physics

THE COLLEGE OF WOOSTER 2010-2011 ANNUAL REPORT

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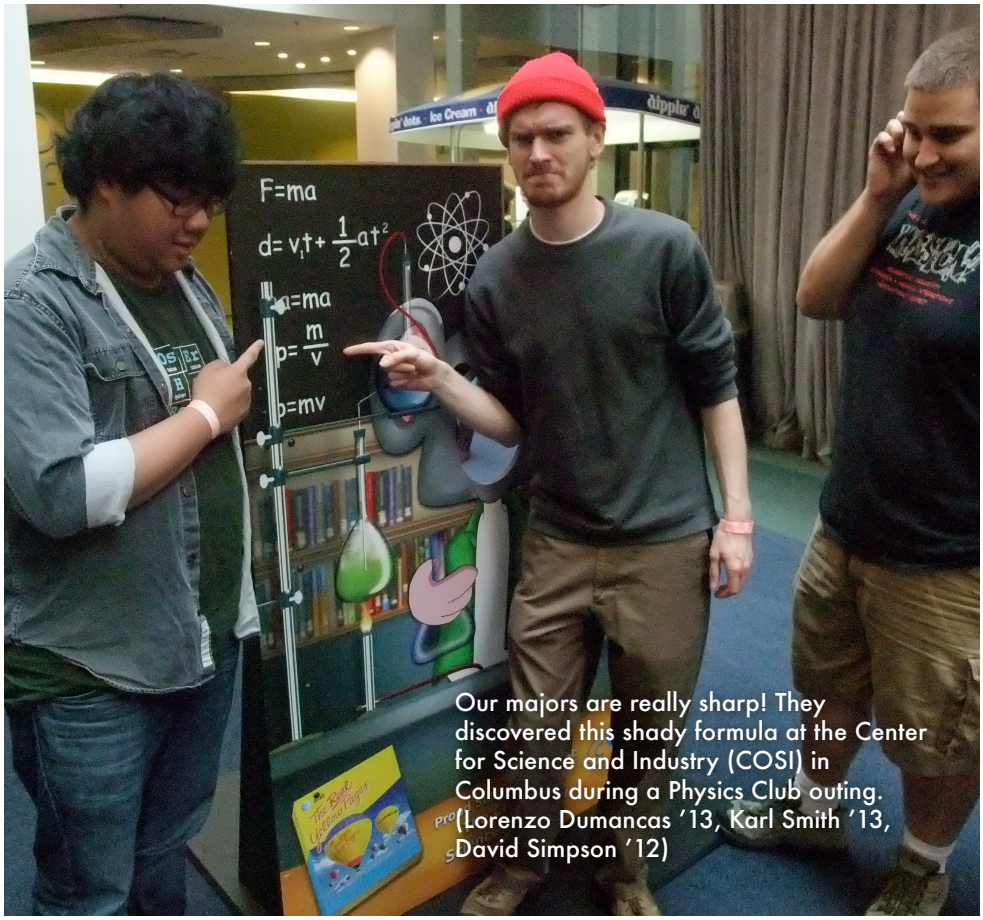
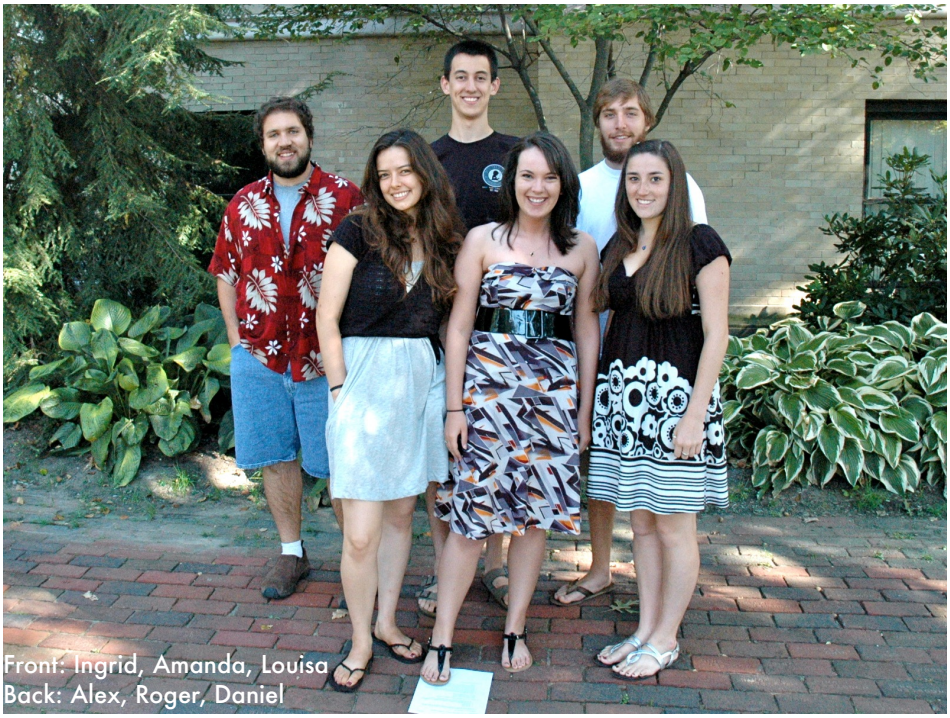


Our majors are really sharp! They discovered this shady formula at the Center for Science and Industry (COSI) in Columbus during a Physics Club outing. (Lorenzo Dumancas '13, Karl Smith '13, David Simpson '12)

Fun with liquid nitrogen

Professor Jacobs' "fast Fourier transform" cake he created to celebrate sophomore "declaration of major day".

Contents:



Front: Ingrid, Amanda, Louisa
Back: Alex, Roger, Daniel

Class of 2011

Roger Klein

Grosse Pointe, MI

Double major in Physics and Biochemistry Molecular Biology

Plans: Roger will be entering Washington University's "Medical Scientist Training Program", a combined MD/PhD federally funded program which is designed to encourage students to go into the field of medical research Tentatively, he plans on specializing in immunology during the medical years and molecular biophysics during the graduate years.

At Wooster, Roger participated in Xi Chi Psi (Service Chair, Alumni Coordinator, Treasurer), Inter-Greek Council (Treasurer, President), Biochemistry Club (Treasurer, President), First Responders, COW Residence Life (Resident Assistant) and Intramural Sports.

Louisa Catalano

Cleveland Hts, OH

Double Major in Physics and Mathematics

Plans: Louisa plans to find a job related to physics or mathematics in the Cleveland area and eventually will be applying to graduate school in engineering or mathematics.

At Wooster, Louisa played the trumpet in Scot Band (symphonic and marching) for all four years.

Daniel "Alex" Sullivan

Columbus, OH

Major in Physics

Plans: Employment
Alex served as an officer in the Physics Club and was involved in Greek life on campus.

Amanda Logue

Jacobsburg, OH

Major in Physics

Plans: Employment and eventually graduate school
While at Wooster, Amanda co-authored a paper that appeared in Physical Review E. She minored in chemistry.

Alex Saines

Logan, OH

Major in Physics

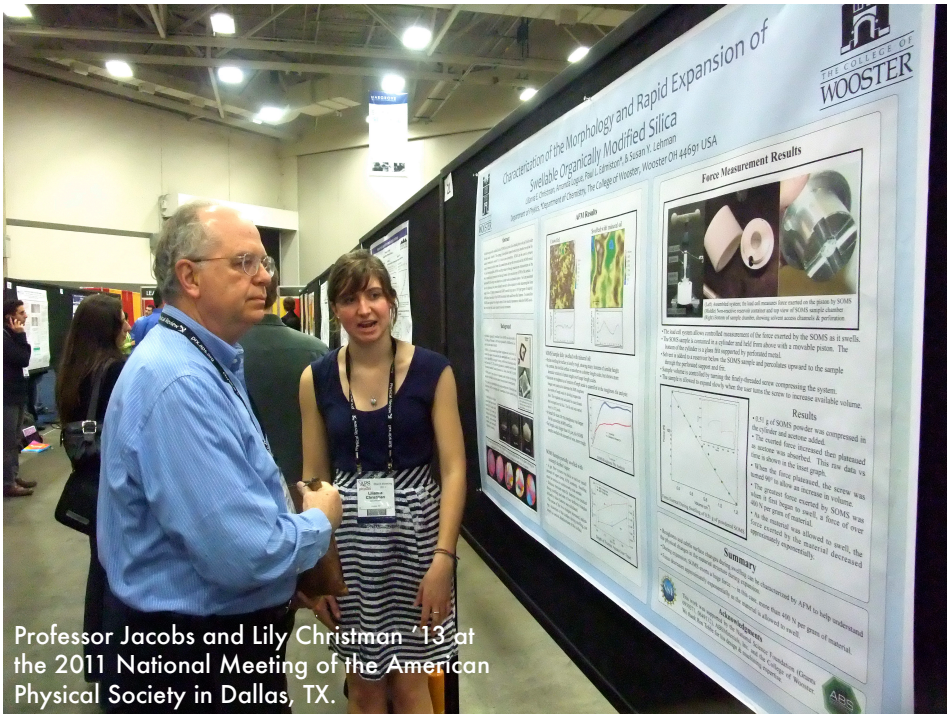
Plans: Alex plans to get a masters degree in a field yet to be decided. At Wooster, Alex was active in the Physics Club and was a regular participant in the club's outreach program at local elementary schools. He enjoyed practicing karate with his many Wooster friends.

Ingrid Thvedt

San Leandro, CA

Double major in Physics and German

Plans: Travel in Europe
Ingrid spent both semesters of her junior year studying in Germany after doing her Junior Independent Study in physics during her sophomore year.



Professor Jacobs and Lily Christman '13 at the 2011 National Meeting of the American Physical Society in Dallas, TX.

Physics Faculty

Donald T. Jacobs

Victor J. Andrew Professor of Physics (at Wooster since 1976; PhD Colorado 1976; BA,MA South Florida 1971, 72)

Even though Professor Jacobs revealed the earth-shattering news that he will retire in December of 2011, he continued to juggle his many and varied responsibilities and commitments with his usual efficiency and dedication during this past academic year.

A publication "Micellization and phase separation for triblock copolymer 17R4 in H_2O and D_2O" in *Langmuir* culminated three years of research supported by Research Corporation that included three undergraduate co-authors. In addition, three of Dr. Jacobs' students who worked with him in last summer's research program presented their work at the national conference of the American Physical Society in Dallas, TX.

Dr. Jacobs served once again as the faculty grants associate and was part of a team developing research proposals to the Sherman Fairchild Foundation, NSF S-STEM, HHMI, and NSF-UBM (biology/math collaborative research.) He also served on the HHMI steering committee and the McGregor ethics modules.

Dr. Jacobs handled the assessment goals and measures duties for the Physics Department this past year. On campus, he did idea judging for the Center for Entrepreneurship and was a presenter at new faculty orientation and a leaves proposal workshop.

In May, Dr. Jacobs and Dr. Susan Lehman participated in the Workshop on Large Fluctuations and Collective Phenomena in Disordered Materials at the Institute for Condensed Matter Theory and Materials Computation Center at the University of Illinois. They presented a poster entitled "Avalanche Scaling Using a Tuning Parameter in a Conical Bead Pile".

Teaching

General Physics 101
Modern Physics 205
General Physics 102
Thermal Physics 302

Senior Independent Study

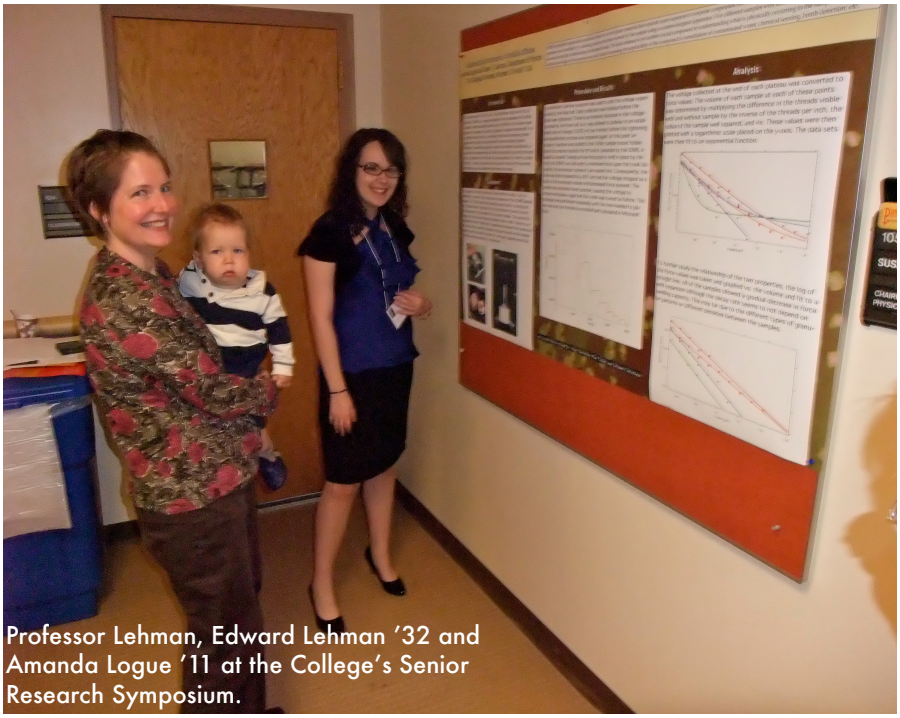
Roger Klein
A Study of the Structure/ Function Relationship of NicF in the Bordetella bronchiseptica Nicotinic Acid Degradation Pathway

Publications

Alison Huff*, Kelly Patton*, Hosanna Odhner*, D.T. Jacobs, Bryna Clover, and S. C. Greer, "Micellization and phase separation for triblock copolymer 17R4 in H_2O and D_2O", *Langmuir* 27, 1707-1712 (2011).
*Student co-authors

Research Interests

Experimental research in phase transitions of liquid-liquid mixtures, polymer-solvent systems, triblock copolymers and micelles including measurements of turbidity, heat capacity, viscosity, density, and the coexistence curve on these systems. Self-organized criticality and percolation in granular materials.



Professor Lehman, Edward Lehman '32 and Amanda Logue '11 at the College's Senior Research Symposium.

Physics Faculty

Susan Lehman

Clare Boothe Luce Associate Professor of Physics and Chairperson (at Wooster since 2003; MS, PhD North Carolina 1996, 99; BA Goshen 1993)

Dr. Lehman's long-term collaboration with scientists from Ohio State University and Sandia National Laboratory resulted in the publication "Measurements of the quantum-confined conduction band energy in the wetting layer surrounding individual $In_{0.4}Ga_{0.6}As$ quantum dots by cross-sectional ballistic electron emission microscopy" in *Physical Review B*. Using the department's NSF Research Experience for Undergraduates grant, Dr. Lehman and Lily Christman '13 began investigating the physics behind the unusual absorption and swelling properties of SOMS (or Osorb ®), the material developed by Dr Paul Edmiston in the Wooster Chemistry Department. She also began collaborating with Dr. Don Jacobs on his on-going work with avalanches and granular materials. Results from both of these projects were presented by the students at the national American Physical Society meeting in March.

On campus, Dr. Lehman served as chair of the Financial Advisory Committee, Admissions liaison for the Physics Department and the Pre-engineering Program, and as a member of the Cross-talk committee. She was part of a team that presented to the Board of Trustees regarding the College's Strategic Initiatives and financial resources.

In May, Dr. Lehman and Dr. Don Jacobs participated in the Workshop on Large Fluctuations and Collective Phenomena in Disordered Materials at the Institute for Condensed Matter Theory and Materials Computation Center at the University of Illinois. They presented a poster entitled "Avalanche Scaling Using a Tuning Parameter in a Conical Bead Pile".

Dr. Lehman developed a presentation and student workshop on *Ethics and Science*, and gave this training to the physics summer research students in 2010 and 2011.

Dr. Lehman will be on sabbatical during 2011-2012 and plans to use ballistic electron emission microscopy (BEEM) to investigate a new type of material: GaN nanowires.

Teaching

Foundations of Physics 203
Mechanics 301
Condensed Matter 377
Junior Independent Study

Senior Independent Study

Amanda Logue
Understanding the Expansion of a Swellable Silicate

Ingrid Thvedt
Exploration of the Effects of Cohesive Forces in a Bead Pile

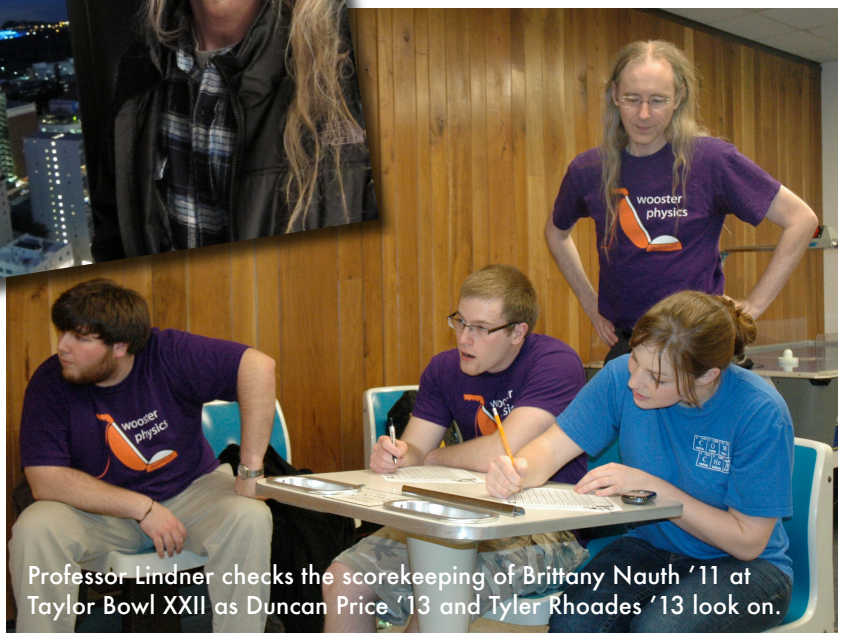
Publications

C. Marginean, J. P. Pelz, S. Y. Lehman, and J. G. Cederberg, "Measurements of the quantum-confined conduction band energy in the wetting layer surrounding individual $In_{0.4}Ga_{0.6}As$ quantum dots by cross-sectional ballistic electron emission microscopy", *Physical Review B* 82, 035304 (2010).

Research Interests

Investigation of semiconductor nanostructures using ballistic electron microscopy, avalanching and critical behavior in granular materials, experimental research into structure and swelling behavior of swellable organically modified silica (SOMS). Also studying the optics of cavity ringdown, and the freezing behavior of differently treated, ultrapure water.

Auckland, New Zealand, July 2011



Professor Lindner checks the scorekeeping of Brittany Nauth '11 at Taylor Bowl XXII as Duncan Price '13 and Tyler Rhoades '13 look on.

Physics Faculty

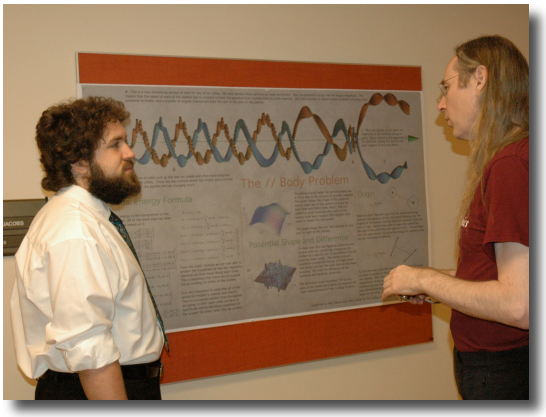
John Lindner

Moore Professor of Astronomy (at Wooster since 1988; PhD Caltech 1989; BS University of Vermont 1982)

Dr. Lindner's paper on celestial trackers, which he co-authored with Corey Atwood-Stone '10 and Travis Brown '10, was featured on the cover of the November 2010 issue of American Journal of Physics.

At the Winter Meeting of the American Association of Physics Teachers in Jacksonville, Florida, Dr. Lindner gave an invited talk entitled "20 Years of Computational Physics at Wooster". He also gave invited talks at Denison University and Kenyon College.

At Wooster, Dr. Lindner developed and taught a new course, Computational Physics. He served as advisor for a very active Physics Club and helped organized the 3rd annual Community Science Day which brought approximately 400 children, parents, and others to Taylor Hall for science demos in physics, chemistry, biochemistry, geology, biology, and neuroscience.



Professor Lindner and Alex Saines '11 at the Senior Research Symposium.

Teaching

Astronomy of Stars & Galaxies 122
Electricity & Magnetism 304
Modern Physics 205 Lab
Foundations of Physics 204
Foundations of Physics Lab
Computational Physics 230

Senior Independent Study

Louisa Catalano
Tighten Up: A Preliminary Study of Knots

Alex Saines
//
Order & Chaos in the Rotation & Revolution of Two Line Segments

Publications

B. J. Breen, A. B. Doud*, J. R. Grimm*, A. H. Tanasse*, S. J. Tanasse*, J F. Lindner, K. J. Maxted*, "Electronic and mechanical realizations of one-way coupling in one and two dimensions", Physical Review E volume 83, pages 037601(1-4) (2011)

C. McAlpine, C. Atwood-Stone*, T. Brown*, J. F. Lindner, "Tracking Stars, Sun, and Moon to Connect with the Universe", American Journal of Physics volume 78, pages 1128-1131 (2011)

*Student co-authors

Research Interests

Celestial mechanics, nonlinear dynamics of one-coupled arrays, practical knots

Professor Lewis checks out the Physics Club's "Air Zooka "at Scot Sprit Day

Physics Faculty

Karen Lewis

Assistant Professor of Physics (at Wooster since 2010; PhD Penn State 2005; BS Physics & Mathematics University of Wisconsin 1999)

Professor Lewis demonstrates a telescope to a young fellow at Community Science Day

Dr. Lewis joined the Department of Physics this past year as a new tenure-track faculty member. During the year, she noted that there was quite a lot of interest in astronomy among the physics majors and helped them to form an Astronomy Club. There are several non-majors in this club as well, which is very exciting. The Astronomy Club participated fully in Community Science Day and Dr. Lewis helped conduct activities which included the creation of comets from dry ice and dirt. The Physics Department recently purchased a Meade 8-inch LX90-ACF (f/10) advanced coma-free telescope and a dual sensor self-guiding CCD camera. Dr. Lewis plans to use the new telescope for viewing events with the Astronomy Club this fall and will be helping to incorporate the telescope into the Junior Independent Study course.

This past summer, Dr. Lewis attended the American Association of Physics Teachers' New Physics and Astronomy Faculty Workshop in Greenbelt, MD and a workshop at the University of Nebraska on using astronomy to teach physics.

Teaching

Astronomy of the Solar System 122
Astrophysics 320
Foundations of Physics 203 lab
Astronomy of Stars & Galaxies 121
Math Methods 208
Foundations of Physics 204 lab

Senior Independent Study

Daniel Sullivan

Determining the clumpy nature of the toroidal region: An analysis of X-ray emissions from active galactic nuclei

Publications

Lewis, K.T., Sambruna, R., Angelakis, E., Eracleous, M., Cheung, C. C., Kadler, M., 2011, Multi-Wavelength Observations of a Sample of Intermediate Luminosity Radio Galaxies, *The Astronomical Journal*, 142, 9.

Lewis, K. T., Eracleous, M., Halpern, J., & Storchi-Bergmann, T., 2010, Long-Term Profile Variability in Double-Peaked Emission Line AGNs, *The Astrophysical Journal Supplements*, 187, 416.

Winter, L., Lewis, K.T., Koss, M., Veilleux, S., Keeney, B., and Mushotzky, R.F., 2010, Optical Properties of Swift BAT-detected Active Galactic Nuclei Sources, *The Astrophysical Journal*, 710, 503.

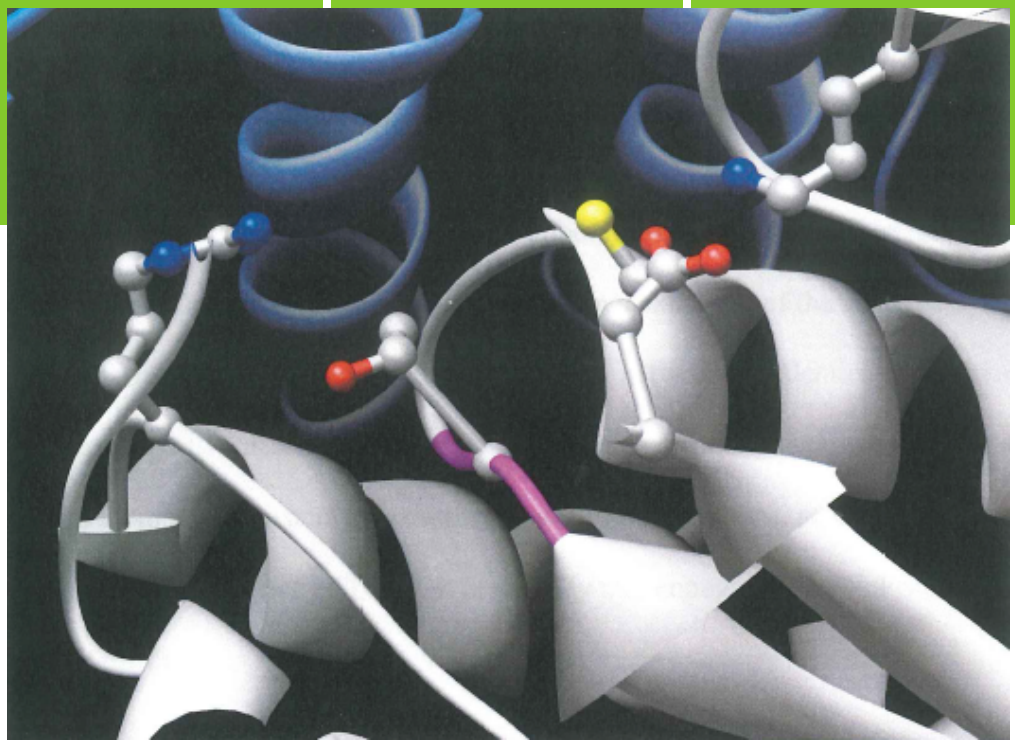
Research Interests

Analysis of Active Galactic Nuclei (AGN) found in the XMM-Newton Slew Survey. Dr. Lewis is most interested in using the X-ray and optical spectra in conjunction to probe the structure of the dusty material that shrouds the AGN, to literally "x-ray" the torus.

Roger Klein

A Study of the Structure/Function Relationship of NicF in the Bordetella bronchiseptica Nicotinic Acid Degradation Pathway

Senior	Independent	Study
advised by	Mark Snider (BCMB)	Donald Jacobs (Physics)



Abstract

Six genes responsible for the aerobic catabolism of nicotinic acid have been recently identified in bacterial systems (Jiminez et. al., 2008). We examine this pathway in the pathogenic genus *Bordetella*, in which the buildup of nicotinic acid has been shown to affect the expression of transcription factors regulating the virulence factors during infection in humans and other mammals. The fifth enzyme in this pathway, NicF, catalyzes the hydrolytic deamination of maleamic acid to maleic acid. Based on a crystal structure obtained using X-ray diffraction, we propose a complete catalytic mechanism based on the chemical identity and arrangement of residues in the active site. This mechanism occurs in two major steps, the first of which is the formation of a covalently bound tetrahedral intermediate following the attack of Cys150 on the alpha carbon. Following the release of ammonia, a second tetrahedral intermediate forms upon the attack of a hydroxide ion on the carbon, resulting in subsequent substrate release. Asp29 is thought to play an important role as both a general acid and general base in the abstraction and subsequent donation of a proton from cysteine to ammonia. To further probe structure and potential conformational changes during catalysis, a series of conditions based around Hampton Research's Crystal Screen® were explored in an attempt to co-crystallize NicF with its product, maleic acid. Unfortunately, these screens proved unsuccessful in obtaining a product-bound form of NicF. Attempts were also made to reproduce the conditions used to obtain crystals of the apoenzyme for use in soaking studies. However, even under the identical buffer and protein conditions, diffraction-quality crystals did not form. It was determined that Buffer 15 (0.2 M Ammonium sulfate + 0.1 M sodium cacodylate trihydrate 6.5 + 30 percent w/v Polyethylene glycol 8,000) yielded the most promising results, and that variants of the buffer should be tested under tightly controlled temperature and humidity conditions for further studies. The K_D of the product, maleic acid, was also determined using isothermal titration calorimetry (ITC) to be 3.8 ± 0.4 mM, a value 40-fold higher than the K_D of the substrate, maleamic acid.

Above: Proposed active site of NicF. The placement of the Cys150 residue underneath the plane of the other three active site residues indicates that the maleamic acid is attacked from beneath the plane of the molecule. The cis peptide (threonine) is pictured in magenta.

Louisa Catalano

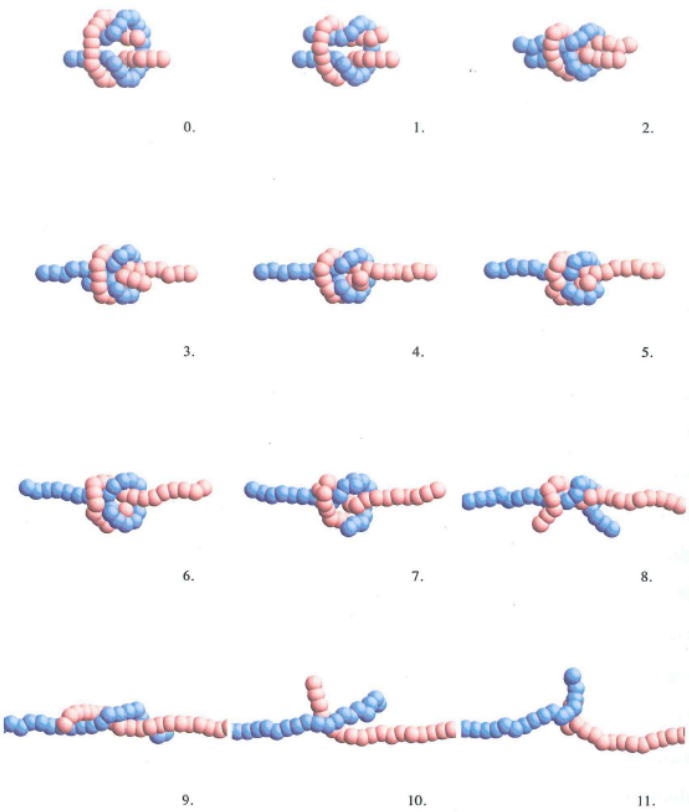
Tighten Up: A Preliminary Study of Knots

Senior Independent Study

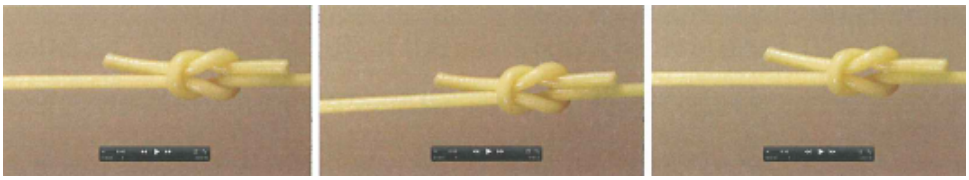
advised by Jennifer Bowen (Math) John Lindner (Physics)

Abstract

Knots are a common occurrence in everyday life, so common, in fact, that they are often taken for granted. Knots are able to make one string out of two, without any adhesive, simply by entangling the strings' ends in a certain way. Some weaker knots may slip, but strong knots will outlast the string, forcing the string to break before the knot slips. This thesis outlines the initial steps in creating a solid basis for studying knots, both mathematical and physical. The basics of the mathematical field of knot theory are explored. Two preliminary simulations modeling the motion of knots slipping are discussed; the first simulation uses Newtonian mechanics to describe the motion of the strings, while the second uses Lagrangian mechanics. Exploratory experiments studying the behavior of a knot tied with two pieces of perciatelli pasta are also examined. This study lays the groundwork for further research into the properties and benefits of mathematical and physical knots.



Above: Still images from the completed FMA simulation (based on Newton's second law) with a viscosity of 0.1.



Left: The hanging end of the pasta (on the left side of each frame) is swinging back and forth. The time between each frame is about 1 second.

Alex Saines

// Order & Chaos in the Rotation & Revolution of Two Line Segments

Senior Independent Study

advised by John Lindner (Physics)

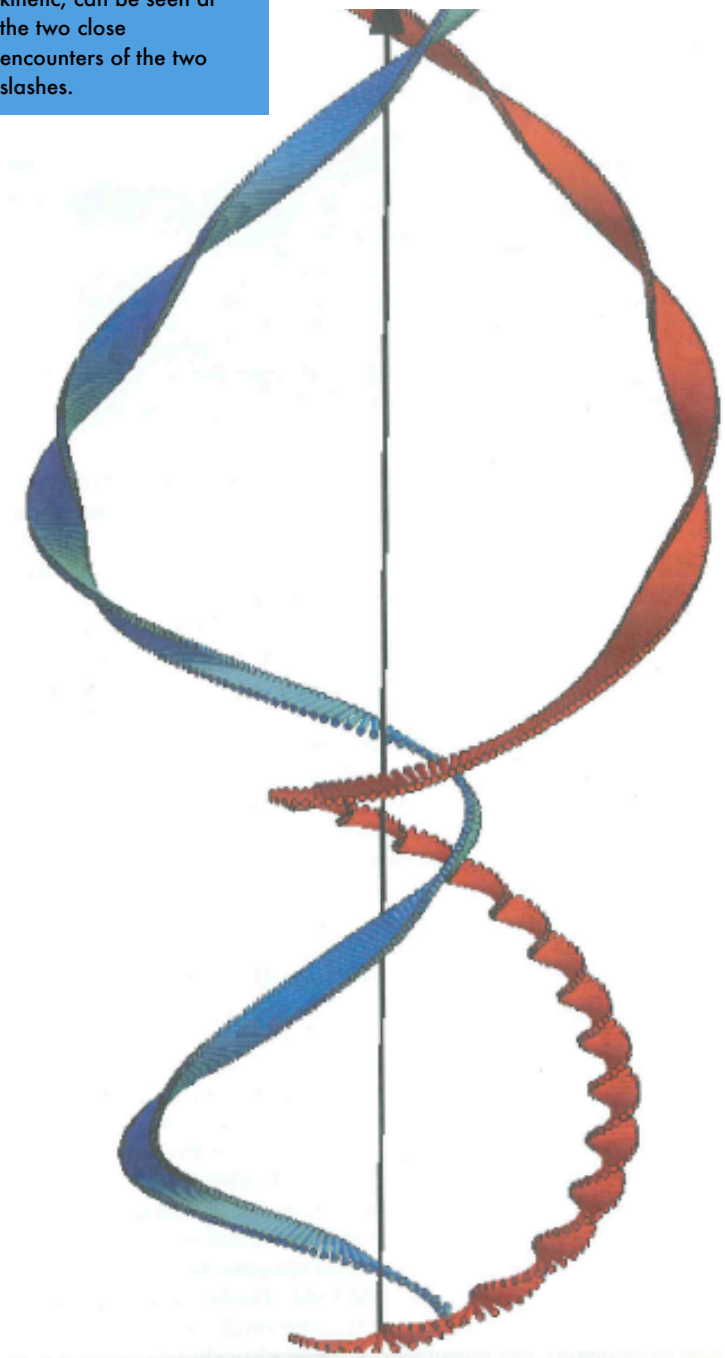
Abstract

Describing the motion of two line segments (slashes, //) orbiting about each other is the goal of the // Body Problem. To calculate the movement of the slashes in the // Body Problem we used the LaGrange method considering only the gravitational potential energy. Once an algebraic expression of the potential energy was obtained by integration of the Newtonian potential energy we created a Lagrangian for the system. Finally, using the Euler-Lagrange equation we derived the exact equations of motion for all variables within the // Body Problem.

To check the potential energy we numerically integrated the potential at a specific set of parameters and then evaluated our derived potential energy using the same set of parameters and variables. We found that our potential energy is a near-exact version of the numerically integrated instance finding errors no larger than one part per hundred thousand using several tests. The tests include graphing the potential energy while rotating the slashes, moving the slashes physically apart while fixing their rotation, viewing their orbits and checking for the conservation of energy and momentum.

Further study included a preliminary search for families of orbits by numerically integrating the equations of motion. We attempted to find orbits which shared similar initial and final conditions based on the linear and angular velocities as well as the slashes separation. The orbits were further sorted by clarifying whether the specific initial conditions spawned an orbit where the slashes collided, diverged or formed stable orbits.

Snapshot of a 90 time unit period of the spacetime graph. The best instances of energy exchange, between potential and kinetic, can be seen at the two close encounters of the two slashes.



Amanda Logue

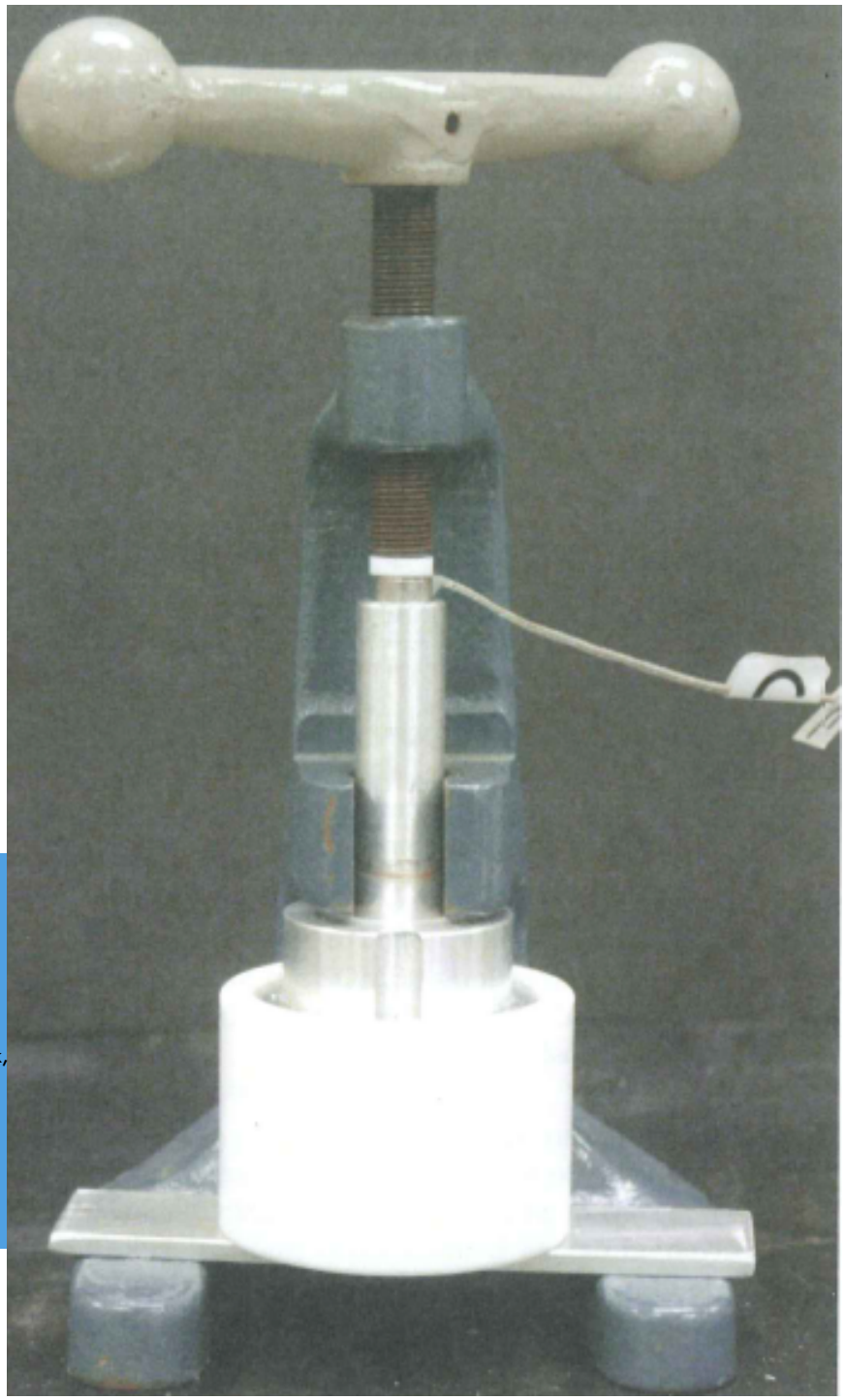
Understanding the Expansion of a Swellable Silicate

Senior Independent Study

advised by Susan Lehman (Physics)

Abstract

SOMS (swellable organically-modified silica) is a novel glassy material that expands upon exposure to nonpolar compounds but not upon the addition of water. The behavior upon expansion was modeled by collecting data on the force exerted by the sample using a custom-designed apparatus. Five different samples with different swelling capacities were processed using the methodology developed herein. The data obtained is yet another crucial component to understanding what is physically occurring to the sample as it expands. Further knowledge of this process can lend itself to increasing the applicability of the compound in remediation of contaminated water, chemical sensing, bomb detection, etc.



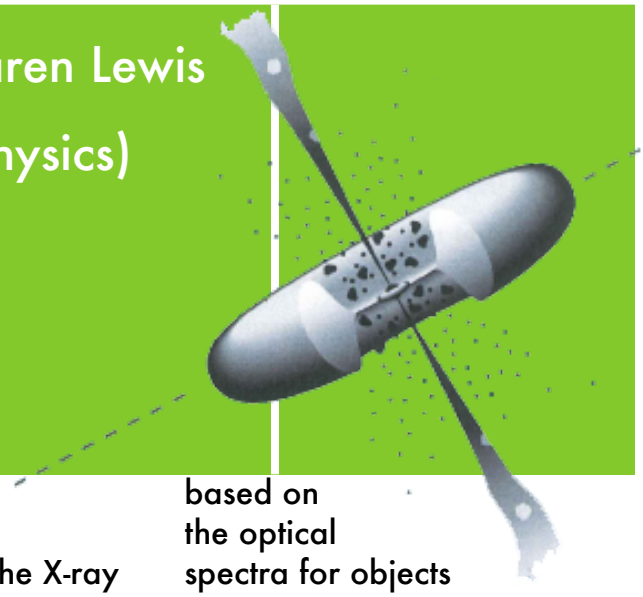
All of the components of the custom-designed apparatus are shown: adjustable crank, sample mount and holder, expandable piston, and the load cell

Daniel Sullivan

Determining the clumpy nature of the toroidal region: An analysis of X-ray emissions from active galactic nuclei

Senior Independent Study

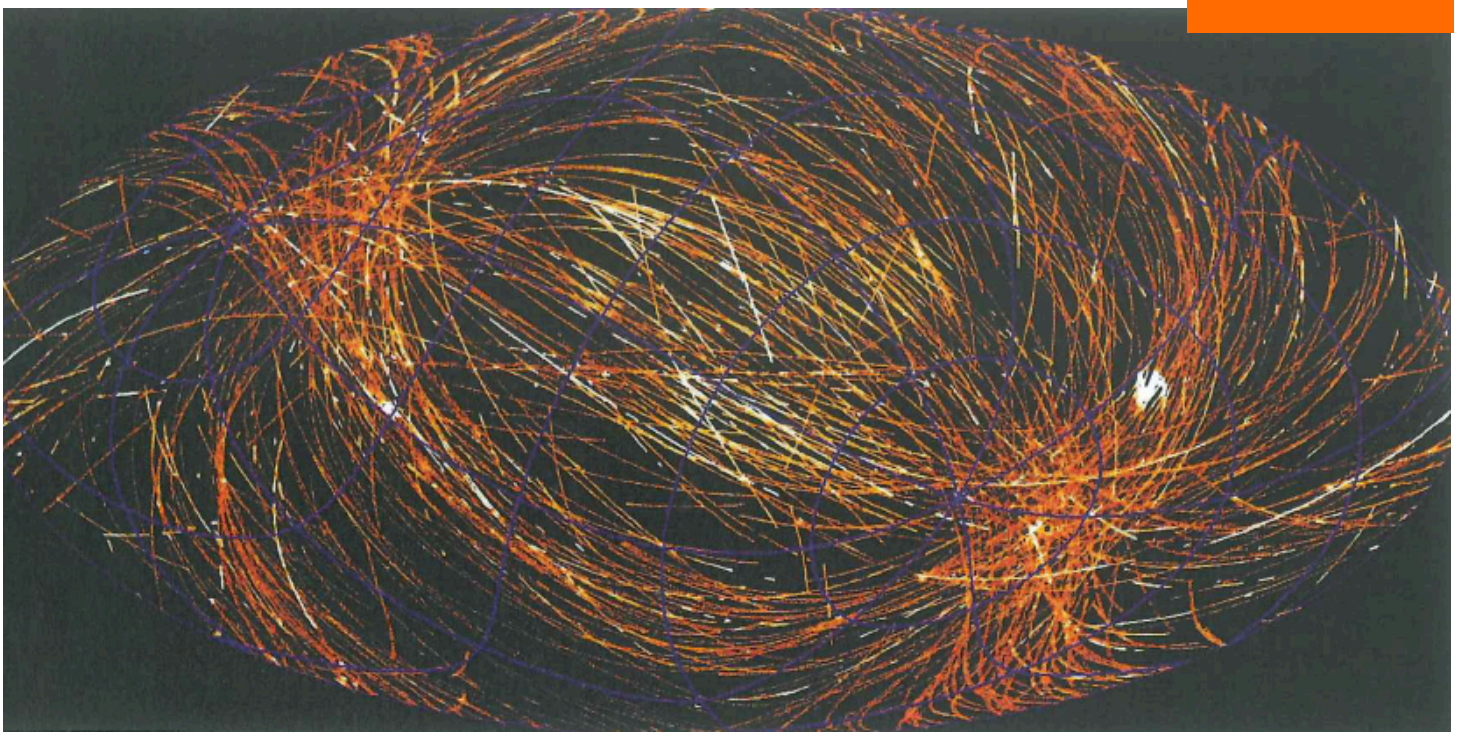
advised by Karen Lewis (Physics)



Abstract

X-ray spectroscopy creates the opportunity to study the emission and absorption characteristics in the central region of active galactic nuclei (AGN). Here, the structures fundamental to AGN are briefly explored as they contribute to the observed X-ray spectra, and the current working model of AGN is identified. The analysis, conducted in XPSPEC, utilizes reverse modeling of the X-ray spectra for 19 objects found in the XMM-Newton catalogue, yielding values for the column density of absorbing material near the source, photon index, flux, and luminosity. These parameters were then used to classify the objects which were compared to the optical classification for each. No classifications have been made based on the optical spectra for objects J081237.1-571421, J095220.3-623234, J112736.7+244918, and J223248.4-202222, so no comparisons could be made for these objects.

Traces of XMM slews currently completed within the slew survey

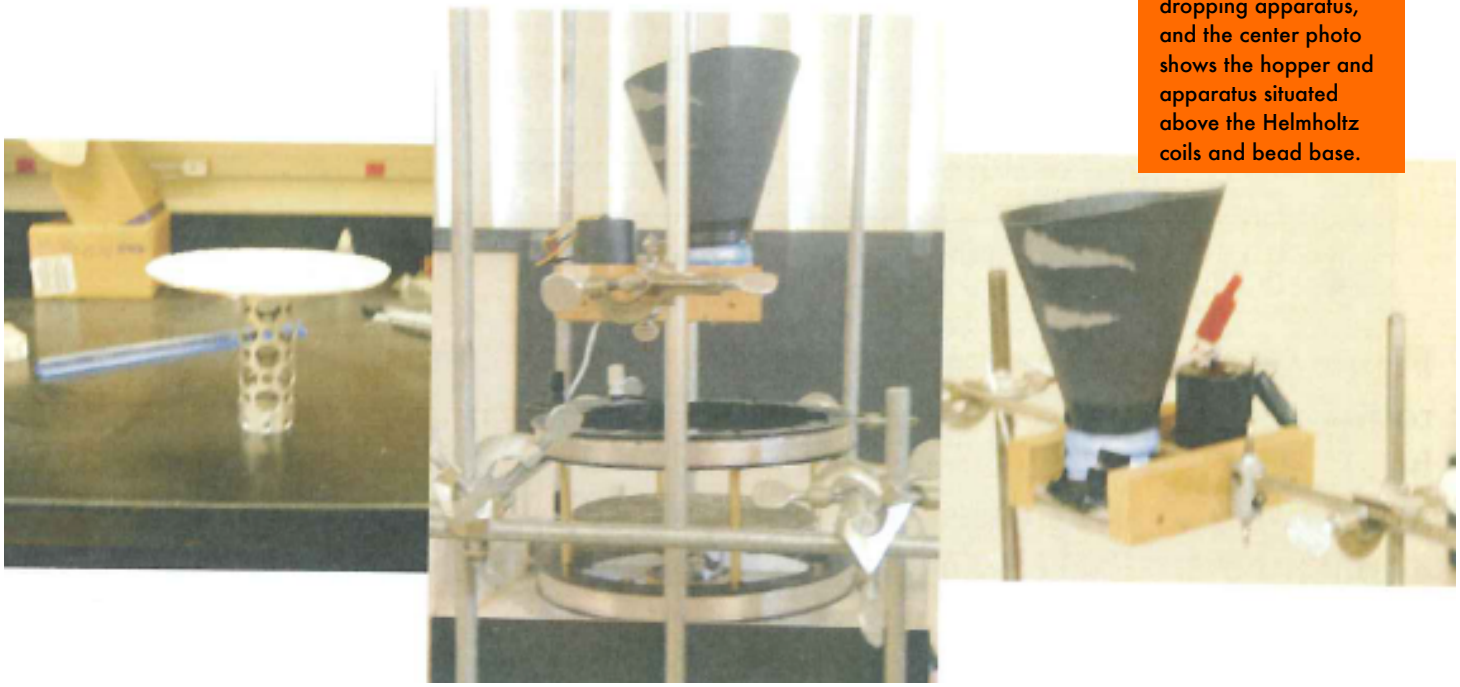


Ingrid Thvedt

Exploration of the Effects of Cohesive Forces on a Bead Pile

Senior Independent Study

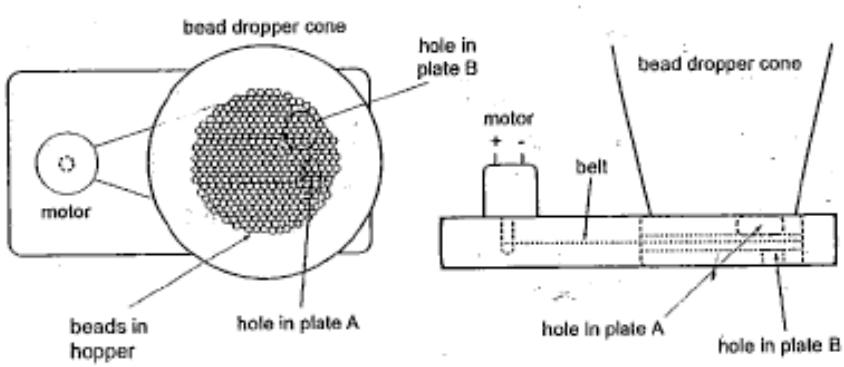
advised by Susan Lehman (Physics)



The left-most photo shows the base of the bead pile, isolated from the rest of the apparatus. The right-most photo shows the bead hopper and dropping apparatus, and the center photo shows the hopper and apparatus situated above the Helmholtz coils and bead base.

Abstract

The effects of the addition of cohesive inter-particle forces to a bead pile were investigated by placing a bead pile composed of ferromagnetic beads in a magnetic field. Data was taken at four different field values and analyzed in order to create avalanche probability plots. The data taken in the absence of a magnetic field matched data taken previously at The College of Wooster under similar circumstances. When placed under a magnetic field, the probability of mid-sized avalanches decreased and the probability of very large avalanches increased, causing humps in the probability plots. Increasing the magnetic field caused these humps to become more defined and move to the right. At strong enough magnetic fields, the decrease in mid-sized avalanches becomes so great that the hump separates from the rest of the data completely.



Self-Designed Projects

David Simpson
The Rainbow Connection: Optical Observations of Swellable Organically Modified Silica (SOMS)

Junior

Matt Damon
Shake, Shake, Shake, Tacoma

Margaret Raabe
Comparing the Performance of Baseball Bats

Norman Israel
Quantum Gravity: Causal Dynamical Triangulation

Independent

Patrick Butler
Spherical Ballistics and the Magnus Effect

Alyse Marquinez
Splish, Splash: Modeling Diving

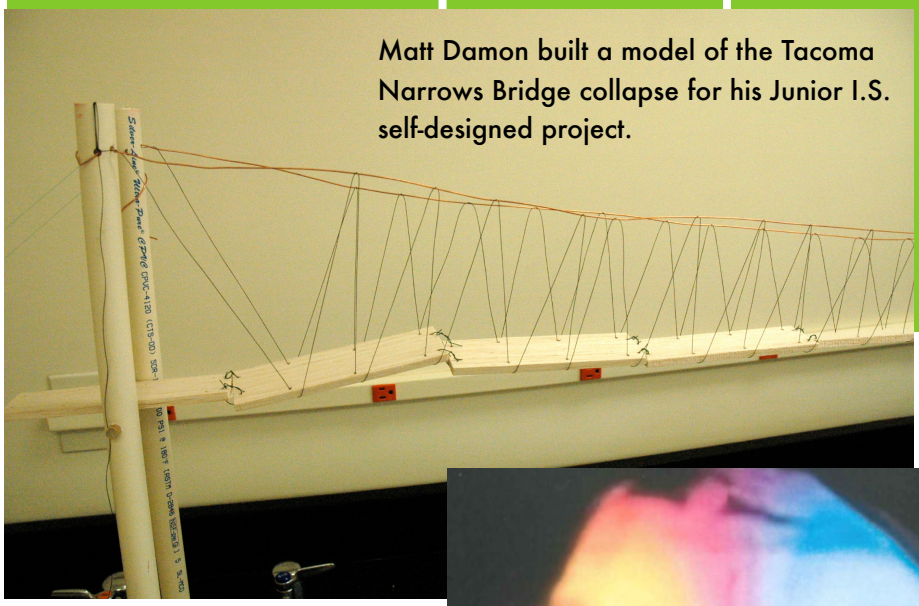
Mohammad Saif Ahmad
Bend it Like Magnus: Simulating Soccer Ball Physics

Study

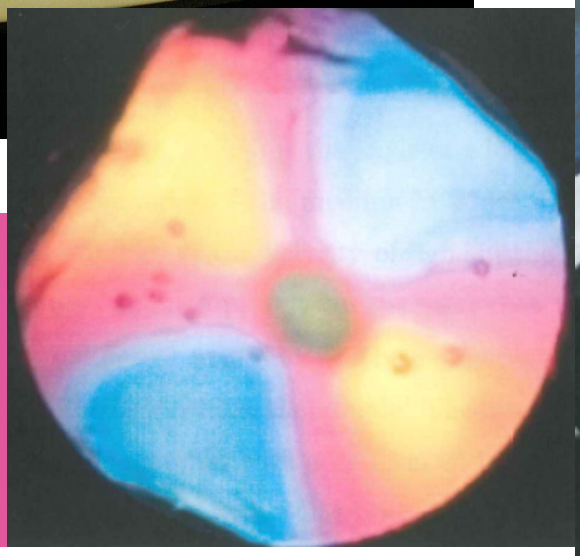
Katsuo Maxted
Analysis of Magnetic Fields for Toroidal Coils

Larry Markley
//: Beyond the Plane

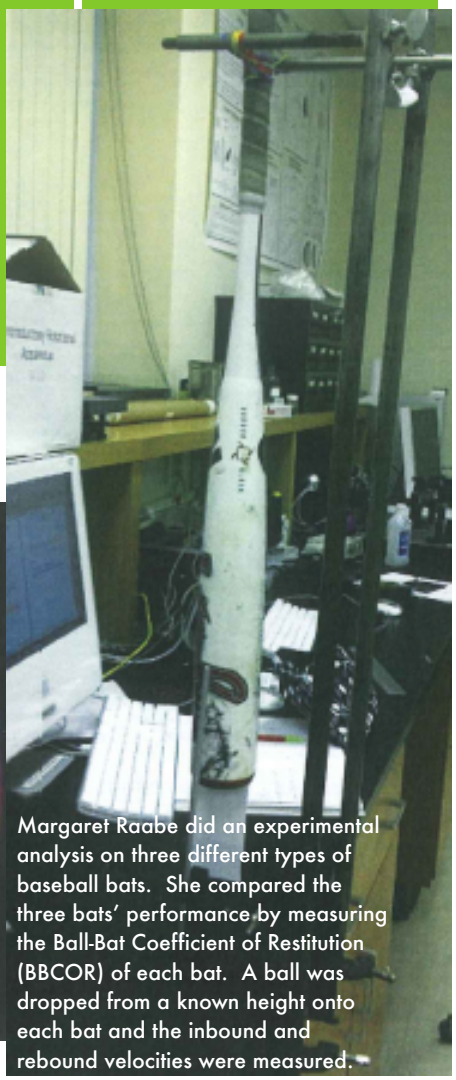
Kemal Ramic
X-ray Structural Analysis: Bragg Reflection and Laue Diagrams



Matt Damon built a model of the Tacoma Narrows Bridge collapse for his Junior I.S. self-designed project.



David Simpson investigated optical properties of Swellable Organically Modified Silica (SOMS) when observed with cross-polarized light and a first order red plate. As the sample swelled, it displayed color in a cross pattern known as the Maltese Cross which vanished once the maximum swelling size was reached.



Margaret Raabe did an experimental analysis on three different types of baseball bats. She compared the three bats' performance by measuring the Ball-Bat Coefficient of Restitution (BBCOR) of each bat. A ball was dropped from a known height onto each bat and the inbound and rebound velocities were measured.

Honors and Awards

Latin Honors

Summa cum laude

Roger Davies Klein

Cum laude

Ingrid Anne Thvedt

Departmental Honors

Roger Davies Klein

Phi Beta Kappa

Roger Davies Klein

Arthur H. Compton Prize in Physics

honors Dr. Compton, who received the Nobel Prize in Physics in 1927. This prize is awarded to the senior physics major attaining the highest standing in that subject.

Roger Davies Klein

Joseph Albertus Culler Prize in Physics

is awarded to the first- or second-year student who has attained the highest rank in general physics.

Andrew Douglas Blaikie

Mahesh K. Garg Prize in Physics

is awarded to an upper-class physics major who has displayed interest in and potential for applying physics beyond the classroom.

David Emery Simpson and Larry Christopher Markley

William Wallace Chappell-Elizabeth Dalton Memorial Prize

is awarded to the Section President who has exhibited the outstanding characteristics of scholarship, leadership, fraternity, and integrity.

Roger Davies Klein

Campus Council Leadership Award

honors gifted seniors who have demonstrated exemplary leadership during their four years at Wooster.

Roger Davies Klein

Relating to the second major:

Foster Prize in Mathematics

Louisa Gabrielle Catalano

Francis and Elizabeth Twinem Prize (pre-medicine)

Roger Davies Klein

Cary R. Wagner Prize in Chemisty

Roger Davies Klein

American Chemical Society Senior Award

Roger Davies Klein

Departmental Honors in German Studies

Ingrid Anne Thvedt

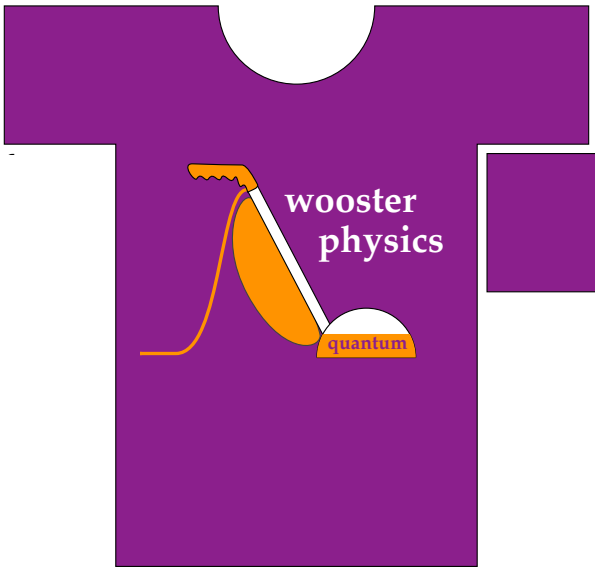
Departmental Honors in Biochemistry Molecular Biology

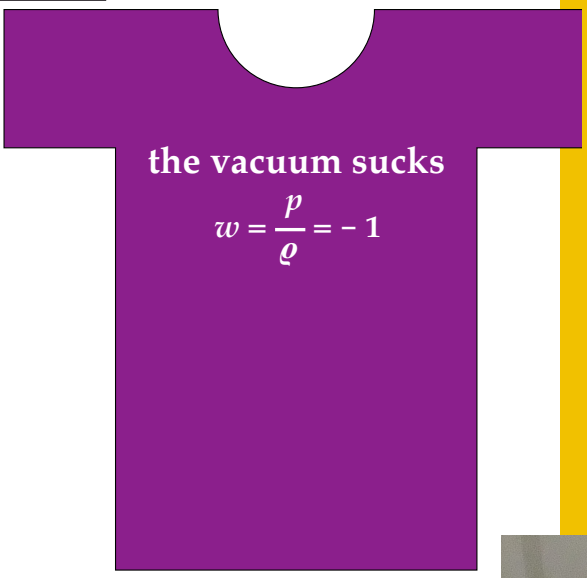
Roger Davies Klein

Physics Club

Society of Physics Students

The equation of state $p = w\rho$ relates density ρ to pressure p, where the dimensionless proportionality constant $w = 0$ for dust and $w = 1/3$ for radiation. The latest data suggests that $w = -1$ for space itself, which is consistent with Einstein's cosmological constant, and implies $p = -\rho < 0$. Positive pressure blows, but negative pressure sucks. This negative vacuum pressure anti-gravitates and apparently accelerates the expansion of the universe.





2011 T-shirt

"Quantum Vacuum"

Officers 2010-11

President: Larry Markley
Vice President: Karl Smith
Treasurer: David Simpson
Secretary: D. Alex Sullivan
Advisor: Dr. John Lindner

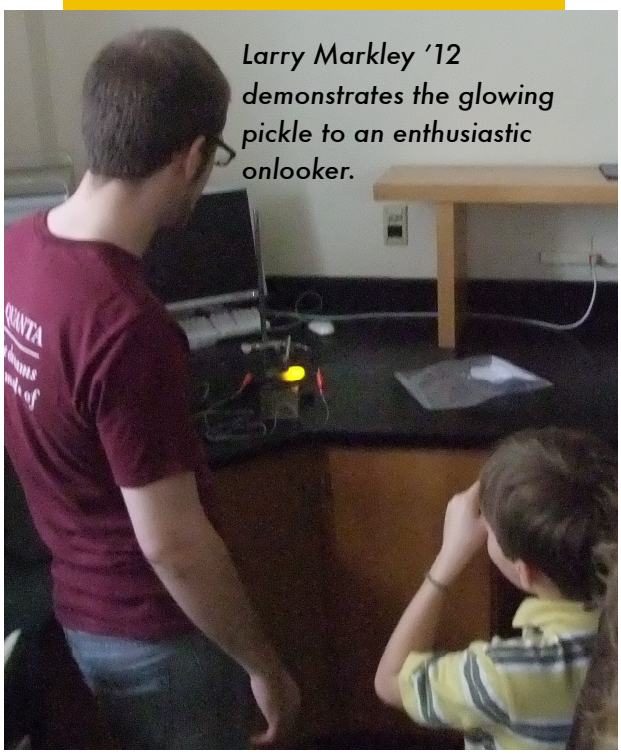
Events

3 September 2010: Scot Spirit Day
16 September 2010: Luce Dinner
22 September 2010: General Meeting
24 September 2010: Outreach Training (Force & Motion)
1 October 2010: Outreach Training (Air Pressure)
20 October 2010: General Meeting
29 October 2010: Outreach Training (Light & Sound)
20 November 2010: COSI Columbus
9 February 2011: General Meeting
2 March 2011: General Meeting
2 April 2011: Community Science Day
29 April 2011: Senior Posters
1 May 2011: Taylor Bowl 22

The Physics Club made 19 outreach visits to local elementary schools in 2010-2011.

Community Science Day

This year we organized the third annual Science Day at The College of Wooster. The name itself implies that we dedicate this day not only to physics, but to many different sciences including biochemistry and molecular biology, geology, biology, neuroscience, chemistry, and, of course, physics. This event is open to the community and many people come from the surrounding area – an estimated **400 people** this year. It is a great opportunity to get young children interested early in science by showcasing many riveting demonstrations of our respected sciences at work. Some of the exhibits include: a giant iguana from the biology club, liquid nitrogen ice cream from the chemistry club, a volcano from the geology club, methane bubbles from the BMB club, hands-on experience from the neuroscience club and a glowing pickle from the physics club. Science Day is becoming a part of the tradition of community involvement here at Wooster, and we are excited for the event to grow in the many years to come.



Larry Markley '12 demonstrates the glowing pickle to an enthusiastic onlooker.

COSI

Annually in the fall our SPS chapter takes a group of students on a trip to either COSI in Columbus, Ohio or to the Great Lakes Science Center in Cleveland, Ohio. This year our chapter took a trip to COSI. During our trip, we had the opportunity to explore many aspects of science, not just physics. Though, the Science Center certainly had a plethora of different exhibits dedicated to various areas of physics. There were sections devoted to sound, electricity, chaotic systems, and light. This trip is designed to offer a chance for new and old club members to bond and help create the type of environment we at The College of Wooster pride ourselves on. To top things off, the group goes to dinner after the trip to further provide opportunity for discussion and camaraderie.

Taylor Bowl XXII

Math/CS 115.22
Physics 96.84

Conferences

Mike Winters '10 attended the **17th Annual Conference on Auditory Display** in Budapest, Hungary (June 2011) and gave the following presentations:

Andrew Blaikie*†, R. Mike Winters*, Deva O'Neil, *Simulating the Electroweak Phase Transition: Sonification of Bubble Nucleation*

R. Mike Winters*†, *1/f noise and auditory aesthetics: Sonification of a driven bead pile*

National Meeting of the American Physical Society, Dallas TX (March 2010)

Andrew Blaikie*†, R. Mike Winters*, Deva O'Neil, *Simulating Electroweak Baryogenesis in the Standard Model*

Lilianna E. Christman*†, Amanda Logue*, Paul L. Edmiston, Susan Y. Lehman, *Characterization of the Morphology and Rapid Expansion of Swellable Organically Modified Silica*

Lorenzo Dumancas*†, David Simpson*†, D.T. Jacobs, *Specific heat at the micellization and phase transitions in a triblock copolymer-water system*

Alyse Marquinez*, Ingrid Thvedt*, S.Y. Lehman, D.T. Jacobs, *Scaling, clustering and avalanches for steel beads in an external magnetic field*

Hosanna Odhner†, Alison Huff*, Kelly Patton*, D.T. Jacobs, Bryna Clover, Sandra Greer, *Micellization and phase transitions in a triblock copolymer-D_2O system*

217th Meeting of the American Astronomical Society, Seattle WA (January 2011)

Christine Welling†, B. P. Miller, W. N. Brandt, R. R. Gibson, M. C. Eracleous, K. T. Lewis, *Broad Absorption Line Variability in Radio-Loud Quasars*

62nd Southeastern Meeting of the American Chemical Society, New Orleans LA (December 2010)

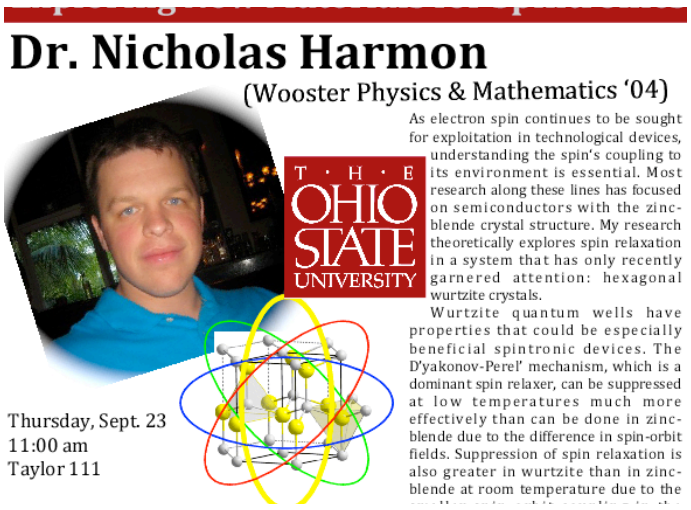
Colin McGuire† and Sarah Schmidtke, *Effects of temperature and pH on the fluorescence of 4-amino benzoic acid and its derivatives*

*A * denotes a Wooster student and a † denotes an REU student*

Below: Lorenzo Dumancas '13, Alyse Marquinez '12, Andrew Blaike '13, Lily Christman '13, Dr. Lindner, Hosanna Odhner (Bryn Mawr '13), Dr. Jacobs at APS, Dallas TX

2010–2011 Colloquium Series

- Wooster Physics Juniors, Round II, *Junior Independent Study Oral Presentations*, 2 May 2011,
- Wooster Physics Juniors, Round 1, *Junior Independent Study Oral Presentations*, 26 April 2011
- Elizabeth Schoene, University of Oregon, *Laser and Atoms and Demons, Oh My!* 22 April 2011
- Nicole Moore, Beloit College, *Focused Intensely: Modeling Lasers in Optical Tweezers and Novel Microscopes*, 20 April 2011
- Demian Cho, Kenyon College, *Neutron Stars in Gambier*, 12 April 2011
- Terry Sheridan, Ohio Northern University, *Waves in one-dimensional dusty plasma rings*, 24 February 2011
- Cody Leary, University of Warsaw, *Measurement and Control of a Photon's Spatial Wavefunction*, 21 January 2011
- Adam Clausen, Lawrence University, *What Happens at the Big Bang?* 14 December 2010



- Wooster Physics Seniors, *Senior Independent Study Fall Presentations*, 7 December 2010
- Taviare Hawkins, U Mass Amherst, *A Day by Day Study of Microtubule Rigidity*, 6 December 2010
- Sarah Nichols, Whitman College, *Multiphoton Biological Imaging: Femtosecond Laser Microscopy Techniques*, 3 December 2010
- Shannon O'Leary, Lawrence University, *Inducing Transparency using a Noisy Laser and a sub-microGauss Magnetic Field*, 29 November 2010
- Gregory Mack, Ohio Wesleyan University, *Dark Matter: Mother Natures's Big Secret*, 29 September 2010
- Nicholas Harmon, The Ohio State University, Wooster Physics and Mathematics '04, *Exploring New Materials for Spintronics*, 23 September 2010

Summer Research

Vanessa Logan '14, Karl Smith '13, Dr. Lehman, Dr. Lindner, Dr. Jacobs, Matt Schmitthenner '13, Theresa Albon '13, Ian Wilson '14, Dr. Lewis, Tom Gilliss '13

Theresa Albon at the local strawberry patch

Summer 2011 Projects

Vanessa Logan (advised by Karen Lewis)
- Active Galactic Nuclei in the Optical Spectrum

Karl Smith (advised by John Lindner)
- String Theory (Knot Really): Simulating Knots

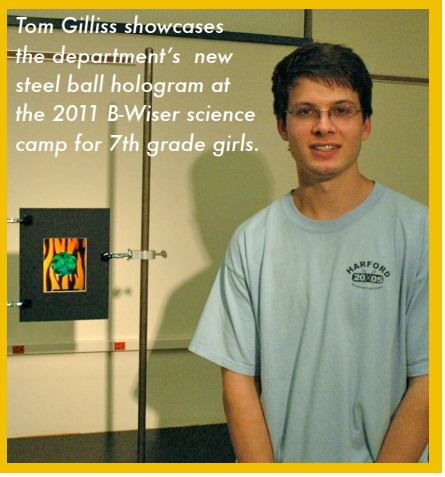
Matt Schmitthenner (advised by John Lindner)
- Beyond Newton: // Body Problem

Theresa Albon (advised by Susan Lehman)
- Expansion Forces Exerted by Swellable SOMS

Ian Wilson (advised by John Lindner)
- Stochastic Resonance in a Mechanical System

Tom Gilliss (advised by Donald Jacobs)
- Bead Pile Dynamics in the Presence of Cohesive Forces

Our 2011 summer research group was small but very active. In addition to Wednesday picnics at local parks, we had weekly video showings of BBC's *Rough Science* and a Harry Potter film festival which culminated in a trip to the theater to see the midnight premier of the final movie in the series. Other fun activities included strawberry picking, an ice cream social, a pie fest at Dr. Lehman's house, and a BBQ at Dr. Lewis' house. Tutorials were given to the students in various software, including Mathematica, LaTeX, Igor Pro, and Canvas. An ethics workshop and a writing workshop were presented. Each student gave a physics demonstration to 7th grade girls as part of the Buckeye Women in Science, Engineering and Research (B-WISER) camp. A poster session for the campus community was held on the last day of the summer research session.



Tom Gilliss showcases the department's new steel ball hologram at the 2011 B-Wiser science camp for 7th grade girls.

Off-Campus Summer Research

Lorenzo Dumancas '13 did theoretical work in random dielectric mirrors at Case Western Reserve University. Though the study of "perfect" mirrors is well developed, the study of mirrors that contain randomness isn't as well developed. Lorenzo used *Mathematica* to analyze wave propagation through dielectric mirrors with significant randomness.

Sarah-Beth Loder '12 spent her summer at the polymer science facility of the University of Massachusetts in the CURE (Collaborative Undergraduate Research in Energy) program. Her project involved studying poly(3-hexylthiophene) as a potential p-type material to be used in solar cells. Poly(3-hexylthiophene) is a molecule that self-assembles first into short chains, then into long 'fibrils' or 'nanowires'. Sarah's project involved growing the fibrils as long and as crystalline as possible with only a little monomer or short chains remaining in solution. Next, she attempted to grow combined p- and n-type monomers using previous techniques into long chains of solar-active semiconductors. After this, a device can be made (anode and cathode attached) and tested for efficiency.

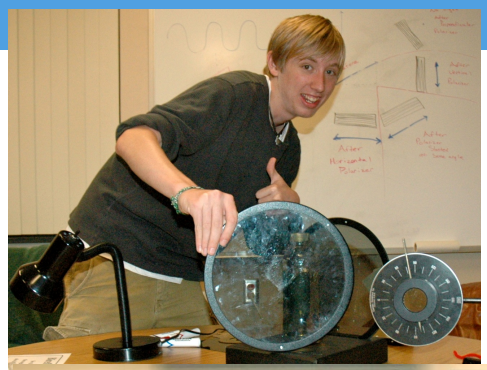
Margaret Raabe '12 did an REU program in engineering at the University of Maryland.

Tyler Rhoades '13 spent the summer as an intern at Kent Displays in Kent, OH. He built prototype liquid crystal displays and performed tests on the displays to see how they reacted with light.

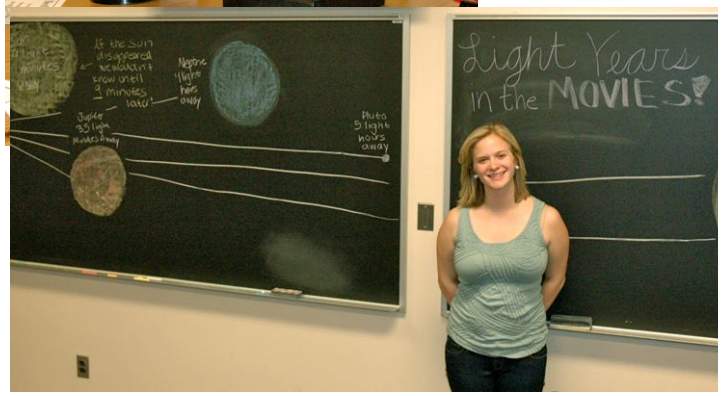
David Simpson '12 investigated the properties of nanoparticle doped liquid crystals using optical microscopy at the University of Paderborn in Germany.

Phil Wales '13 did an internship with the College's Center for Entrepreneurship.

Alyse Marquinez '12 interned at ABSMaterials Inc. which provides solutions for removing neat, dispersed, and dissolved VOCs, solvents, pesticides, and other persistent organic pollutants from water and soil. ABSMaterials is revolutionizing water treatment and environmental remediation with Dr. Paul Edmiston's (Chemistry) patented Osorb® technology. Alyse was in Research and Development working on how Osorb technology can be used to sense the presence of volatile organic compounds.



B-Wiser Physics
Left: Ian Wilson demonstrates the transmission of light through crossed polarizers.
Right: Matt Schmitthenner uses lasers of different wavelengths to show total internal reflection.



Vanessa Logan's B-Wiser session was "Light Years in the Movies".

ALUMNI NEWS

R. Mike Winters '10 (a physics and music double major) will begin graduate school in the fall at McGill University in Montreal in the Music Technology program.

Mary Elizabeth Mills '09 has successfully defended her master's thesis at Miami University of Ohio and will begin the PhD program in science education at Indiana University in the fall.

Rob Daniels '10 received his degree in mechanical engineering from Case Western Reserve University and is working at the Cleveland Clinic's Biomedical Engineering Prototype Lab.

Anna Ploplis Andrews '87 accepted a position with Avery Dennison Medical Solutions in April. She is applying the concepts of biophysical gels to make products for ostomy care and wound healing.

Anindya Mukherjee '97 is a director at Sonodyne, which is widely considered a pioneer of Indian pro audio manufacturing. Sonodyne has become the first major Indian manufacturer to seriously target the US market.

Nathan Utt '07 earned his MSE (agricultural and biological engineering) from Purdue University and began the PhD program at the University of Nebraska Lincoln this past January.

Ryan Hartschuh '03 is a new concept discovery leader in the Advanced Concepts program at The Goodyear Tire and Rubber Company in Akron, OH.

Manon Grugel-Watson '99 and her husband Mike Watson '99 welcomed their son, Alden Louis Watson, on April 17th, 2011.

C. Elliott Strimbu '99 received his PhD in physics from UCLA. He did his thesis research at UCLA's Brain Research Institute as part of the Inner Ear Affinity Group.

Daniel Utley '05 is residing in Jerusalem, Israel and studying at Hebrew Union College–Jewish Institute of Religion, the main seminary for training rabbis in Reform Judaism.

Darwin Keith-Lucas '96 is a Senior Industrial Designer at Goddard Technologies, a full service mechanical engineering and industrial design firm located in Beverly MA.

Rob Sweeney '02 is an engineer at MIT's Lincoln Laboratory, a federally funded research and development center chartered to apply advanced technology to problems of national security.

Amy Lytle '01 is an assistant professor of physics at Franklin & Marshall College in Lancaster, PA.

Nick Harmon '04 completed his PhD in physics at The Ohio State University and is now a post-doctoral researcher at the University of Iowa.

Joe Thomas '08 is a sixth grade teacher at the Wilson School in St. Louis, MO.

Little bit of history...

How long has the Physics Department been housed in Taylor Hall?

TEACH PHYSICS IN TAYLOR HALL

Building Formerly Used for Prep Department Will Serve New Purpose Soon.

It has been definitely decided at the college to use Taylor Hall, formerly the location of the preparatory department of the college for the physics and mathematics departments of the college. The upper floor will be given over entirely to mathematics. The lower floor and the basement will be used by the physics department. This change was necessitated by the increase in both the physics and chemistry departments. Severance Hall, where the physics department is now located will next year be given over entirely to chemistry. At least one new course in chemistry will be offered next year.

Experts who have investigated the proposition stated Wednesday that Taylor Hall is admirably adapted to this purpose. Physics and mathematics are natraully allied subjects. The basement will also make a very admirable physics laboratory. The old commercial room will be used for this purpose. Taylor Hall auditorium will be left as formerly for the use of the Sunday school, Christian Endeavor Society, etc.

The credit for this expansion in the department of physics at the college is due to Prof. W. R. Westhafer, M. A. head of the department. Prof. Westhafer came to Wooster this year from Amherst where he was for ten years Professor of physics. This department will also be very much enlarged. Four years of physics will be offered, so that any man interested in Engineering and Physics can now get a very comprehensive and exhaustive course in this department at Wooster.

The Physics department has also added a great deal of new apparatus to their equipment this year. This apparatus is very expensive now due to war demands, and was added at a high cost. Some of the new pieces of apparatus are:—a Bridge Truss, moving crane, dissectable transformer, hydraulic ram, pyramagenic and diagmagnet apparatus and many other pieces.

Wooster Daily Republican
May 8, 1919

Wooster Physics

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STAY IN TOUCH