

# Department of Physics Annual Report 2001-2002



THE COLLEGE OF  
**WOOSTER**

[www.wooster.edu/physics](http://www.wooster.edu/physics)

## Note from the Chair

It is always a real pleasure to write this note at the end of a year filled with accomplishments and events. I want to thank Jackie for her hard work, creativity, and imagination in putting together this year's newsletter. Despite a few setbacks (the file was lost when someone accidentally 'trashed' it), Jackie recovered almost the entire file. This is especially important since so many of you look forward to receiving news of the department. And, as always, Judy has helped the department function smoothly by maintaining equipment, setting up labs, and many, many other tasks.

My colleagues and I had a very productive year. We just completed our ninth summer of a NSF Research Experience for Undergraduates site. Dr. Jacobs accompanied students to Indianapolis for the March APS meeting, where six of our majors presented their research. Two students presented their research at the 199th American Astronomical Society meeting. Our majors have done exciting summer jobs and research projects. We are the recipients of a grant from the Alden Trust that allowed us to purchase a scanning probe microscope. We are looking forward to scientifically significant student projects using this instrument. The one disappointment of the year was my unsuccessful grant proposal to set up an international REU site in Beijing, China. The reviewers did not like the model where a faculty member did not spend the entire research period at the Beijing site with the students. The timing was not right for this to be successful; perhaps at a future date we will attempt this endeavor again. I remain committed to the principles of an international REU experience.

As you may already know, there are some changes in the staffing of our Department. Dr. Goetz has left Wooster for happy reasons—she is getting married to Bryce Bixby in Buffalo this fall. We wish her all the best for a very happy future. I have started my new position as the Dean of the Faculty. I still hope to be involved in what goes on in the Department and look forward to continuing with I.S. and summer research students. Dr. Lindner and I will be submitting a request for continuation of our REU grant for another four years. Dr. Lindner will be taking over as department chair, and I am sure he will do a wonderful job. I want to welcome Dr. Alice Churukian and Mr. Rick Batman to the Department and wish them a great year.

Best wishes,

Shila Garg



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# Faculty

## Shila Garg

### Professor and Chairperson

#### Teaching

Fall: Modern Physics  
Modern Physics Lab  
Electronics  
Electronics Lab  
Thermal Physics

Spring: Foundations of Physics  
Foundations of Physics Lab  
Quantum Mechanics

Supervised two Senior I. S. projects

#### Areas of current research

- Focal Conic Domain Growth in Smectic A Liquid Crystal Subjected to an Electric Field
- Phase Transitions in a Binary Nematic Mixture
- Pattern Formation in Liquid Crystals Due to Nonlinear Flow

#### Professional meetings attended/papers presented \* student co-author

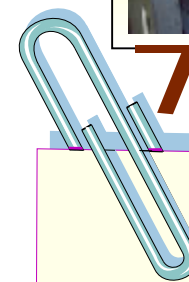
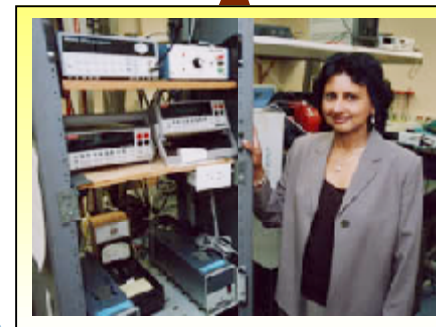
- Attended and presented at International Liquid Crystal Conference, Edinburgh, Scotland (June 2002)  
Shila Garg and Tom Spears\*, "Dielectric Properties of a Nematic Binary Mixture"
- Attended & co-authored two papers, American Physical Society meeting, Indianapolis (March 2002)  
Joshua Martin\* and Shila Garg, "Binary Mixtures of Calamitic and Discotic Liquid Crystals"  
Tom Spears\* and Shila Garg, "Dielectric Interactions in a Nematic Binary Mixture"

#### Publications appearing

- A. Christine Rauch\*, Shila Garg and D. T. Jacobs, "Phase Transitions in a Nematic Binary Mixture" **Journal of Chemical Physics** 116, 2213 (2002)

#### Other activities

- Appointed by the President of American Physical Society (APS) to the APS Committee on Education (2002-2005)  
Attended the first COE meeting at the American Institute of Physics headquarters in Baltimore (April 2002)
- Reviewer for NSF Graduate Research Fellowship panel (Feb 2002) and NSF Distinguished Teaching Scholars panel (Dec 2001)
- Reviewer for Research Experience for Undergraduates (NSF-REU) panel (Nov 2001)
- Reviewed a material science program at a university
- Helped the Physics Club start an outreach program to take 'hands-on' physics to local elementary schools
- Did a Q&A column for **The Daily Record** on the "Physics Outreach" program; Did a televised **Campus Profile** interview
- Part of a team of scientists from OARDC and The College of Wooster that are in the planning stages to bring the Wonders of Our World (W.O.W) Program to the Wooster city school system
- Served on Teaching Staff & Tenure Committee, Faculty Development Committee, Writing Advisory Board, Int'l Education Committee
- Advisor for South Asia Committee
- Program Advisor for Wayne County Children's Services program
- Introduced physicist and mathematician Brian Greene at the 2001 Wooster Forum



*Best wishes to*

*Dr. Garg*

*as she assumes her duties as*

*Dean of the Faculty*

# Faculty

## Donald Jacobs

The Victor J. Andrew Professor of Physics



### Teaching

Fall:	General Physics	Spring:	General Physics
	General Physics lab (2 sections)		General Physics lab
	Mechanics		Junior Independent Study
			Tutorial

Supervised two Senior I. S. projects

### Areas of current research

- Phase transitions of binary fluid mixtures, polymer-solvent systems, living polymers, and biological proteins including measurements of turbidity, heat capacity, viscosity, density, and the coexistence curve on these systems
- Developing experiments in the emerging area of self-organized criticality

### Professional meetings attended/papers presented \*student co-author

- Gordon Conference on Polymer Physics, Newport RI (August 2002)  
D.T. Jacobs, C.J. Locke, and Nithya Venkataraman\*, "Turbidity of an 8-arm Star Polystyrene in Methylcyclohexane Near the Critical Temperature"
- Gordon Conference on Granular Materials, Plymouth NH (July 2002)  
D.T. Jacobs, Kelle Cruz\*, Christie Egnatuk\*, Tim Sir Louis\*, Hanna Wagner\*, Matt Krivos\*, Rebecca Urban\*  
"Self Organized Criticality in a Bead Pile"
- NASA workshop, Laguna Beach, CA (May 2002)  
D.T. Jacobs, Amy Lytle\*, Geoff Bonvallet\*, Carrie Williams\*, "Turbidity in a Density Matched System"
- Attended & co-authored two papers, American Physical Society meeting, Indianapolis (March 2002)  
Clinton Braganza\* & D.T. Jacobs, "The correlation length of the liquid-liquid mixture perfluoroheptane and 2,2,4-trimethylpentane"  
R. Hartschuh\* & D.T. Jacobs, "Composition dependence for the near-critical heat capacity of triethylamine and water"

### Publications appearing

- Krishna Pendyala, S.C. Greer, and D.T. Jacobs, "Poly( $\alpha$ -methylstyrene) in methylcyclohexane: densities and viscosities near the liquid-liquid critical point" **J. Chem. Phys.** 115, 9995-10000 (2001)
- A. Christine Rauch\*, Shila Garg and D. T. Jacobs, "Phase Transitions in a Nematic Binary Mixture" **J. Chem. Phys.** 116, 2213 (2002)

### Other activities

- Served on Teaching Staff and Tenure Committee
- Department admissions liaison
- Selection Committee for the 2002 APS prize to a Faculty Member for Research in an Undergraduate Institution
- Associate Editor for the **American Journal of Physics**
- Reviewer for **American Journal of Physics**, **Journal of Chemical Physics**, **Physical Review Letters**, **Physical Review E**
- Reviewed the physics departments at two universities



# Faculty

## John Lindner Associate Professor



### Teaching

Fall:	First Year Seminar: "The Conscious Universe" Particle Physics Foundations of Physics Lab	Spring:	Astronomy of the Solar System Astrophysics (General Relativity) Foundations of Physics Lab
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Supervised one Senior I.S. project and ten Junior I.S. computer simulations

### Areas of current research

- Use of disorder and noise to regularize extended nonlinear systems
- Noise enhanced propagation
- Cellular automata
- Computer visualization

### Professional meetings attended/papers presented

- Co-authored two posters presented at the spring meeting of the APS

### Publications appearing

- J. Lindner, K. Wiesenfeld "The Pendulum Automaton"  
Int'l Journal of Bifurcation and Chaos 11, 3171-3178 (December 2001)

### Other activities

- Reached the summit of Mount Kilimanjaro (August 2002) ➔
- Chair, Copeland Fund for Independent Study Committee
- College Scholar Exam Committee
- Hewlett-Mellon Advisory Committee
- Presented at Science Round Table (with Jenn Goetz), "Proposed Astronomy Laboratory" (October 2001)
- Presented to Pursuing Scientific Interests, "Chas and the 3-Body Problem" (December 2001)
- Presented to the Physics Club, "Climbing Kilimanjaro" (April 2002)
- Presented to the Science and Humanities Program, "Time Machines" (April 2002)
- Invited talk at Denison University, "Exploiting Noise and Disorder" (April 2002)
- Physics Club Advisor
- Juggling Club Advisor
- Wrote Q&A on space debris for **The Daily Record**
- Reviewed manuscripts for **Physical Review Letters**, **Physical Review E**, **American Journal of Physics**, **The Physics Teacher**, **Europysics Letters**, **Fluctuation and Noise Letters**, **IEEE Transactions on Circuits and Systems**



# Faculty

## Jennifer Goetz

Clare Boothe Luce Assistant Professor



### Teaching

Fall: Foundations of Physics  
Foundations of Physics Lab  
Astronomy of Stars and Galaxies  
Supervised one Senior I. S. project

Spring: Foundations of Physics Lab  
Astronomy of Stars and Galaxies  
Math Methods for Physical Sciences

### Areas of current research

- methanol maser emissions
- visual and infrared observations of star clusters

### Professional meetings attended/papers presented

- Attended 199th Meeting of the American Astronomical Society and presented a paper entitled "Methanol Maser Emission in W75N and Orion Molecular Cloud 2 (OMC 2)" with Daniel Brubaker and Christian Clerc (student co-authors), (January 2002)

### Other activities

- Member of Faculty Scholarship Committee
- Member of Excellence in Teaching Selection Committee
- Member of Cultural Events Committee
- Member of Educational Policy Committee Subcommittee on Enhancing Science Education
- Member of College Scholars Committee
- Campus Representative for the Semester at Oak Ridge Program
- Advisor to Pursuing Scientific Interests (PSI)
- Physics Department Library Liaison
- Organized Summer B-WISER Physics program. Planned hands-on activities to explore lunar craters, accuracy of science in movies, optics (June 2002)
- Presented "Stardust" at Ohio Wesleyan University, Ohio Five Physics Faculty presentation exchange (April 2002)
- Presented at Science Round Table (with John Lindner), "Proposed Astronomy Laboratory" (October 2001)
- Parents' Weekend Faculty Presentation, "Stardust" (October 2001)
- Co-facilitated an associated Forum event, "The Essential Threads of The Elegant Universe", a discussion of Brian Greene's book, prior to his Forum appearance (September 2001)
- Presented "Dinner Table Physics" to Pursuing Scientific Interests (September 2001)

### Future plans:

- Beginning fall 2002, Dr. Goetz will be teaching AP physics, honors physics, and math at Buffalo Seminary, an all-girls, non-religious high school. She hopes to continue her research through a collaboration with the University of Rochester, her graduate school alma mater.

*Congratulations  
to Professor Goetz  
as she weds  
Bryce Bixby  
on October 11, 2002  
in Buffalo, New York.*



# New Faculty

Dr. Churukian's  
Research Interests:  
Physics education,  
nonlinear dynamics

## Alice Churukian

Juliana Wilson Thompson  
Visiting Assistant Professor  
B.A. The College of Wooster 1991  
M.S. University of Wisconsin 1994  
Ph.D. Kansas State University 2002



Mr. Batman's Research Interests:  
Computational modeling of polymer  
blends next to surfaces

## Richard Batman

Visiting Instructor of Physics  
B.S. University of Akron 1995  
M.S. University of Akron 2000  
Ph.D. Kent State University exp. 2002



# Staff

## Judith Elwell

Laboratory Technician



## Jackie Middleton

Administrative Assistant

# Graduates

Class of  
2002



Matt Krivos, Josh Martin, Dave Miller, Sara Connolly, Chris Locke, Derek Somogy (not pictured: Rob Sweeney)



Sara D. Connolly  
Medina, Ohio  
Plans: Employment

Christopher J. Locke  
Canton, Ohio  
Plans: Employment

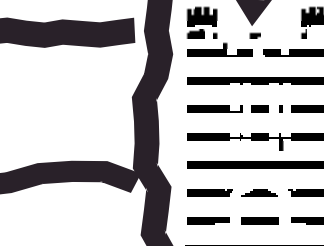
David J. Miller  
Fort Wayne, Indiana  
Plans: Graduate School  
Drexel University

Joshua S. Martin  
Dresden, Ohio  
Plans: Graduate School  
Brandeis University

Robert J. Sweeney  
Wilton, Connecticut  
Plans: 3/2 Engineering  
Worcester Polytechnic Institute

Matthew C. Krivos  
Hinckley, Ohio  
Plans: Employment

Derek J. Somogy  
Wooster, Ohio  
Plans: Employment



# Senior I.S.

David J. Miller

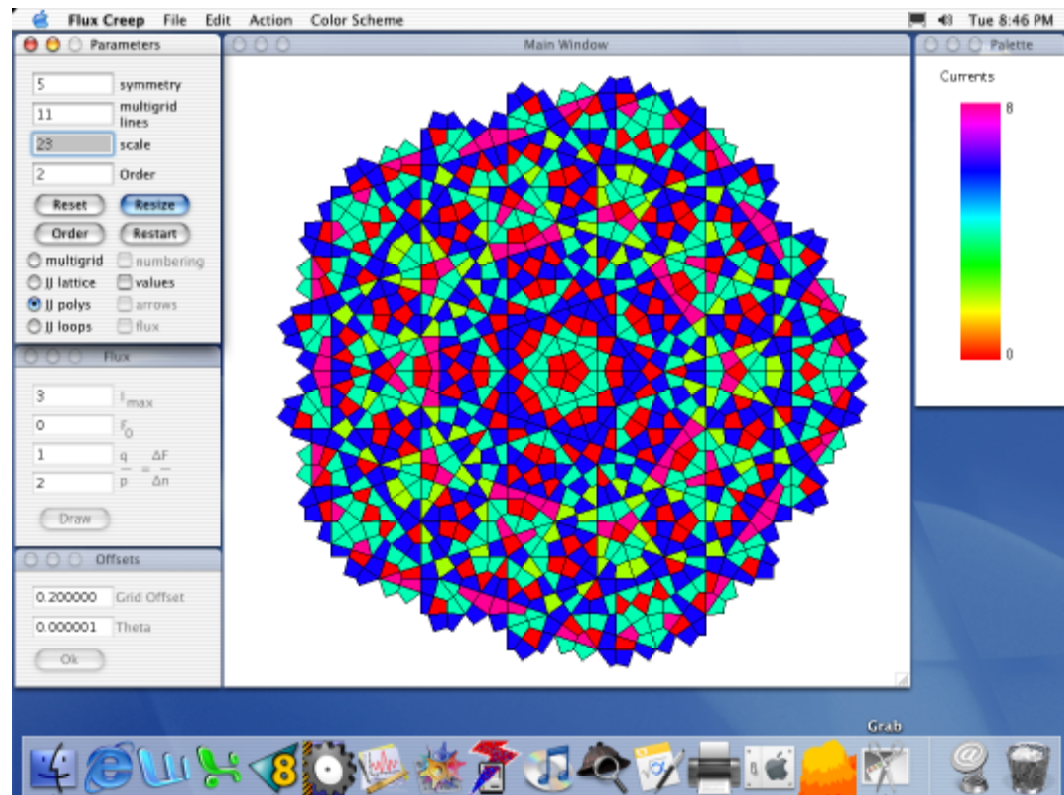
Advisor: John Lindner

We study a cellular automaton derived from the phenomenon of magnetic flux creep in two-dimensional granular superconductors. We model the superconductor as an array of inductively coupled Josephson junctions evolving according to a set of coupled ordinary differential equations. In the limit of slowly increasing magnetic field, we reduce these equations to a simple cellular automaton.

The Flux Creep Automaton is the two-dimensional generalization of the one-dimensional Pendulum Automaton. The flux creep dynamics, derived from Kirchoff's laws and the Josephson relations, reduce to a Gradient Sand Pile Automaton with an unusual non-local seeding, wherein all sites except the boundaries are seeded concurrently. Loop and line currents in the Flux Creep Automaton correspond, respectively, to heights and gradients in the Sand Pile Automaton.

We implement the Flux Creep Automaton on lattices of very different rotational symmetries, including periodic lattices that are 3-fold, 4-fold, and 6-fold symmetric as well as aperiodic lattices that have 5-fold, 7-fold and higher symmetries. In each case, the automaton evolves to a state of constant flux gradient, as described by the Bean model. The intimate connection with the Gradient Sand Pile Automaton reinforces the idea that in the Bean state superconducting vortices exhibit avalanching dynamics.

## The Flux Creep Automaton

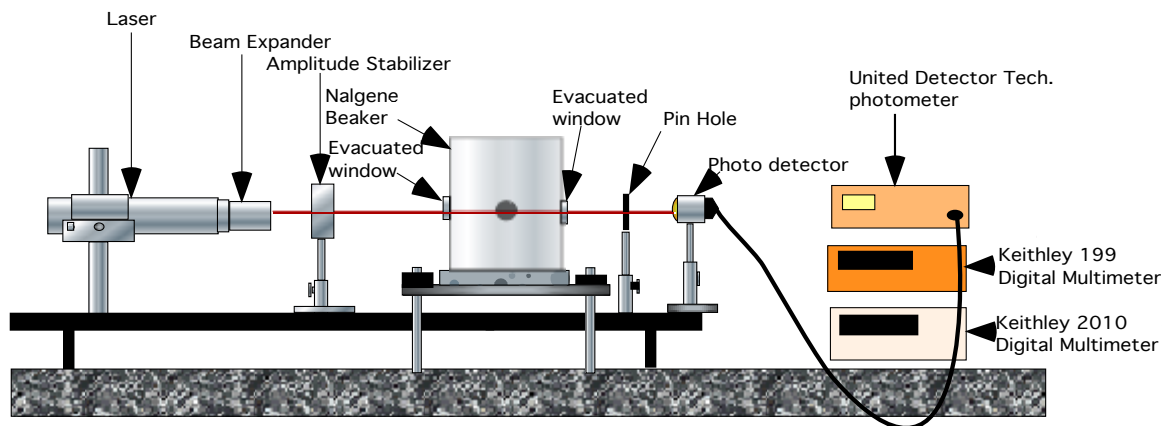


## The Turbidity of an 8-arm Star Polystyrene in Methylcyclohexane Near the Critical Temperature

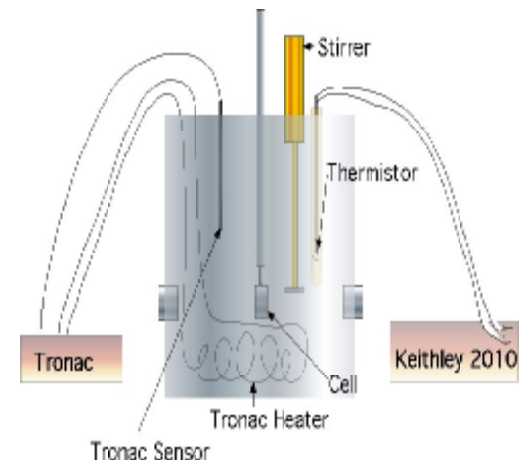
Christopher Locke

Advisor: Donald Jacobs

Measurements of the light intensity transmitted through a cell containing a mixture of a star polystyrene and methylcyclohexane (star-ps/myc) were made as a function of temperature. The turbidity was calculated from the transmitted light intensity data and turbidity was compared to the theoretical prediction of universal exponents  $\nu$  and  $\gamma$ , for correlation length amplitude  $\xi_0$ , and for turbidity amplitude  $\tau_0$ . The data were analyzed using a weighted nonlinear least squares routine with the critical exponents  $\gamma$  and  $\nu$  held constant at the predicted values of 1.24 and 0.63, respectively. For a 0.155 mass fraction star-ps/mcy, the amplitude of correlation length  $\xi_0$  was determined to be  $0.452 \pm 0.005$  nm with a turbidity amplitude of  $\tau_0 = (84.8 \pm 0.6) \times 10^{-6} \text{cm}^{-1}$ . For a 0.145 mass fraction star-ps/mcy, the amplitude of correlation length  $\xi_0$  was determined to be  $0.597 \pm 0.005$  nm and the turbidity amplitude to be  $\tau_0 = (107.4 \pm 0.7) \times 10^{-6} \text{cm}^{-1}$ . These values of  $\xi_0$  are less than what has been measured for a linear polystyrene of the same  $M_w$  in methylcyclohexane.



Optical Setup



Temperature Control

## Synthesis and Deformation of Smectic-A Liquid Crystals

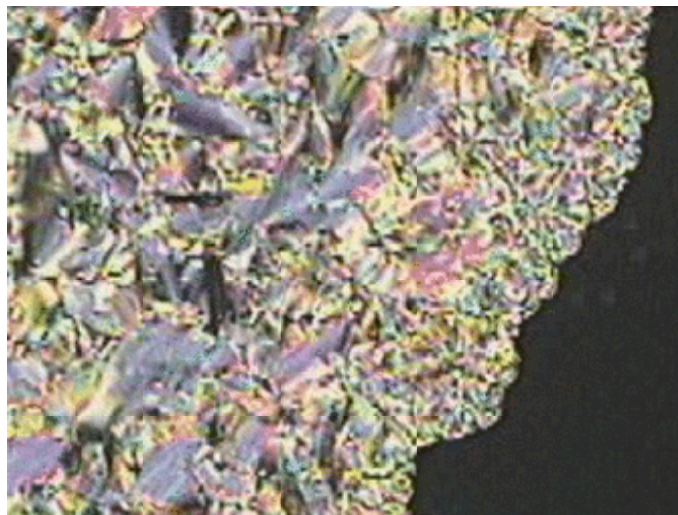
**Sara Connolly (Chemical Physics major)**

**Advisor: Shila Garg**

Synthesis of a compound exhibiting smectic A liquid crystal properties was completed. This synthesis exposes one to many aspects of organic chemistry. Similar compounds have been synthesized and used in binary smectic A liquid crystal mixtures, the eventual hope for the compound made for this study. The final product was found to have a liquid crystalline phase at 48.2 degrees C. Both the focal conic domains and the fan structure that the compound began to show at this temperature when observed under polarized microscopy noted the phase. These observations were then confirmed with differential scanning calorimetry.

In a second part of this study, the focal conic domain growth of the smectic A liquid crystal CCN-47 was studied. Nevertheless, the growth, as one will find, did not occur from the domain itself. Rather, growth was seen occurring from the edge of the ITO lining within the cell that the liquid crystal was being viewed from. This problem was attempted to be corrected using a homemade cell with an ITO lining which spans the entire surface of the cell. Nevertheless, this attempt was again not successful.

In order to connect the two studies, the CCN-47 was the compound originally intended to be used as the second component for the binary liquid crystal mixture mentioned above. The synthesis as well as the focal conic domain study allow one to study very similar materials in two different scientific disciplines-chemistry and physics.



Growth of focal conic domains

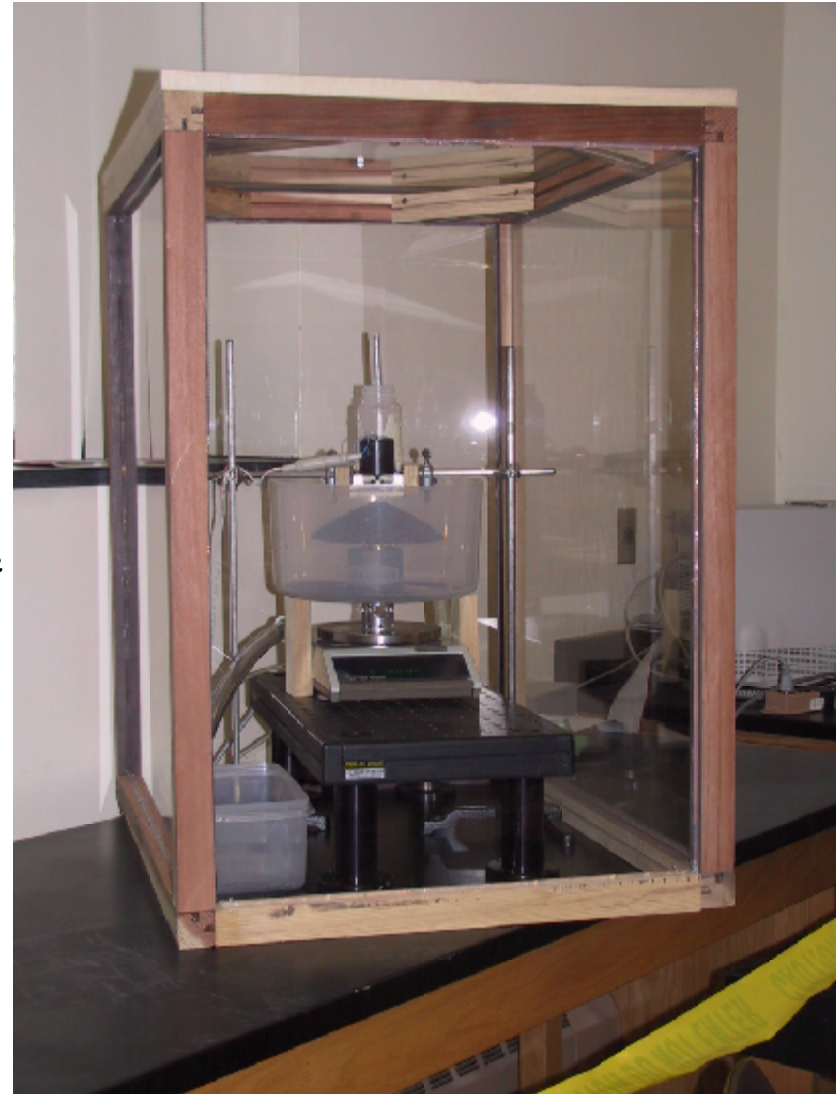
**Senior I.S.**

## Effect of a Dropped Bead's Kinetic Energy on the Self-Organized Critical Behavior of a Bead Pile

**Matthew Krivos**

**Advisor: Donald Jacobs**

Self-organized criticality is a relatively new theory which attempts to explain how large complex dynamical systems work. One of the key points of self-organized criticality is that these systems self-organize themselves into a critical state and while at this state a perturbation to the system could yield a result of any size. The distribution of these results plotted on a log-log plot forms a straight line which indicates a simple power law. This experiment studies the self-organized critical behavior of a bead pile and how the size of perturbation affects it. Beads were dropped one at a time on the apex of a bead pile at its critical state. After a bead was dropped, a mass reading was taken to see if there was any mass change in the bead pile signifying whether or not an avalanche had occurred. The height from which the beads were dropped was varied during this experiment. Heights of 1.5 cm, 2.5 cm, 5 cm, and 10 cm were used as the drop heights, keeping constant during a data collection run. The data from the drop height of 1.5 cm followed the simple power law producing a slope of  $-1.47 \pm 0.02$ . The data from the other three heights systematically deviated from the power law, bending down and away; the greater the height, the more bend. The data could be scaled so all the data fell on one curve, which when done produced a curving line on a log-log plot of the distribution.



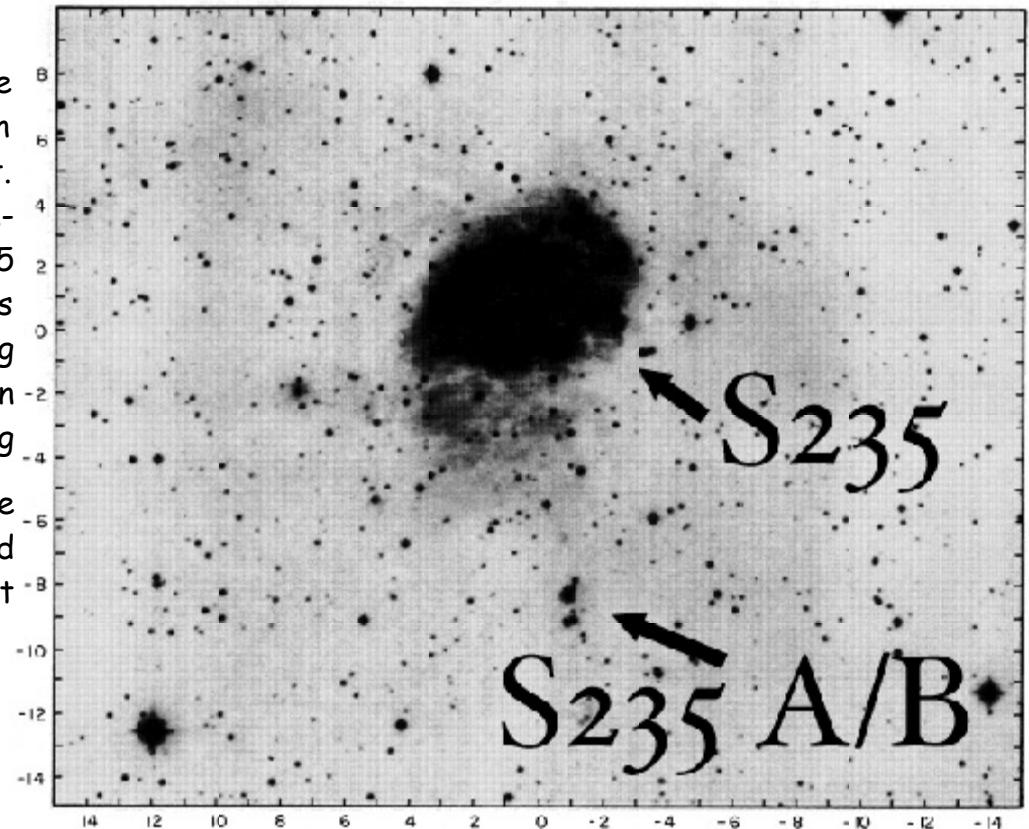
## Ammonia Emission in Star Forming Region S235 A/B

Derek Somogy

Advisor: Jennifer Goetz

Ammonia rotation-inversion transitions emit radiation detectable by radio telescopes. By studying the ammonia emission intensities in a known star-forming region, the excitation, rotational, and kinetic temperatures of the cloud may be found. The presence of ammonia in a region, and the corresponding higher temperatures, may be indicative of recent or ongoing star formation. Indeed, ammonia emission was found in S235 A/B, a known star-forming region.

S235 is an optical nebulosity that lies away from the center of the Galaxy 18 in the constellation Auriga. An optical nebulosity is a dense region of gas and dust. In astrophysics, the word "dense" refers to the concentration of molecular hydrogen ( $H_2$ ). The S235 region contains traces of advanced evolutionary stages (S235) in addition to less evolved stages including S235 A and S235 B. Research, including studies on  $H_2O$  masers, suggests that S235 and the surrounding region are an area of active star formation. Since S235 and the surrounding A/B region are well studied and are a known source of active star formation, it was selected for this investigation.



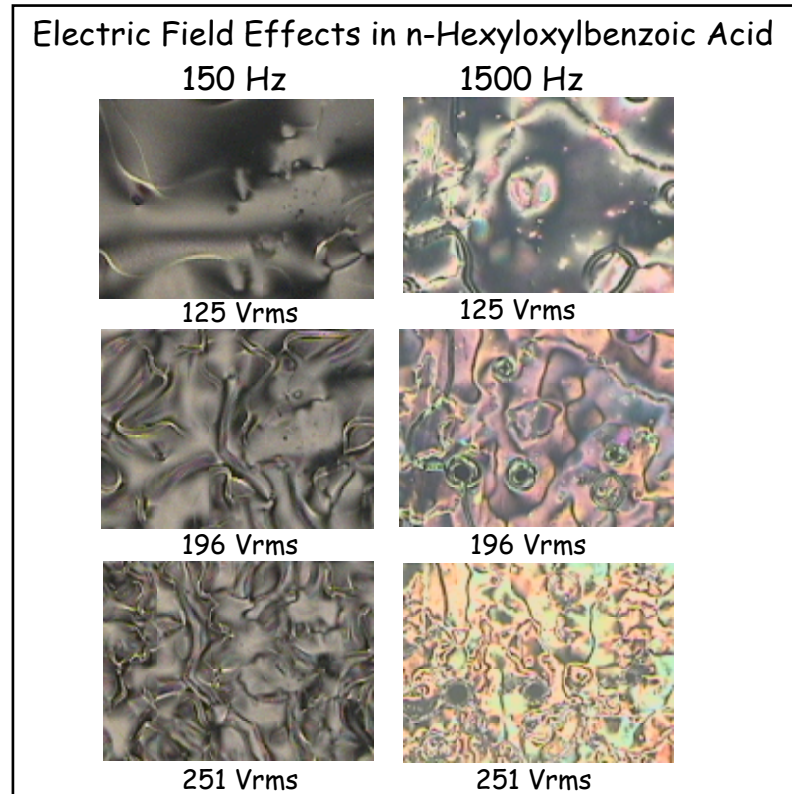
## The Investigation of Possible Candidates for a Calamitic and Discotic Mixture and the Physical Properties of the Eutectic Mixture N4

Joshua S. Martin

Advisor: Shila Garg

A synthesis of the discotic liquid crystal 2,4,6-Tris[3,4-bis(decyloxy)phenyl-1-amino]-1,3,5-triazine was attempted. IR, NMR, DSC, and melting point data indicated that the synthesis was unsuccessful due to a failed attempt to reduce 3,4-di(dodecan-1-yloxy)-1-nitrobenzene. The calamitic liquid crystal n-hexyloxybenzoic acid posed a few interesting experimental challenges that were solved to allow some exploration of this material. The nematic to crystal phase in this calamitic material was recorded to be on the order of a tenth of a second while the actual temperatures for the phase transitions matched those given in the literature. When an electric field was applied to the n-hexyloxybenzoic acid at high frequencies, the sample showed striking colors and some dynamic effects. At low frequencies the sample displayed electrohydrodynamic convection normally associated with negative dielectric material.

The splay and bend deformation constants were measured in the commercial mixture Nematic Phase 4 (N4). The bend deformation constant,  $K_3$ , was measured to be  $(1.29 \pm 0.01) \times 10^{-11}$  N at 25 degrees while only the ratio of the splay constant to magnetic anisotropy,  $K_1/\chi_a$  could be found since  $\chi_a$  is unknown for this mixture.  $K_1/\chi_a$  is shown to be temperature dependent and was not very repeatable for different cells. Electrohydrodynamic convection was also observed in N4 cells and Fast Fourier Transforms were performed. The patterns were also analyzed by taking line profiles of the pixels through the frames. The observed patterns are in rough agreement with other investigators.



# Senior I.S.

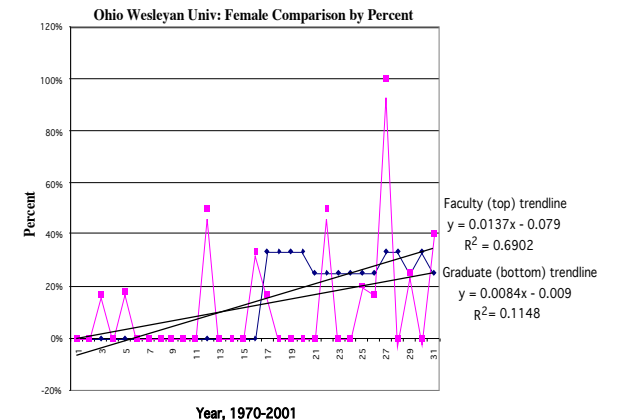
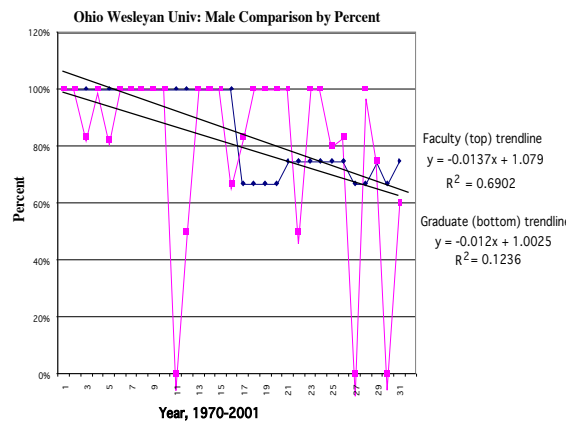
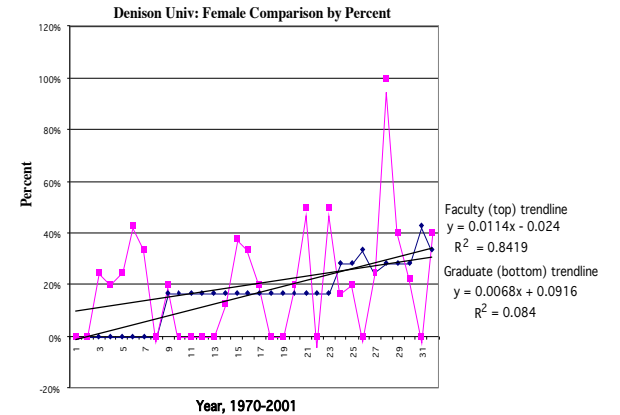
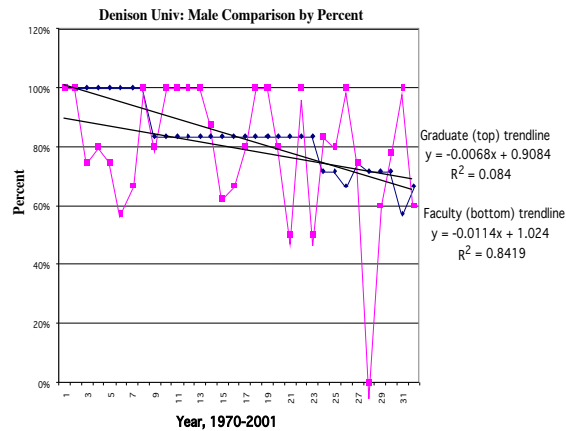
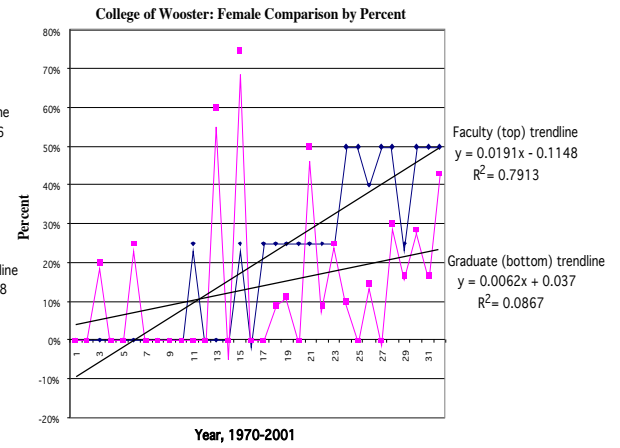
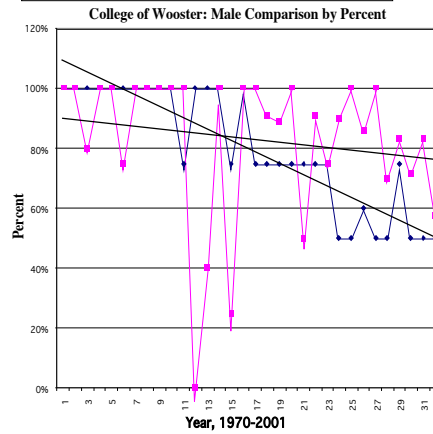
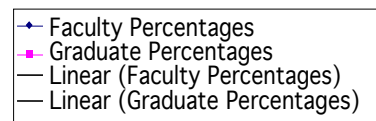
## A Feminist Analysis of Women's Low Representation in Physics: Scientific "Objectivity", Contextual Bias, and Barriers to Women's Inclusion

Michelle Waugh

(Women's Studies Major, Physics Minor)

Advisor: Barbara Burnell

Combining women's studies and physics, this feminist analysis focuses on factors that may influence the access, achievement, and educational outcomes for women participating in physics. The thesis begins with theory, research methods and my feminist methodology. A feminist critique of the scientific method, statistics, an analysis of an introductory physics text, and interviews are the research techniques employed. In order for physics to have less bias, to be more "objective", and to include more women, various data interpretations, new laboratory procedures, and diverse ethnicities need to be both represented and appreciated in the scientific community.

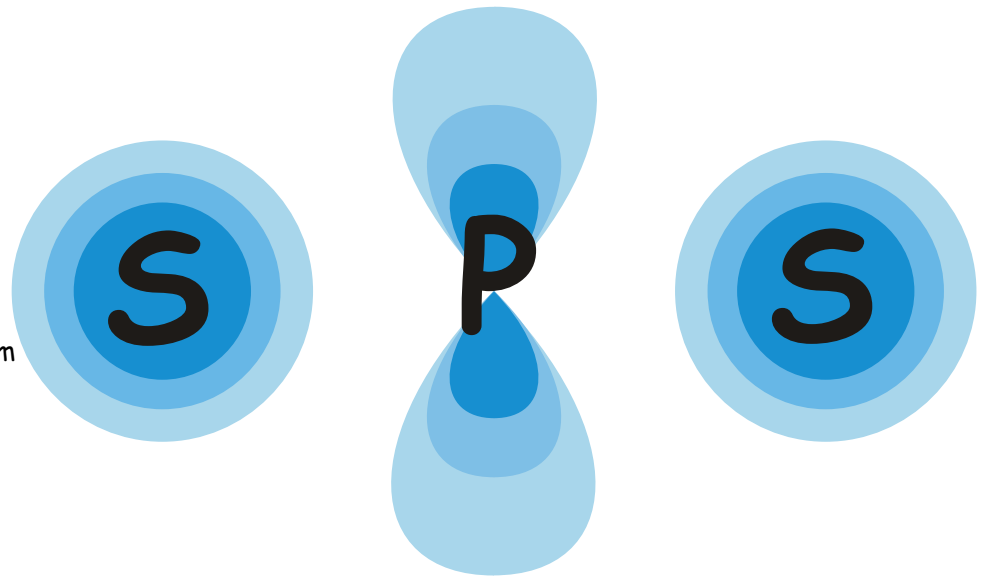




# Physics Club

President: Jeff Moffitt      Vice President: Ryan Hartschuh  
Treasurer: Christie Egnatuk      Secretary: Dan Brubaker  
Advisor: John Lindner

- Fri 31 Aug 2001: Physics Table at Scot Spirit Day
- Tue 18 Sep 2001: Pizza & Dessert Night & Liquid Nitrogen Ice Cream
- Tue 16 Oct 2001: Summer Research Symposium
- Thu 18 Oct 2001: Yearbook Photo
- Sat 17 Nov 2001: Columbus Science Museum & Dinner
- Tue 27 Nov 2001: Senior I.S. Research Presentations
- Tue 4 Dec 2001: Lecture by Dan Stinebring (Oberlin College)  
"Using Pulsars to Probe the Interstellar Medium"
- Thu 11 Jan 2002: Lecture by Ben Schumacher (Kenyon College)  
"Quantum Information and Quantum Computing"
- Wed 27 Feb 2002: Lecture by Tatiana Sergan (Kent State LCI)  
"Liquid Crystals Display Technology"
- Thu 28 Feb 2002: Lecture by Monwhea Jeng (UC Santa Barbara)  
"Scaling, Universality, & Self-Similarity in Disordered Systems"
- Fri 29 Feb 2002: Lecture by Stacy Palen (Univ of Washington)  
"Planetary Nebulae"
- Mon 8 Apr 2002: Lecture by Todd Coleman (Univ of Wisconsin)  
"Phenomenology of Heavy-Light Mesons"
- Thu 11 Apr 2002: Lecture by John Lindner  
"Climbing Kilimanjaro"
- Wed 17 Apr 2002: Lecture by Alice Churukian (Kansas State)  
"Interactive Engagement in an Introductory Physics Course:  
Learning Gains and Perceptions"
- Sun 21 Apr 2002: Taylor Bowl 13
- Fri 3 May 2002: Senior I.S. Posters, Pizza & Pop
- Sun 5 May 2002: Dr. Garg's Indian Dinner
- Mon 3 June 2002: Lecture by Mauro Alves (Oregon State)  
"Simulated Static Line Broadening in PAC Spectra"
- Thu 6 June 2002: Lecture by Rick Batman (Akron U)  
"Computational Method of Studying Polymer Mixtures Next to Surfaces"



Riding the Rotor at COSI

# Taylor Bowl

For the second year running, Physics came away with the coveted slide rule trophy in the annual bowling competition with Math/Computer Science. Apparently those Friday night practice sessions at Scot Lanes paid off! A total of 92 people participated in this year's contest. After the event, the first tally of scores showed that Math/CS had won. The next morning, it was discovered that an extra 620 pins had been added to the Math team's score. Oops! What an embarrassing mistake for the Math Department!

# Physics Rules Again!



# Outreach

The Physics Club embarked on a new adventure this year when it decided to bring the excitement of physics to elementary school classrooms with the goal of sparking an interest in the sciences among grade school children and breaking down the stereotype that physics is "hard". Led by Jeff Moffitt, the students created a demonstration involving air pressure and another involving lasers and holograms. The response has been overwhelming. The students made classroom visits two or three times per month, and one school even brought their entire 5th grade to the College for a more expanded format of demos. For its efforts, the Outreach program received an "Of the Month" award from the National Residence Hall Honorary. The best rewards, however, are the (often amusing!) words of gratitude that are received from the children.

Dear Chris, Jeff + Ryan,  
I thank you for coming and talking to us about science. My favourite part was when you poured liquid nitrogen into a little cup and let it sit a little while and the lid popped off like a rocket. Good luck in the rest of your education.  
Love,  
Jacque Ressler



Dear Becky, Josh and Jeff,

My name is Joey Bosler and I go to Lincoln Way Elementary. I would also like to tell you that I am 11 years old. I wrote this letter to tell you how much I enjoyed you coming and telling us what you do and why you do it. So thank you for coming.

I learned a lot of things and one thing that I liked but did not know about was the holograms. I learned that a hologram is not the same as a picture, but if you change the angle, then the image will be different. It is just like real life, you can move and the image in the hologram will change. Another thing that I liked was how you got the lasers to split up into many different parts.

I really liked what you showed to us and you explained it so well. I really do thank you for doing that. So once again thank you so very much for coming and talking to us about Physics and why you think that your college studies are important to you. It does really seem to me that when I go to college Physics will be a thing that I will look into. I would like to say good luck to Josh and I hope that all of you have a good time and that you graduate. I hope that all of your dreams of what you ever wanted to do is about to come true for the first time in your life. So thanks,

Sincerely,

Joey Bosler

Dear Brad,  
I thank you for taking time out of your school time for us. I had a lot of fun. My favourite part was the waves. I want to be a physics major when I grow up. I also want to be a teacher. I might be a science teacher.



Sincerely,  
Jesenia

# Outreach

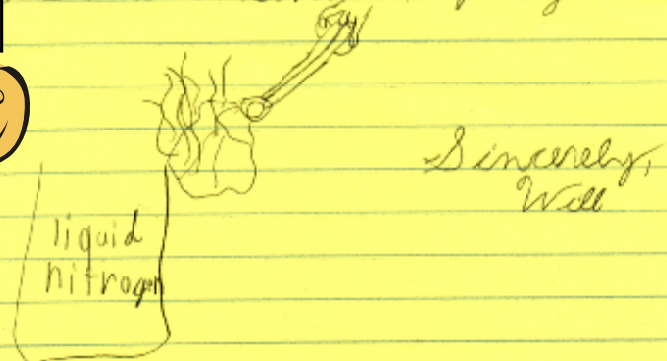


Dear Dr. Garg and Physics Students,  
Thank you for showing a teaching us about light and molecules. I really learned alot about light and molecules. Now I can get all A's on Science light and molecules test. Those Holograms, nitrogen, and the laser were all very good things to use to teach us with - Especially the nitrogen. I especially say thank you to Ryan for doing all of the talking.

Your best friend,  
Camille

Jeff Moffitt, Ryan Hartschuh, and Chris Locke use a bell jar to demonstrate a vacuum.

Dear Tom, Jeff, and Don,  
I thank you for volunteering to do these experiments with us. My favorite one was when we put the balloon in the liquid nitrogen and it shrunk. I also liked the bell jar and the over growing marshmallows. I never really thought of molecules until you came. Thanks for teaching us that lesson. I hope you come again.



Sincerely,  
Will

Dear Jeff, Chris, Ryan,  
Thank you for coming to our class room and doing all of those experiments. I thought it was great that you guys came. My favorite experiment was when the balloon popped. My second favorite was when you guys did the lickwed nitrogen with the littel cup cap thing. You guys are awesome.

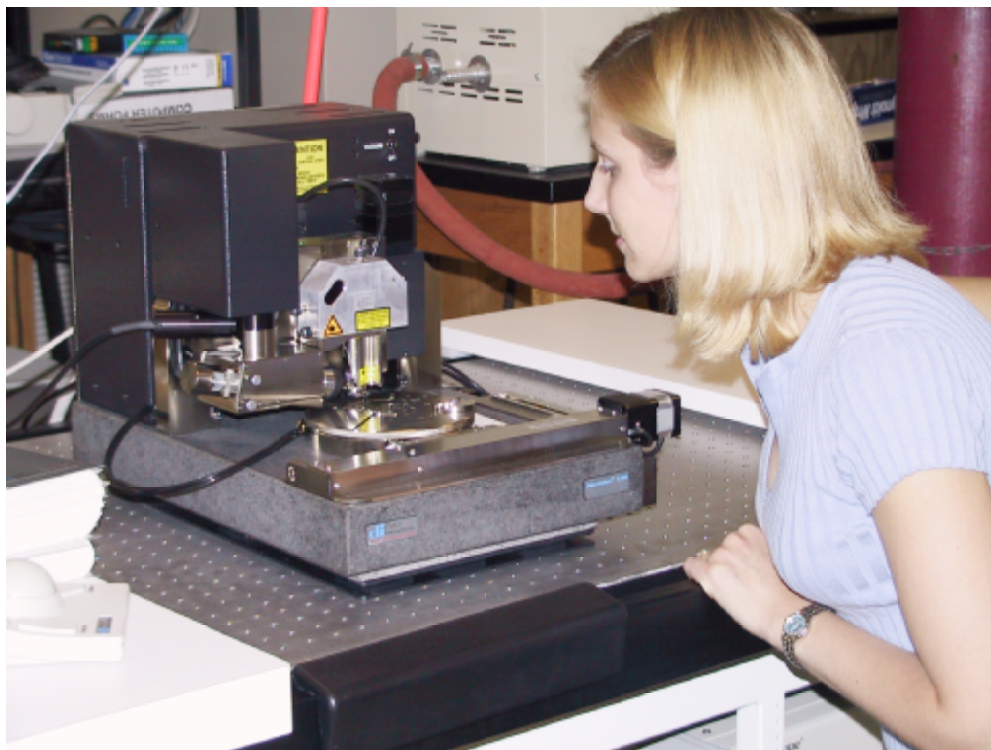
creative spelling award



love love  
Laura Thompson

# New Equipment

The Physics Department is very grateful to the Alden Trust for the \$100,000 grant for the purchase of a Digital Instruments Scanning Probe Microscope (SPM). The entire instrument costs nearly \$165,000, with The College of Wooster providing the balance. The SPM, which is capable of atomic and molecular resolution, has taken the level of projects that our students and faculty can do to a new level.



Becky Urban tests out the Department's new Scanning Probe Microscope

The SPM combines two instruments in one. The Scanning Tunneling Microscope (STM) uses quantum mechanical tunneling to sense and image individual "atoms". The Atomic Force Microscope (AFM) uses electrostatic forces to hold a tip above a surface and allows imaging of molecules and nano-scale structures.

Since the instrument was delivered and assembled in February, two Junior Independent Study students have used it to successfully carry out projects. Jeff Moffitt used atomic force microscopy to investigate intermolecular packing of two liquid crystals of opposite dielectric anisotropy, 5CB and MBBA, in a 1:1 molar ratio. Christie Egnatuk's project involved placing a solution composed of denatured DNA and Tris/Edta buffer solution on a glass slide or a piece of freshly cleaved mica. The solution was placed on a heating plate at 50°C and allowed to evaporate. The sample was examined with a microscope with crossed polarizers and with the atomic force microscope.

We plan to develop more student projects in both Independent Study and summer research. Some of our majors are interested in biophysics and chemical physics. There are several interesting projects that we hope to develop in collaboration with our colleagues in the Departments of Chemistry and Biology.

# Summer Research



Christine Leidel, Don Jacobs, Shila Garg, Pat MacDonald, Matt Sirocky, Dave Merriman, Judith Elwell, Jenn Goetz, Brad Thomas, Hanneke Hoekman, Austin Carter, Nithya Venkataraman, John Lindner, Becky Urban, Michelle Sestak

Dave Merriman (CoW '04)

Advisor: Shila Garg

Investigating the Elastic Properties of a Liquid Crystal and the Measurement of  $\chi_a$  of N4

Nithya Venkataraman (CoW '04)

Advisor: Don Jacobs

The Relationship Between the Correlation Length Amplitude of a Star vs. Linear Polymer in Methylcyclohexane

Michelle Sestak (Baldwin Wallace '04)

Advisor: Jenn Goetz

Methanol Maser Search of Star Forming Region S 235 A/B

Matthew Sirocky (Mount Union '03)

Advisor: Jenn Goetz

The Basics of Astrophotometry for The College of Wooster

Brad Thomas (CoW '04)

Advisor: John Lindner

The Flux Creep Automaton

Rebecca Urban (CoW '03)

Advisor: Don Jacobs

Self-Organized Criticality - Looking into Energy Dissipation

Austin Carter (CoW '05)

Advisor: Don Jacobs

Testing Yang-Yang Theory Using the Heat Capacity of Triethylamine and Water

Patrick MacDonald (Univ of Notre Dame '04)

Advisor: John Lindner

Invariant Seeds on a Cellular Automaton Sandpile

Hanneke Hoekman (CoW '04)

Advisor: Shila Garg

Dielectric Properties of a Nematic Binary Mixture

Christine Leidel (Ohio Northern '05)

Advisor: John Lindner

Optimal Exit: Solar Escape as a 3-Body Problem

# Off-Campus Summer Research

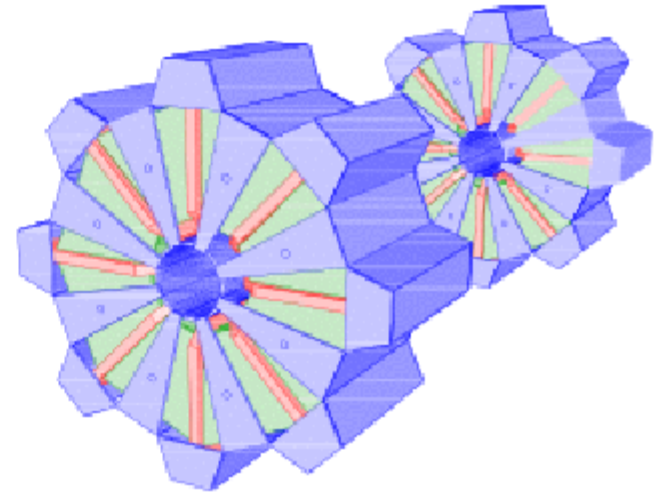
**Jeff Moffitt '03** worked at CERN (European Laboratory for Particle Physics) in Geneva, Switzerland this summer as a member of the University of Michigan REU. His project was to describe certain elements of the ATLAS detector using a new syntax of XML in order to determine if the descriptions in the new syntax can be more easily maintained.

**Katie Frato '04** did biophysics research at Bucknell University with Dr. Beth Cunningham and Dr. Dave Wolfe. She studied the effects of tocopherols (vitamin E) on model phospholipid membranes using x-ray diffraction data, phosphorous NMR and computation chemistry.

**Nick Harmon '04** worked at the University of Toledo on elastic electron scattering from closed-shell atoms. He used a program to calculate the differential cross sections for the elastic scattering.

**Ryan Hartschuh '03** spent the summer at the Department of Polymer Science, The University of Akron, studying Brillouin light scattering of polymeric photolithographic nanostructures. He presented a seminar at the Goodyear Polymer Center where he overviewed studies performed on thin films and presented preliminary spectral data from silicon supported thin polystyrene films (thicknesses 359-1150 nm) and photolithographic polymer gratings.

**Tom Spears '04** worked for the Laboratory for Elementary Particle Physics at Cornell University in Ithaca, NY. He did research with Joe Rogers into the behavior of particle beams in the positron/electron damping rings in two designs for a second generation linear collider. The behavior is the Touchek Lifetime and the emittance due to intra-beam scattering.



# Conference Presentations

\*Student co-author/presenter

## **National Meeting of the American Physical Society, Indianapolis IN (March 2002):**

C. Braganza\* and D.T. Jacobs, "The correlation length of the liquid-liquid mixture perfluoroheptane and 2,2,4-trimethylpentane"

T. Spears\* and S. Garg, "Dielectric Interactions in a Nematic Binary Mixture"

J. Martin\* and S. Garg, "Binary Mixtures of Calamitic and Discotic Liquid Crystals"

R. Hartschuh\* and D.T. Jacobs, "Composition dependence for the near-critical heat capacity of triethylamine and water"

D.J. Miller\* and J.F. Lindner, "Effects of Lattice Connectivity on the Flux Creep Automaton"

N.J. Harmon\* and J.F. Lindner, "Optimizing Solar Escape: An Interesting Variation of the 3-Body Problem"

## **199th Meeting of the American Astronomical Society, Washington DC (January 2002):**

J.A. Goetz, D.W. Brubaker\*, and C.A. Clerc\*, "Methanol Maser Emission in W75N and Orion Molecular Cloud 2 (OMC 2)"

# Awards



**Thomas G. Spears**  
Cincinnati Ohio

**The Joseph Albertus Culler Prize in Physics**

Awarded to the first- or second-year student who has attained the highest rank in general college physics

**The Elias Compton Freshman Prize**

Awarded to the student who has achieved the highest standing in scholarship during the first year

**Latin Honors (Cum laude)**



**Derek James Somogy**  
Wooster, Ohio

**Joshua Scott Martin**  
Dresden, Ohio



**Joshua Scott Martin**  
Dresden, Ohio

**The Arthur H. Compton Prize in Physics**

Awarded to the senior physics major attaining the highest standing in that subject



**Jeffrey R. Moffit**  
New Concord, Ohio

**The Mahesh K. Garg Prize in Physics**

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



**Ryan D. Hartschuh**  
Akron, Ohio

**Jeffrey R. Moffit**  
New Concord, Ohio

**Phi Beta Kappa**  
(on basis of junior standing)



# Alumni Spotlight



## Doug Halverson '91

Doug provided us with a wonderful account of his life since Wooster, so here it is in its entirety! "After recuperating from the march from the Kauke arch to the Underground and the consumption of the coveted Tootsie roll, I completed my MS at Case Western Reserve University. I moved to Chicago, where my fiancé, Karey, was working. Some of you may remember Karey as she visited Wooster often, and even attended a Physics Table or two and bowled in the infamous Taylor Bowl to help us capture the coveted giant slide rule in 1989. Karey and I were married in Chicago in May of 1993 and toured Ireland and England for our honeymoon. I started working as a manufacturing consultant at Andersen Consulting, after working as the Operations Manager of an electronics manufacturing facility. Karey and I really enjoyed living in Lincoln Park, a happenin' area of Chicago close to Lake Michigan, many restaurants and pubs. We continued traveling, one of our favorite hobbies, and made a memorable trip to Europe where we toured Germany, Switzerland, Italy and Austria. Back stateside in 1996, we headed for Atlanta to see the Olympics — what a great experience to see so many world citizens participating together! We moved to Boston in 1998 and lived in Newton, MA. We really had a fun time living in the Northeast exploring so many of the historically significant spots in American history. Met up with Tom Taczak '91 in Maryland and had a nice visit. I began working as an independent consultant, specializing in manufacturing software implementation and customization. Kathryn, our oldest daughter, was born in Boston in March of 1998. Wow, what a great new chapter in our life! We have really enjoyed being parents. We moved back to Chicago and purchased a home in Evanston, IL, which is just north of Chicago. Margaret, our second daughter (see recent picture), was born in October 2001. Kathryn is now a proud "Big Sister" and Margaret is eager to learn how to do everything that Kathryn does. I am eager to define my next career which will allow me to curb my traveling and spend more time with my family in Evanston."

### WE WANT TO HEAR FROM MORE OF YOU!

As you can see, only nine alumni are featured in our spotlight this year. Let's fill these pages up next year!

Write to us at:

Department of Physics  
The College of Wooster  
1189 Beall Avenue  
Wooster OH 44691

OR (even better)

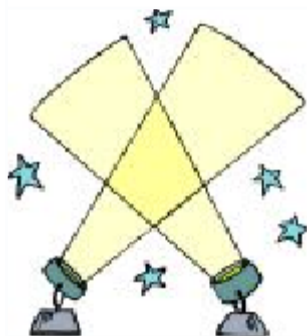
email one of these Wooster Physics "lifers" at:

[jmiddleton@wooster.edu](mailto:jmiddleton@wooster.edu) (Jackie Middleton)  
[jlindner@wooster.edu](mailto:jlindner@wooster.edu) (John Lindner)  
[sgarg@wooster.edu](mailto:sgarg@wooster.edu) (Shila Garg)  
[djacobs@wooster.edu](mailto:djacobs@wooster.edu) (Don Jacobs)  
[jelwell@wooster.edu](mailto:jelwell@wooster.edu) (Judy Elwell)

**Dale Peebles '70** has been changing careers, from physics research to computer consulting. He supports existing applications and develops new software for small organizations. He has mostly worked for a group of patent attorneys at the Naval Research Laboratory in Washington DC. Dale reports that the sense of structure that he developed in physics is just as useful for database applications. He has had a good time learning how to develop good software and enjoys being an independent consultant, although the work is a challenge at times. Dale's son Byron is a senior computer science major at The College of Wooster and his daughter Elizabeth is a sophomore. Dale has been back several times in the last few years and enjoyed each visit.

Visit Wooster Physics on the web:  
[www.wooster.edu/physics](http://www.wooster.edu/physics)

# Alumni Spotlight



## **Tim McLinden '73**

After teaching physics and math for 13 years at Yellow Springs High School in Yellow Springs, Ohio (where he also coached track and cross country and served as athletic director and transportation supervisor), Tim became an administrator and served 11 years as a high school assistant principal and 7 years as a principal in two different districts. He went to Carlisle Schools in 2000 as assistant superintendent and took over as superintendent in July, 2001. He and his wife Pam are the parents of three daughters, two of whom are in college and one who is in high school. Says Tim, "being a superintendent is fun and challenging, but it doesn't come close to the enjoyment I got out of teaching physics!"

## **Christy Rauch '99**

Christy has finished her stint with the Peace Corps and is excited to report that she will be teaching junior high science at a private K-8 school in Vienna, Virginia. She will also be in charge of the new school garden, which will enable her to carry out her dream of being a worm farmer and making compost while still living near a major metropolitan area. : )

**Solomon Ngubane '86** is the CEO of a company in information technology, Everest Systems Solutions, located in Gauteng, South Africa. The company does business with government and large corporate institutions.

**Cyrus Screwvala '96** received three degrees from Miami University of Ohio - master of science (physics and statistics), and most recently, master of arts in teaching. Cy recently moved to Batesville, Indiana and will begin teaching full time at the Oldenburg Academy this fall. He also teaches physics at the Hamilton branch of Miami University. Cy is also busy planning his wedding which will take place next April!

**Andy Nowicki '00** is working as an electromagnetic physicist at Kennedy Space Center, Florida, designing and testing instrumentation for electrostatic properties of lunar and Martian simulant. He lives in Port St. John, Florida, with his wife Christie and two dogs, Zerk and Zara.

**Chris Hamilton '92** is a technician in the Machine Research and Development Lab at Lincoln Electric in Cleveland, Ohio. He also works in sales at CompUSA. Chris is married and has three children (including twins!).

**Tom Taczak '91** lives on the Chesapeake Bay in Maryland and has a daughter Sophie (4 years), a son Tate (1.75 years), and a dog Zak (10 years). They enjoy lots of water sports. After Wooster, Tom went to the University of South Florida and earned a master of science in physics and a PhD in engineering science. His research field was laser spectroscopy mainly of atmospheric constituents. Since 1996, he has been working as a contractor at the Naval Research Laboratory in Washington DC. At NRL, he works for the Measurements and Simulation Research Group of the Advanced Techniques Branch in the Tactical Electronic Warfare Division (wow, Tom, isn't there an acronym for that?).