professors presented their research. We also attended seminars about presenting scientific research. It was an excellent experience and I would recommend it for anyone interested in graduate school for sciences.

By Bill Menges '12

During the summer I worked under the auspices of Dr. McGee. Our research on the solution based fabrication of organic semiconductors was done between Drew University and Johns Hopkins. The project was an exciting blend of chemistry and applied physics.

By Ashish Shah '13

During the summer, I worked with Dr. Mary-Ann Pearsall on Transition Metal Clusters. My worked involved reacting different Osmium Carbonyl clusters. Transition metal clusters are usually good industrial catalysts and they also have potential in nano-technological applications. My work mainly involved connecting two $Os_3(CO)_{10}(OCH_2CH_2OH)_2$ clusters with ethylene glycol. These two carbonyl clusters were created by reacting $Os_3(CO)_{10}(OEt)_2$ with ethylene glycol.

By Ariel Breitbart '11

Neural circuitry of the visual system is very complex. Visual sensory neurons transmit and process signals from the retina, and they contribute to our perception of different visual features such as motion, color, depth, and contrast. These visual features and the corresponding neural selectivity can be studied using mathematical and computational techniques. The purpose of this study is to characterize neural feature selectivity, by using (1) natural stimuli, (2) linear model of a neuron, and (3) linear regression technique. Linear regression will be used to characterize the response properties of the neurons to such visual features as color and contrast, by solving for the linear weights for given input and output pairs and finding a small set of dimensions within a high dimensional stimulus space that is relevant for the neural responses.

"Summer Research" section continued on Page 8...

…"Summer Research" section continued from Page 7

By Alae Kawam '14

After my acceptance into Drew's HHMI Bridge Program, I wasn't sure what to expect. I knew I was going to work in a laboratory, but I didn't know what experiments I was conducting or who I was going to work with. When I met the professor I was assigned to, Dr. Kouh, he handed me a tote bag with the most unexpected items in it: a Bluetooth dongle and a Wii remote. He explained to me the physics experiments I was going to conduct with a Wii Remote. I wasn't sure how I was going to do any experiments with a game remote controller but learning how to do it all was the best part. I learned how to collect and analyze data from a Wii remote using computer programs- which I did not know existed. I also learned that working with any experiment requires patience because the only way to deal with tens of thousands of data points is by being patient.

By Melissa Hoffman '13

This summer I worked with Dr. Murawski in Drew's observatory. I used our DFM 16" telescope and SBIG CCD (charge coupled device) camera to study variable stars. Using differential photometry I studied two variable stars, delta cepheid, a standard cepheid pulser, and SS cygni, a white dwarf. Photometry and spectroscopy of variable stars is an important tool for astrophysics to understand the life and workings of stars.

By Erinn O'Neill '13

This summer I worked with Dr. Ryan Z. Hinrichs, researching atmospheric chemistry. I studied reactions between solid potassium iodide and gaseous nitrogen dioxide (a sea salt aerosol and a pollutant) at various relative humidities and concentrations of nitrogen dioxide. We monitored our reactions with infrared spectroscopy and UV-Vis spectroscopy and were able to identify I_2 (g) as our major gaseous product.

By Aaron Loether '11

New Jersey's prestigious Governor's School in the Sciences is a an academically challenging program for brilliant high school students. It was my great pleasure to work as a counselor and Teaching Assistant for this program which is hosted by our own Drew University. Working with these exceptional kids was one of the most rewarding experiences of my life. My primary function was helping a team of students to do Ramen Spectroscopy research. I greatly enjoyed my time with the Governor's School and hope to return again next summer.

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

"You just can't tell where the math stops and the physics starts!"

-Dr. Candiotti

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. David McGee
Drew University
Department of Physics
Madison, NJ 07940
E-mail: dmcgee@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. David McGee at the address listed above in the laboratory equipment announcement.

Upcoming Events:

April 16, 2011:

Spring Saturday Admissions Open House. Welcome prospective physics majors by joining the physics department as we show our stuff with "phun" physics demos and tasty treats (who doesn't love liquid-nitrogen-frozen marshmallows?).

May 14th, 2011:

Commencement. Join us at the physics department table for fond farewells and a champagne toast following the ceremonies.

Watch For:

Lunchtime Pizza Talks on Fridays (want to give a talk? Contact Dr. David J. McGee)

Remember:

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

The Dilated Times

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Address Correction Requested

Don't forget to visit the physics department website at:

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

Inside...

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Contributors…

Dr. David J. McGee, Dr. Bob Fenstermacher, Liz Bannon, Aaron Loether, Alae Kawam, Ariel Breitbart, Ashish Shah, Bill Menges, Dan Clement, Drew Bryar, Erinn O'Neill, Melissa Hoffman