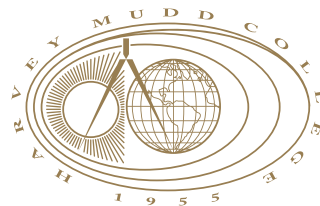


Presentation Days 2007



A Celebration of Student Projects

April 30, May 1 & 2



Harvey Mudd College
Claremont, California

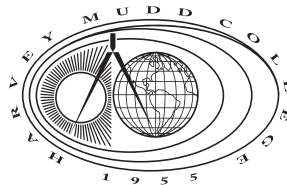
Presentation Days 2007 A Celebration of Student Projects

Scholarship is an integral part of the education of all students at Harvey Mudd College. The ability to conduct original investigations, to plan an approach to a problem, and to see it through are essential to success in any intellectual endeavor. We set time aside during the spring semester to celebrate the work of Harvey Mudd College students as they present their original projects in design, research and the arts. Whether this work is done in the context of the Clinic Program, as an individual research project with a faculty advisor, or as part of a class project, the emphasis is on the students' own achievements. Some of this work has already been published; much more of it will be published in the future.

This year, 200 students are participating in Presentation Days, including more than 100 research talks from students in each of the majors. Students in the Department of Humanities and Social Sciences are displaying their black and white photographs, while students in the Computer Science Department will be presenting research related to concept and tool development in diagram recognition. The results of the Introduction to Engineering Design projects, involving 21 teams of first-year and sophomore students, will also be presented.

The guest speaker for Presentation Days 2007 is Margaret Martonosi, Ph.D., professor of electrical engineering and associate dean, School of Engineering and Applied Science, Princeton University. Her talk will be held in Galileo Hall Monday, April 30, at 4:00 P.M. For more information, please contact the Office of the Dean of the Faculty at (909) 621-8122.

The Presentation Days Committee consists of Ann Esin, Esther Hughes, Debra Mashek, Catherine McFadden, Elizabeth Orwin '95, Nick Pippenger, Sally Rich Arroyo and Gerald Van Hecke '61, and is chaired by Robert Keller.



Presentation Days 2007 Schedule

Monday, April 30

■ 9:00 A.M. Research Presentations Begin

All Day Chemistry Poster Session—Galileo Hall Foyer/Chemistry Presenters available 10:30 A.M. to 11:30 A.M.

All Day Computer Science Poster Session—Galileo Hall Foyer/Computer Science Presenters available 9:30 A.M. to 10:30 A.M.

	Biology Beckman B126	Biology Galileo-Pryne	Humanities and Social Sciences Galileo-McAlister	Humanities and Social Sciences Jacobs B134	Mathematics Beckman B126	Physics Galileo-Edwards	
9:00 A.M.	Bio 82: Bioethics and Embryology Debate			M. Roberts			
9:15 A.M.				V. Camacho			
9:30 A.M.				M. Braly		S. Kibler	
9:45 A.M.						J. Fornaca	
10:00 A.M.	Reception—Galileo Hall Foyer						
10:15 A.M.							
10:30 A.M.		H. Johnsen, C. Rau	MS 182: Video Production C. Alvino, F. Dang		J. Azose	C. Meldgin	
10:45 A.M.						K. Zielnicki	
11:00 A.M.		E. Heyer			K. Brito		K. Bergemann
11:15 A.M.		J. Hetzel					M. Reed
11:30 A.M.		H. Watson		K. Tevin	V. Camacho		
11:45 A.M.				J. Moore			
12:00 NOON	Lunch						

■ 1:00 P.M. Research Presentations Begin

	Biology Galileo-Pryne	Computer Science Galileo-McAlister	Humanities and Social Sciences Jacobs B134	Mathematics Beckman B126	Physics Galileo-Edwards	
1:00 P.M.		D. Turner	R. Rutledge	J. Moore	IE 198: W. Buchanan, B. Tribelhorn	
1:15 P.M.		M. Lamdin	M. Ernst			
1:30 P.M.		M. Hunt, S. Jones, D. Morrison	A. Petros-Good	M. Hansen		
1:45 P.M.			M. Hunt			
2:00 P.M.						
2:15 P.M.	J. Shoffeitt	A. Wolin, et al.	S. Gussin	A. Heald		
2:30 P.M.	L. LaCount		C. Andrade			
2:45 P.M.	M. Youssef		M. Sondjaja	A. Izsak		
3:00 P.M.	K. Walker		K. Bergeman			
3:15 P.M.		C. Alvino, et al.	M. Quitt	M. Jameson		
3:30 P.M.			S. Smith			
3:45 P.M.	Reception—Galileo Hall Foyer					

4:00 P.M. Presentation Days Address—Galileo-McAlister

GUEST SPEAKER: Margaret Martonosi, professor of electrical engineering and associate dean, School of Engineering and Applied Science, Princeton University

Architecting Mobile Systems of the Future: Experience from ZebraNet and Beyond

Tuesday, May 1 Projects Day 10:30 A.M.–6:00 P.M.

Please see page 13 for general information; see Projects Day program for times and locations, or visit www.hmc.edu/academicsclinicresearch/clinicprogram.html.

Presentation Days 2007 Schedule

Wednesday, May 2

■ 9:00 A.M. Research Presentations Begin

All Day Humanities and Social Sciences Art 50 and Art 150 Poster Session—Galileo Hall Foyer/Presenters available 2:30 P.M. to 3:30 P.M.

All Day Humanities and Social Sciences Photography Exhibit—HSS Parsons Hall Gallery, First Floor, Parsons Hall

	Biology Galileo-Pryne	Chemistry and Biology Galileo-Pryne	Engineering Galileo-McAlister	Mathematics Beckman B126	Physics Galileo-Edwards
9:00 A.M.	N. Esclamado				
9:15 A.M.	J. Holth				
9:30 A.M.	R. McCarthy			MCM: M. Hunt,	W. Buchanan
9:45 A.M.	M. Smith			K. Kozai, G. Tucker	N. Alger
10:00 A.M.	Reception—Galileo Hall Foyer				
10:15 A.M.					
10:30 A.M.		F. Chang	Eng 158: Introduction	M. Koyama	D. Lafferty
10:45 A.M.		J. Moretti	to CMOS VLSI Design	E. Quan	K. Mistry
11:00 A.M.		K. Mouzakis		C. Tan	M. Maindi
11:15 A.M.		M. Lum			E. Hogan
11:30 A.M.		M. Cavanaugh-O'Keefe			S. Skillman
11:45 A.M.					
12:00 NOON	Lunch Break				

■ 1:00 P.M. Research Presentations Begin

	Chemistry Galileo-Pryne	Engineering Galileo-Edwards	Engineering Galileo-McAlister	Mathematics Beckman B126	Physics Jacobs B134
1:00 P.M.					
1:15 P.M.	K. Poindexter	E 4 Design	E 4 Design	I. Ventura	Physics 170:
1:30 P.M.	J. Kouzelos	Presentations	Presentations	D. Walton	Computational
1:45 P.M.	K. Zarzana			N. Herman	Physics
2:00 P.M.	J. McDonough				
2:15 P.M.	F. Hocutt				
2:30 P.M.	A. Hickman				
2:45 P.M.	Reception—Galileo Hall Foyer				
3:00 P.M.					
3:15 P.M.	J. Moretti	E 4 Design	E 4 Design	H. Orem, B. Rice	Physics 170:
3:30 P.M.		Presentations	Presentations		Computational
3:45 P.M.		continued	continued		Physics
4:00 P.M.					continued
4:15 P.M.					
4:30 P.M.					
4:45 P.M.					
5:00 P.M.					
7:00 P.M.	Humanities and Social Sciences—Joseph B. Platt Campus Center-Riggs Plaza Electronic Music Ensemble				
7:45 P.M.	Humanities and Social Sciences—Joseph B. Platt Campus Center-Riggs Plaza S. Jones: Two Dollar Suite				
8:00 P.M.	Dessert Reception—Joseph B. Platt Campus Center-Riggs Plaza				
8:15 P.M.	Music 84: Jazz Improvisation—Joseph B. Platt Campus Center-Riggs Plaza Music of Thelonious Monk				

Monday, April 30, 2007**9:00 A.M.–12:00 P.M.****■ Research Presentations**All Day **Chemistry Poster Session, please see below**All Day **Computer Science Poster Session, please see below**9:00 A.M. **Biology Presentations, please see page 5**9:00 A.M. **Humanities and Social Sciences Presentations, please see page 6**9:30 A.M. **Physics Presentations, please see page 6**10:30 A.M. **Mathematics Presentations, please see page 7**10:30 A.M. **Media Studies Presentations, please see page 8****Chemistry Poster Session—Galileo Hall Foyer**All Day **Chemistry Research Posters****Chemistry 168: Special Topics in Physical Chemistry****Andrew Chen (PZ), Amanda Hickman, Judy Hines, Lauren Hughs, Minseok Jang, Andrew Kouzelos, Ken Loh, Janina Moretti, Taylor Neiman, Glennis Rayermann, Sam Sobelman, Andrew Stewart, Kyle Zarzana, Dan Hickstein (PO), Margaret Schuerman (SC)****Presenters available 10:30 A.M.–11:30 A.M.**

In this course, we learned the fundamental principles of X-ray diffraction as it applies to structure determination of small molecules. As part of the course, students grew single crystals of molecules from their research, or of samples donated by researchers in the Pomona, Joint Sciences and Harvey Mudd College departments of chemistry. X-ray diffraction data was obtained by collaboration with the Center for Molecular Structure at the California State University at Fullerton. Students then solved their structures by standard methods and prepared their structures for publication.

Course Instructor: *Adam R. Johnson, Chemistry***Computer Science Poster Session—Galileo Hall Foyer**All Day **Computer Science Research Posters*****Making A Video Game*****Chris Alvino, James Egan, Joe Ishikura, Josh Utter-Leyton, Steven Wyckoff****Presenters available 9:30 A.M.–10:30 A.M.**

What makes something fun? How hard is too hard? How do you implement a flexible real-time simulation? How do you create a flexible framework for a data-driven program? These are just a few of the unique design and technical challenges that making video games present. We will present our experience making a video game as a year-long independent study project and discuss our solutions to these and other challenges.

Course Instructor: *Christine Alvarado, Computer Science*

Abbreviations: CM for Claremont McKenna College; PO for Pomona College; PZ for Pitzer College; SC for Scripps College; KGI for Keck Graduate Institute of Applied Life Sciences.

Biology—Beckman B1269:00 A.M. **Biology 82: Bioethics and Embryology Debate***Should Federal Funds Be Used to Support Embryonic Stem Cell Research?***Caitlin Andrade, Jennifer Du Mond, Logan Gordon, Jerrah Holth, Jenny Lee (PO), David Lempert (PZ), Katie Mouzakis, Ellie Tokar (PO)**

This course examines the ethical, societal and legal implications that arise from technological advances in human reproduction including in vitro fertilization, cloning, gene therapy, and therapeutic uses of embryonic stem cells. Students will present a brief scientific background on stem cell research, the results of a public opinion survey about the use of federal funds for embryonic stem cell research, and formally debate this topic. Following the debate, the audience will be invited to ask questions of the students.

Course Instructors: *Mary E. Williams and Robert A. Drewell, Biology*

10:00 A.M. **Reception—Galileo Hall Foyer****Biology—Galileo Hall-Pryne**10:30 A.M. **Holly Johnsen, Christoph Rau: *Characterization of Conservation of cis-Regulatory Elements in Drosophila***

Homeotic genes play a crucial role in development by specifying segment identity in an organism. In the *Drosophila* bithorax-complex (BX-C), three homeotic genes are regulated by *cis*-regulatory elements (CREs). While the mechanism of these CREs is unknown, they are critical for proper development. CRE sequences are not highly conserved between *Drosophila* species as is expected of a functional region of DNA. In order to elucidate this apparent incongruity, we have performed bioinformatic analyses of several CREs to characterize the levels of conservation. We are performing transgenic studies on the IAB5 and IAB8 enhancers to test functional conservation.

Faculty Advisor: *Robert A. Drewell, Biology*

11:00 A.M. **Erin Heyer: *The Role of Dynein Light Chain 4 in Ciliary Reversal***

Dynein is a molecular motor complex that moves along microtubules within the cell. Light Chain 4 (LC4) is believed to be the component of outer arm dynein that acts as a calcium-sensitive regulator of ciliary reversal in *Tetrahymena thermophila*. There are two LC4 isoforms in *Tetrahymena*; one isoform may be the calcium sensor, they may be redundant, or they may act in concert. Single and double knockdown mutant cell lines were created via macronuclear knockdowns of LC4A and LC4B. The ability of these mutants to undergo ciliary reversal in the presence of calcium was monitored using timed exposure darkfield microscopy.

Faculty Advisor: *David Asai, Biology*

11:15 A.M. **Jonathan Hetzel: *Characterization of Dynein 2 Light Intermediate Chain in Tetrahymena thermophila***

The dynein 2 motor complex is believed to be involved in retrograde intraflagellar transport (IFT) which is required to maintain cilia and flagella by bringing back recycled materials from the ciliary tips to the cytoplasm. It is hypothesized that Dynein 2 Light Intermediate Chain binds dynein 2 to its IFT cargo. To test this hypothesis, I have overexpressed D2LIC in *Tetrahymena thermophila* to create a dominant negative effect by filling all binding sites with individual D2LIC, thus breaking down IFT. It is expected that this will result in observable ciliary defects comparable to what is observed when the D2LIC gene is knocked out.

Faculty Advisor: *David Asai, Biology*

Biology Presentations continued

11:30 A.M. **Hadley Watson: *A Versatile GFP Tagging Construct for Localizing Dynein Heavy Chains in Tetrahymena thermophila***

The dynein heavy chain provides force to allow movement of the dynein motor protein complex. In light of the recent discovery of a large family of 25 expressed dynein heavy chains in the ciliate *Tetrahymena thermophila*, the locations and functions of which only seven are known, the question was raised why so many isoforms were necessary when other organisms survive with just 14–16. In order to provide answers to this question, steps for localizing the dynein heavy chains in *Tetrahymena* were undertaken, beginning with the creation of a versatile construct that would tag any dynein heavy chain with Green Fluorescent Protein.

Faculty Advisor: *Mary E. Williams, Biology*

Humanities and Social Sciences—Jacobs B1349:00 A.M. **IE 150: Science and Citizenship**

Effective public speaking is essential for both social engagement and scientific leadership. The goal of this course is to build student speaking skills in three areas: communicating advanced topics in science and technology to non-specialists; speaking out on questions of politics and values; and engaging the intersection of the two through presentations on technically intensive social controversies. In this presentation, students will share findings from their research papers on social controversies at the intersection of science, technology and society.

Course Instructor: *Paul F. Steinberg, Humanities and Social Sciences*

9:00 A.M. **Michael Roberts: *Ethical Considerations on Surveillance in the Information Age***9:15 A.M. **Victor Camacho: *Global Warming—From the Other Side***9:30 A.M. **Michael Braly: *The Shaping of American Nuclear Doctrine—A Reaction to the Nuclear Posture Review***10:00 A.M. **Reception—Galileo Hall Foyer**11:30 A.M. **Kenn Tevin: *Is Organic Food Good for Us?***11:45 A.M. **James Moore: *Ethics of Stem Cell Research and Therapy*****Physics—Galileo Hall-Edwards**9:30 A.M. **Scott Kibler: *Surface Deformation from Compressive Uplifting—A Fault Driven Tectonic System Emulating the Transverse Ranges***

A finite element analysis program (GeoFEST) was used to analyze the effects of various parameters on the spatial and time-dependence of surface deformations arising from repeated fault events within a particular tectonic model. The model was comprised of coupled strike-slip and thrust faults so as to mimic some of the major properties of the compressive uplift found in tectonic systems like those of the Transverse Ranges of Southern California. The material viscoelastic properties were also chosen in close approximation to reality and to allow for postseismic stresses to evidence themselves.

Faculty Advisor: *Gregory A. Lyzenga '75, Physics*

9:45 A.M. **Julia Fornaca: *Back to School—Interning at Claremont High***

During the fall of 2006, I interned in two physics classes at Claremont High School in order to familiarize myself with secondary school teaching and to practice educational techniques. In addition to conducting classroom observations, my responsibilities included one-on-one tutoring, lecturing and designing lessons with the help of my mentor teacher. Throughout the experience, I struggled to create lessons that were meaningful and relevant to the students and to provide increased opportunities for student participation. I will describe the results.

Faculty Advisor: *Peter N. Saeta, Physics*

Physics Presentations continued

10:00 A.M. **Reception—Galileo Hall Foyer**

10:30 A.M. **Carrie Meldgin: *Magnetization Dynamics in Magnetic Bilayers***

The non-equilibrium properties of coupled ferromagnetic and antiferromagnetic layers are examined using time-resolved magneto-optical techniques with 100-fs pulses of 800-nm light. Under appropriate conditions, an excitation pulse severs the exchange coupling between layers, allowing the magnetization of the ferromagnetic layer to precess, as described by the Landau-Lifshitz-Gilbert equation. I will discuss the dynamics of the magnetization rotation and how it can yield information on the exchange coupling of the layers.

Faculty Advisor: *Peter N. Saeta, Physics*

10:45 A.M. **Kevin Zielnicki: *Time-Resolved Magneto-Optical Kerr Effect***

The magneto-optical Kerr effect describes the change in polarization of a beam of light reflected from a magnetized surface, and can be used to optically measure the magnetization of thin films. I employed a femtosecond scale Ti:sapphire laser to probe the magnetization of an exchange coupled ferromagnet/antiferromagnet on short time scales. By using a pump/probe system with variable time delay between two pulses, I studied the impact of an optical excitation on the coupling of the ferromagnet/antiferromagnet system.

Faculty Advisor: *Peter N. Saeta, Physics*

11:15 A.M. **Kevin Bergemann: *A Platform for MOKE (Magneto-Optical Kerr Effect)***

To enable simultaneous optical and electrical studies of magnetic systems in the Quantum Design Physical Properties Measuring System (PPMS), I have developed a removable platform that enables measurements of the magneto-optical Kerr effect. I will discuss the design constraints imposed by the PPMS, including its restricted internal space and the alignment requirements of MOKE. I will also discuss the limitations of this setup, such as the noise introduced by vibrations in the PPMS/platform system.

Faculty Advisor: *Peter N. Saeta, Physics*

11:30 A.M. **Matthew Reed: *Measurement of Incommensurate Spin Density Waves in Superlattices of Vanadium-doped Chromium***

Superlattices of chromium and vanadium-doped chromium were studied to investigate the effects of incommensurate spin density waves on material properties. Density waves are established in both materials below their Néel temperature, but the period of these waves are dissimilar, causing irregular effects at the boundaries between the two. Measurements of resistance between 20K and 380K were made to determine the Néel temperature. Magnetization and magnetoresistance were also measured to locate the spin density wave transition temperatures.

Faculty Advisors: *James C. Eckert, Patricia D. Sparks and Chih-Yung Chen, Physics*

Mathematics—Beckman B126

10:30 A.M. **Jon Azose: *A Tiling Interpretation of q-Binomial Coefficients***

The binomial coefficients are one of the essential building blocks of enumerative combinatorics. A great deal of research has gone into understanding them both algebraically and combinatorially, and there are a wealth of binomial identities with both algebraic and combinatorial proofs. My work has focused on a generalized version of the binomial coefficients: the q -binomial coefficients. These generalized binomial coefficients appear naturally in the studies of integer partitions and hypergeometric series, and their properties have been examined primarily in these contexts. However, previous study of q -binomial coefficients has tended toward an algebraic viewpoint. My goal for this project has been to provide combinatorial interpretations for q -binomial identities. This includes both giving combinatorial proofs for known q -identities and using a combinatorial understanding of standard binomial identities to find and prove q -analogues.

Faculty Advisors: *Arthur T. Benjamin, Mathematics, and Kristina C. Garrett, Mathematics, St. Olaf College*

Mathematics Presentations continued

11:00 A.M. **Kazh Brito: *Hole Closure in Langmuir Fluid Monolayers***

Amphiphathic molecules are basically long chains, one end of which likes water (is hydrophilic) and the other end abhors it (is hydrophobic). These molecules tend to sit vertically in a fluid and adhere to each other. This attraction of adjacent molecules causes the molecules to condense into regions, referred to as polymer Langmuir layer domains, which are a single molecule thick and behave like a two-dimensional fluid. This attraction also manifests itself as a line tension, analogous to surface tension in a fluid droplet, which causes the regions to become circular as they attempt to minimize the length of their perimeter.

Often the layer will form holes, gaps in the liquid monolayer that contain a much smaller density of molecules. In the presence of humidity, the holes are observed close up, pulled together by the line tension as well as condensation of the hole molecules at the boundary. Previous researchers have computed the fluid velocity for the process when the hole is assumed to be a vacuum. I, however, propose to replace this model with a gas, adding condensation of gas from the hole into the liquid domain of the monolayer to the line tension force. The hope is to obtain a mathematical model that better corresponds to the physical problem than current models do.

Faculty Advisors: *Andrew J. Bernoff, Mathematics, and Shenda M. Baker, Chemistry*

11:30 A.M. **Victor Camacho: *Analyzing Traveling Waves in a Viscoelastic Generalization of Burger's Equation***

I analyzed a pair of nonlinear PDEs describing viscoelastic fluid flow in one dimension. The physical derivation is based on the Oldroyd-B fluid model and is essentially a generalization of Burger's Equation. Based on the boundary conditions and physical parameters, I was able to classify three different categories of traveling wave solutions, two of which involve shock formations. I can prove the existence of weak solutions as well as shock heights by introducing a viscous term and taking epsilon to zero. After calculating the Riemann invariants, I discover that one of the weak solutions is the result of a change of type in the PDE, from hyperbolic to elliptic. The Riemann invariants give a new interpretation of the PDE, which we use to develop a different numerical algorithm based on the characteristic information. Further, I made some progress on proving the global stability of traveling wave solutions.

Faculty Advisors: *Darryl H. Yong '96 and Jon Jacobsen, Mathematics*

Media Studies—Galileo Hall-McAlister10:30 A.M. **MS 182: Video Production**

Chris Byron, Glenn Duenas, Shawn Duenas, Matt Gnaizda, Dane Lindblad, Andy Perez

Students working individually and in intercollegiate groups completed three projects: the first, a spoof of an advertisement; the second, video as art, in either conceptual, expressive, formal or critical modes. The final project assignment was open-ended, but students were given a background in experimental documentary. The presentation will include selections from all three projects.

Course Instructor: *Rachel Mayeri, Humanities and Social Sciences*

11:00 A.M. **Chris Alvino, Faith Dang: *A Boy, a Tiger Cub and a Banyan Tree***

A young poor boy wanders into a jungle and plays with a tiger cub he encounters. While playing with the tiger cub, he accidentally kills the cub, but only to discover a nearby Banyan tree having medicinal properties to revive the tiger. The aim of our project was to explore different media and artistic styles to create a short animation clip based on a Vietnamese legend called "The Buffalo Boy." The animated clip was done using 3-D models created in various software packages and 2-D traditional Vietnamese style painting.

Faculty Advisor: *Rachel Mayeri, Humanities and Social Sciences*

12:00 NOON

■ **Lunch Break**

1:00 P.M.–5:00 P.M.

■ **Research Presentations**

- 1:00 P.M. **Computer Science Presentations, please see below**
- 1:00 P.M. **Humanities and Social Sciences Presentations, please see page 10**
- 1:00 P.M. **Mathematics Presentations, please see page 10**
- 1:00 P.M. **Physics Presentations, please see page 11**
- 2:15 P.M. **Biology Presentations, please see page 12**
- 4:00 P.M. **Presentation Days Keynote Address, please see page 13**

Computer Science—Galileo-McAlister

- 1:00 P.M. **Daniel Turner: *Shredder—An Improved Revocable Back-Up System***

Data back-up systems have long been a ubiquitous part of computing. These systems effectively store both current and old data indefinitely. However, laws like HIPPA and Sarbanes-Oxley, as well as several recent scandals, have highlighted the need for secure destruction of sensitive data. Current practices make it virtually impossible for old records to be erased from back-up tapes. I expanded on work done by Dan Boneh to create Shredder, which allows a user to securely delete old data from back-up tapes at the push of a button.

Faculty Advisor: *Geoffrey Kuening, Computer Science*

- 1:15 P.M. **Micah Lamdin: *A File System Trace Repository***

File systems researchers are constantly faced with the problem of finding current and accurate traces of file system activity. I have built and deployed a national repository of trace data, which makes it easy for researchers to share and download traces, and have populated it with a variegated set of initial information. The talk will focus on unexpected obstacles encountered while deploying the site and lessons learned during the process.

Faculty Advisor: *Geoffrey Kuening, Computer Science*

- 1:30 P.M. **Martin Hunt, Stephen Jones, David Morrison: *A Software Tool for Learning Jazz Improvisation***

We will present work on a number of areas related to concept and tool development for education in jazz improvisation. Areas include: automated bass lines, drum tracks, piano comping, and melody generation, as well as novel input methods. The tool is known as Impro-Visor (Improvisation Advisor) and is available for download on the Web. We will also discuss some future work possibilities.

Faculty Advisor: *Robert M. Keller, Computer Science*

- 2:00 P.M. **Break**

- 2:15 P.M. **Aaron Wolin, Ned Burns, Paul Wais, Howard Chen, Matt Weiner: *Recognizing Hand-Drawn Digital Circuit Diagrams***

The goal of this project is to build a sketch-based tool that can be used to construct and simulate digital circuit diagrams. This tool will be used in E 85: Digital Logic and Computer Architecture. Constructing this tool involves solving a number of important problems in both sketch recognition and user interface design. This presentation will discuss these problems, our approach to solving them, and our latest results. In addition, it will include a number of demos of the current state of the software.

Faculty Advisors: *Christine Alvarado, Computer Science and Sarah L. Harris, Engineering*

Computer Science Presentations continued

3:15 P.M. **Chris Alvino, James Egan, Joe Ishikura, Josh Utter-Leyton, Steven Wyckoff: *Making A Video Game***

What makes something fun? How hard is too hard? How do you implement a flexible real-time simulation? How do you create a flexible framework for a data-driven program? These are just a few of the unique design and technical challenges that making video games present. The team will present their experience making a video game as a year-long independent study project and discuss their solutions to these and other challenges.

Faculty Advisor: *Christine Alvarado, Computer Science*

Humanities and Social Sciences—Jacobs B134

1:00 P.M. **IE 150: Science and Citizenship (continued from Monday morning, 9:00 A.M.–12:00 P.M. session)**

Effective public speaking is essential for both social engagement and scientific leadership. The goal of this course is to build student speaking skills in three areas: communicating advanced topics in science and technology to non-specialists; speaking out on questions of politics and values; and engaging the intersection of the two through presentations on technically intensive social controversies. In this presentation, students will share findings from their research papers on social controversies at the intersection of science, technology and society.

Course Instructor: *Paul F. Steinberg, Humanities and Social Sciences*

1:00 P.M. **Russell Rutledge: *Ruling the World Wide Web—Government Internet Policy of the Past Decade***

1:15 P.M. **Michael Ernst: *Statistical Illiteracy—A Modern Crisis***

1:30 P.M. **Autumn Petros-Good: *The Water Shortage—Where, Why and What We Can Do About It?***

1:45 P.M. **Martin Hunt: *Privacy Issues in an Online World***

2:00 P.M. **Break**

2:15 P.M. **Sara Gussin: *Deterring Nuclear Terrorism—What Could We Do and Why Aren't We Doing It?***

2:30 P.M. **Caitlin Andrade: *Somatic Cell Nuclear Transfer—Applications and Concerns***

2:45 P.M. **Mutiara Sondjaja: *The Ethics of Artificial Insemination by Donor***

3:00 P.M. **Kevin Bergemann: *Innovative Methods for Combating Global Warming***

3:15 P.M. **Marissa Quitt: *No Child Left Untested—Different Approaches to Teaching Basic Mathematics***

3:30 P.M. **Scott Smith: *Is America Becoming "Big Brother?" Surveillance Technologies and Their Impact***

Mathematics—Beckman B126

1:00 P.M. **James Moore: *An ODE Model of Biochemotherapy Treatment for Cancer***

New treatment strategies for cancer give doctors and patients many more options. However, it is difficult to determine exactly what treatment schedule should be used in any given situation except by trial and error. My project will be to model the effects of treatment on tumor-immune dynamics and then determine what combination of treatments is most effective.

Faculty Advisors: *Jon Jacobsen and Lisette de Pillis, Mathematics*

Mathematics Presentations continued

1:30 P.M. **Mike Hansen: *Algebraic Invariants of Phylogenetic Trees***

One of the restrictions used in all of the works done on phylogenetic invariants for group-based models has been that the group be abelian. In my thesis, I hope to generalize the method of invariants for group-based models of DNA sequence evolution to include nonabelian groups. By using a non-abelian group to act as one of the nucleotides, one could capture the structure of the symmetric model for DNA sequence evolution. If successful, this line of research would unify the two separated strands of active research in the area today: Allman and Rhodes' invariants for the symmetric model and Strumfels and Sullivant's toric ideals of phylogenetic invariants.

Faculty Advisors: *Francis E. Su and Michael Orrison Jr., Mathematics*

2:00 P.M. **Break**2:15 P.M. **Andrea Heald: *Understanding Counter-examples to Lubin's Conjecture***

Lubin's Conjecture states the following: given power series f, g with coefficients in the p -adic integers, with f invertible and non-torsion, and g non-invertible, then if $f(g(x)) = g(f(x))$, f, g are endomorphisms of a formal group over the p -adic integers. This conjecture connects formal power series over the ring of p -adic integers dealt with in p -typical dynamical systems to formal groups. There is a type of endomorphism of a formal group called a logarithm, and variants of the logarithm give rise to counter-examples to Lubin's conjecture. I examine such counter-examples.

Faculty Advisors: *Ghassan Sarkis, Mathematics, Pomona College, and Michael Orrison Jr., Mathematics*

2:45 P.M. **Alexander Izsak: *Special Cases of Carry Propagation***

How long does it take a computer to add numbers? Using local parallel computation, this time is directly related to the length of the longest carry propagation chain in the numbers being added. A carry propagation chain is a set of consecutive bit positions in an addition such that the lowest order bit position creates a carry, which causes a carry in the next bit position, which then causes another carry, and so on, across all bit positions in the chain. My thesis looked for the average time needed to multiply a random n -digit number by a number of the form $100\dots 01$ by examining the average length of the longest carry propagation chain in the addition resulting from that multiplication. I found good approximations as well as exact formula for that average length by applying probability, linear algebra and generating function arguments.

Faculty Advisors: *Nicholas Pippenger, Mathematics, and Ran Libeskind-Hadas, Computer Science*

3:15 P.M. **Marie Jameson: *An Algebraic Study of Voting Theory***

The topic of voting theory has intrigued mathematicians for centuries. Voting theory is plagued by seemingly contradictory results, called voting paradoxes. Voting paradoxes can be seen by comparing the use of different methods to tally votes, or by considering the effect of dropping one or more candidates in an election. By adopting an algebraic framework to approach voting theory, this paper strives to understand voting paradoxes caused by dropping candidates in an election.

Faculty Advisors: *Michael Orrison Jr., Mathematics, and Nathan Ryan, Mathematics, UCLA*

Physics—Galileo Hall-Edwards1:00 P.M. **Whitney Buchanan, Ben Tribelhorn: *IE 198—Water, Los Angeles and Harvey Mudd College***

As future leaders in the technical fields, many Harvey Mudd College students are developing a commitment to sustainability. In parallel with student groups working on sustainability, we began an investigation of water use on the Harvey Mudd College campus and its impact, both financial and environmental. Studies were made of the distribution of water usage between academic, residential, dining and landscaping uses. A system by which students can evaluate the efficiency of the fixtures in their living spaces as well as their own usage was developed. Processes were put in place that future groups can use to complete a comprehensive campus-wide water audit.

Faculty Advisors: *Theresa W. Lynn and Richard C. Haskell, Physics*

Biology—Galileo Hall-Pryne

- 2:15 P.M. **Jamie Shoffeitt:** *Controlling the Phenotype of Corneal Keratocytes Through Co-Culture on a Three-Dimensional Matrix for a Tissue Engineered Corneal Equivalent*

It is necessary to control the differentiation of corneal stromal cells in order to achieve a transparent tissue engineered corneal equivalent. When injured or seeded in culture, corneal keratocytes differentiate to myofibroblasts, which express alpha-smooth muscle actin protein and exhibit a loss of corneal transparency. Past work has suggested that co-culture with corneal endothelial cells in monolayer reduces alpha-smooth muscle actin expression, indicating a return towards the quiescent keratocyte phenotype. I have extended this co-culture study to three dimensions, using a collagen sponge as a scaffold. The phenotype of stromal cells was determined by western blot.

Faculty Advisor: *Elizabeth J. Orwin '95, Engineering and Biology*

- 2:30 P.M. **Lauren LaCount:** *Kinematics and Energetics of Bipedal and Quadrupedal Locomotion in the Desert Iguana, *Dipsosaurus dorsalis**

Desert iguanas, *Dipsosaurus dorsalis*, run well both bipedally and quadrupedally. I measured velocity, acceleration, and metabolic rate during both types of locomotion to investigate why these lizards sometimes run bipedally. Velocity and acceleration were determined from kinematic analyses of video recordings of running on a track, and metabolic rate was determined from energetics studies of oxygen consumption during running on a treadmill. While desert iguanas do not seem to run bipedally at faster velocities than quadrupedal running, they may increase acceleration with little increase in energetic cost during bipedalism.

Faculty Advisor: *Anna N. Ahn, Biology*

- 2:45 P.M. **Mina Youssef:** *Hot Skinks or Not-So-Hot Skinks—Thermal Sensitivity of Sprint Performance in *Eumeces gilberti**

Temperature is an important ecophysiological variable that affects the behavior and physiology of ectotherms, and quantifying how physiological performance is affected by temperature is important to understanding an organism's ecology. I measured the thermal sensitivity of sprint performance in Gilbert's skink, *Eumeces gilberti*. The optimal performance temperature of the skinks is very similar to the body temperatures these lizards selected in laboratory thermal gradients.

Faculty Advisor: *Stephen C. Adolph, Biology*

- 3:00 P.M. **Katelyn Walker:** *Phenotypic Plasticity of Resource Allocation in Coastal Sage Scrub Plants Under Water Stress*

Plant morphology varies widely across habitats, often correlated with temperature, water availability and light availability; one way to quantitatively measure plant morphology is through biomass resource allocation. Plants can respond to short-term variation in environmental characteristics through phenotypic plasticity, a non-inheritable change in morphology within the lifetime of an individual plant. In this experiment, I examine the plasticity of resource allocation traits (leaf biomass per photosynthetic area [LMA] and root versus shoot biomass allocation) under conditions of water stress.

Faculty Advisor: *Stephen C. Adolph, Biology*

- 3:45 P.M. **Reception—Galileo Hall Foyer**

4:00 P.M.

■ **Presentation Days Address**

Galileo-McAlister

Introduction: Daniel L. Goroff, vice president for academic affairs and dean of the faculty

Guest Speaker: Margaret Martonosi, professor of electrical engineering and associate dean, School of Engineering and Applied Science, Princeton University

Architecting Mobile Systems of the Future: Experiences from ZebraNet and Beyond

Mobile and wireless computing offers the next big revolution in how we use computing devices. In this talk, I will describe our experiences building the ZebraNet system for wildlife tracking, based on sparse, mobile collections of GPS-based sensing devices. Drawing from ZebraNet and other systems experiences, my colleagues and I are now launching The Sarana Project, which aims to provide a fluid, dynamic, abstract and optimizable systems layer for allowing efficient systems implementations on real-world, highly-mobile platforms. I will discuss both the technical challenges Sarana seeks to address, as well as the broader technical and social issues of creating mobile systems that are simultaneously useful, collaborative, secure and private.

Margaret Martonosi is currently professor of electrical engineering at Princeton University, where she has been on the faculty since 1994. She is also an associate dean for Princeton's School of Engineering and Applied Science and she holds an affiliated faculty appointment in Princeton CS.

Martonosi's research interests are in computer architecture and the hardware/software interface, with particular focus on power-efficient systems and mobile computing. In the field of processor architecture, she has done extensive work on power modeling and management and on memory hierarchy performance and energy. In the field of mobile computing and sensor networks, Martonosi leads the Princeton ZebraNet project, employing mobile ad hoc networking for wildlife tracking. Martonosi is co-author on over 90 refereed publications and inventor on five granted U.S. patents. She completed her Ph.D. at Stanford University, and also holds a master's degree from Stanford and a bachelor's degree from Cornell University, all in electrical engineering.

Tuesday, May 1, 2007

Projects Day—HMC Computer Science, Engineering, Mathematics and Physics Clinics

Please see Projects Day Program for times and locations, or visit www.hmc.edu/academicsclinicresearch/clinicprogram.html

10:30 A.M.

■ **Registration and Poster Sessions**

Ronald and Maxine Linde Activities Center

1:00 P.M.

■ **General Session—Galileo-McAlister**

Welcome: President Maria M. Klawe

Remarks: Weiqing Gu, director, Mathematics Clinic

Milestone Awards: Daniel L. Goroff, vice president for academic affairs and dean of the faculty

Milestone Award Recipients: Amgen Inc., Laserfiche and Sandia National Laboratories

Projects Day continued

1:30 P.M.–5:00 P.M.

■ **Clinic Presentations—Classrooms, Galileo Halls and Labs**

Computer Science Clinic

The Aerospace Corporation: Grid Enabled SOAP Portal

Fair Isaac Corporation: Soft Co-Occurrence Clustering for Natural Language Understanding

Laserfiche: Improved Photo-Document Segmentation

Los Alamos Neutron Science Center (LANSCE) and Los Alamos National Laboratory (LANL):
3-D Interactive Museum Exhibit

NC4—The National Center for Crisis and Continuity Coordination:

Automated Information Acquisition for Incident Research and Situational Awareness

Sandia National Laboratories: Storage Node Simulation for a Supercomputer

Engineering Clinic

The Aerospace Corporation: A Portable, Quick-Response, Satellite Beacon Tracking Unit

Amgen Inc. (Global):

Optimization of a Recombinant Protein Product Through the Analysis of Filtration in the Production Process

Applied Biosystems: Development of an Airless, Ventless, Microfluidic Device

Applied Biosystems: Development of a Variable Precision Powder Dispenser for Oligonucleotide Manufacturing

The Boeing Company: Design and Testing of R-Theta Undersea Propulsion Theory

Cardinal Health: A Virtual Reality Interface for Real-Time Patient Monitoring and Medication Management

Cardinal Health: Cardinal Health Wireless Vital Signs Monitor

Center for Integration of Medicine and Innovative Technology (CIMIT):

Design and Development of a Real Time Mass Casualty Accountability System

DIRECTV, Inc.: Design of a Satellite Signal Meter Add-On and Installation Meter

Edwards Air Force Base: Design and Construction of a Dynamic Long Range Laser Telemetry System

Electro Yak, LLC: Electric Kayak

Hewlett-Packard Company (Global): Gravure Coating and Imprinting in Roll-to-Roll Manufacturing Processes

Honeywell International, Inc.: Pressure Drop Characterization of Congealed Oil Flow in Compact Heat Exchangers

Max-Viz: Instrument Qualified Visual Range: Design of an Aircraft Landing Safety System

National Renewable Energy Laboratory (NREL): Modeling the Solar Photovoltaic Industry

Northrop Grumman Corporation: Solderability of Lead-Free Components in Standard Soldering Processes

Oregon Biomedical Engineering Institute (OBEI): Separation of Medical Grade Shell from Industrial Waste

Raytheon Space & Airborne Systems: Specular Array Radiometric Calibration of Earth-Imaging Satellites

Southern California Edison: Acetylene Gas Monitoring in Distribution Transformers

Southwest Research Institute (SwRI): Bench-Top System to Simulate Space Flight Detectors

Space Systems/Loral: Design and Testing of an Adjustable Thruster Bracket

SRI International: Improved Articulation of National Guard Training Systems

TREX Enterprises Corporation: Very Low Frequency RF Communications System

KGI/Engineering Clinic

Amgen Inc.: Evaluation of Pre-filled Plastic Syringes as the Primary Container for Therapeutic Proteins

Mathematics Clinic

Beckman-Coulter Inc.: Modeling and Optimizing Bead-Based Immunoassays

D4 Networks, LLC: Scheduling and Pricing Flights to Enable a New Air Charter Business Model

Hewlett-Packard Laboratories: Identifying and Minimizing Non-Smoothness in ICC Profiles

Physics/Engineering Clinic

Lawrence Livermore National Laboratory (LLNL): Muon Veto System for a Reactor-Monitoring Anti-Neutrino Detector

Los Alamos National Laboratory (LANL): Design and Construction of a Thermal Link for Optical Isolation

Wednesday, May 2, 2007**9:00 A.M.–12:00 P.M.****■ Research Presentations**All Day **Humanities and Social Sciences Art 50 and 100 Poster Session, please see below**All Day **Humanities and Social Sciences Photography Exhibit, HSS Parsons Hall Gallery, First Floor, Parsons Hall**9:00 A.M. **Biology Presentations, please see below**9:30 A.M. **Mathematics Presentations, please page 17**9:30 A.M. **Physics Presentations, please see page 18**10:30 A.M. **Chemistry and Biology Presentations, please see page 16**10:30 A.M. **Engineering Presentations, please see page 20****Humanities and Social Sciences Poster Session—Galileo Hall Foyer**All Day **Art 50 and Art 150 Poster Session**
Presenters available 2:30 P.M.–3:30 P.M.

Students participate in an end-of-semester show through which they display a selection of their best work. Each student is given a 4X4 poster on which he/she can arrange a thematic display of the work. Each poster includes an “artist’s statement” and description of the theme.

Course Instructors: *Steve Schenck and Tad A. Beckman, Humanities and Social Sciences*

Biology—Galileo Hall-Pryne9:00 A.M. **Nicole Esclamado: *Astrocyte-induced Neuronal Differentiation of Mesenchymal Stem Cells on a Collagen Scaffold***

Human bone-marrow mesenchymal stem cells (MSCs) have recently been shown to restore cognitive and physiological function to victims of traumatic brain injury (TBI). While previous *in vitro* studies have only explored the generation of neurons from human bone-marrow mesenchymal stem cells in monolayer, this study demonstrates that MSCs express neuron-specific proteins when co-cultured with astrocytes on a collagen matrix. This finding indicates that the combination of MSC-derived neurons and a scaffold that offers physical guidance to both transplanted and native cells may provide an effective framework for neural tissue regeneration.

Faculty Advisor: *Elizabeth J. Orwin '95, Engineering and Biology*

9:15 A.M. **Jerrah Holth: *In Vitro Control of Rabbit Corneal Fibroblast Phenotype Through Co-Culture with Endothelial Cells***

The cells in the corneal stroma are quiescent keratocytes, which, upon injury, differentiate to repair fibroblasts and express α -SMA. These repair fibroblasts also downregulate crystallin proteins ALDH1A1 and TKT making the cornea opaque. Previous studies in our lab have suggested that corneal endothelial cells secrete proteins that can induce the redifferentiation from the fibroblast to quiescent keratocyte phenotype, thus restoring transparency. To test this hypothesis, I analyze the effect of cell confluency, protein expression time patterns, and media treatment of monolayer stromal cell culture versus co-culture of stromal and endothelial cornea cells.

Faculty Advisor: *Elizabeth J. Orwin '95, Engineering and Biology*

Biology Presentations continued

9:30 A.M. **Ryan L. McCarthy:** *Investigating Effects of Phosphoinositide Accumulation in sac9 Mutants of Arabidopsis Using Confocal Microscopy Techniques*

Phosphoinositides (PIs) are membrane associating lipid signaling molecules that play roles in cytoskeleton regulation and membrane trafficking. The *sac9* mutant of *Arabidopsis thaliana* overaccumulates the PI species PtdIns(4,5)P2 and demonstrates a constitutively stressed phenotype resembling hyperosmotically stressed wild type plants. Using confocal microscopy with plants expressing GFP transgenes and fluorescent dyes we have identified phenotypic abnormalities at the cellular level in the *sac9* mutants and have developed a model for how the overaccumulation of PtdIns(4,5)P2 and the resulting cellular defects lead to the observed mutant phenotype.

Faculty Advisor: *Mary E. Williams, Biology*

9:45 A.M. **Melissa Smith:** *Phylogenetic Analysis and Functional Characterization of the SAC9 Protein in Arabidopsis and Chlamydomonas*

Phosphoinositides (PI) are membrane-associated phospholipids that perform a key role in intracellular signaling. The regulation of these PIs is partly mediated by PI phosphatases including SAC-domain phosphatases. SAC-domain proteins are characterized by a 500 amino acid long catalytic domain at the N-terminus. However, modifications within the SAC domain and the C-terminal regions have led to different SAC-domain proteins, the most divergent of which is SAC9. I will present a phylogenetic analysis of the SAC9 protein and demonstrate how this analysis informs experiments to investigate functional domains in the SAC9 protein.

Faculty Advisor: *Mary E. Williams, Biology*

10:00 A.M. **Reception—Galileo Hall Foyer**

Chemistry and Biology—Galileo Hall-Pryne

10:30 A.M. **Fang-Yuan Chang:** *Trapping the hOGG1—Nucleosomal DNA Complex*

Human 8-oxoguanine DNA glycosylase (hOGG1), a DNA repair enzyme, requires transient covalent binding with damaged DNA to excise its target lesion. The mechanism by which DNA-interacting enzymes gain accessibility to nucleosomal DNA is still largely unknown. Elucidating the structure of the hOGG1:nucleosomal DNA complex can give insight to the possible mechanism. To investigate the process of DNA repair of damaged bases embedded in chromatin, the preparative steps have been undertaken for the covalent trapping, isolation and characterization of the hOGG1:nucleosomal DNA complex.

Faculty Advisor: *Karl A. Haushalter, Chemistry and Biology*

10:45 A.M. **Janina Moretti:** *Crosslinking Histones to DNA to Prevent Transient Site Exposure*

Although the mechanism of base excision by DNA glycosylases has been well-studied in free DNA, it is unknown how these enzymes gain access to DNA damage densely packed in chromatin. One possibility is that they gain access to nucleosomal DNA when it spontaneously unwraps from the histone octamer surface. To investigate this model, I am creating nucleosome core particles with DNA covalently bonded to the histone octamer via disulfide crosslinks to prevent transient site exposure. This complex can be used to determine how preventing dynamic unwrapping of the DNA affects the rate of base excision repair from nucleosome core particles.

Faculty Advisor: *Karl A. Haushalter, Chemistry and Biology*

Chemistry and Biology Presentations continued

11:00 A.M. **Katie Mouzakis: *Thermolability and Compromised Excision Activity of Polymorphic Forms of hOGG1***

Reactive oxygen species, a common by-product of cellular metabolism, oxidize guanine residues in DNA to form the mutagenic lesion 8-oxoguanine (oxoG). Human 8-oxoguanine DNA glycosylase-1 (hOGG1) recognizes and removes oxoG when it is base-paired opposite cytosine. The critical role of hOGG1 in preventing mutagenesis has prompted extensive studies of hOGG1 variants which are derived from either somatic mutations or polymorphisms. We have purified and characterized the Arg154His, Ala85Ser, Ser232Thr, Arg46Gln, and Ser326Cys hOGG1 variants using thermostability and enzyme kinetics.

Faculty Advisor: *Karl A. Haushalter, Chemistry and Biology*

11:15 A.M. **Michelle Lum: *Synthesis of Chitosan Functionalized with Acid-Amines***

Chitosan is the deacetylated form of naturally occurring polysaccharide chitin. Deacetylation creates positively charged free amines and increases chitosan's antimicrobial activities, anti-inflammatory responses and wound healing properties. Even though the development of biocompatible chitosan bandages has been successful, its activity is limited by low solubility at biological pH. We modified the chemical structure of chitosan with acid-amines to increase its solubility and to ultimately study its antimicrobial properties. We successfully functionalized chitosan with 6-aminocaproic acid, 5-aminovaleric acid and β -alanine. Non- α amino acid 6-aminocaproic acid is structurally similar to lysine, allowing for direct comparison studies to chitosan-lysine conjugates to help determine whether the α -amino group plays a role in determining antibacterial activity. These chitosan derivatives will help assess how the position of the cationic charge ultimately affects bacterial targeting.

Faculty Advisor: *Shenda M. Baker, Chemistry*

Biology—Galileo Hall-Pryne11:30 A.M. **Adam Miller, Balu Krishna, Josh Oklan, Martha Cavanaugh-O'Keefe, Parvin Rastegar, Victor Chiu: *Optimization of a Testing Method for Genetically Modified Traits in Maize (KGI Dow AgroSciences Team Masters Project)***

With the prevalence of genetic modifications, it is important to Dow Agrosciences (DAS) to verify that seed lots are free of unintended transgenes. DAS must be able to detect one "contaminant" seed among thousands of conventional seeds. These factors, combined with the number of seed lots tested, require the analysis of over 1,000,000 samples per year.

KGI's team has evaluated improvements to existing DAS assays: at both the DNA extraction and trait detection stages, alternative methods have been tested which improve throughput, reduce operator time, and reduce reagent costs. This assay is automated using Beckman Coulter Biomek liquid handling platforms.

Faculty Advisors: *Angelika Niemz and Kathrin Schrik, Keck Graduate Institute of Applied Life Sciences (KGI)*

Mathematics—Beckman B1269:30 A.M. **Mathematical Modeling Competition (MCM)**
Martin Hunt, Kenji Kozai, George Tucker: *The Airplane Seating Problem—Modeling Boarding Procedures*

Every minute airplanes spend between flights costs airlines money. Southwest estimates that if planes spent five minutes more at airports, it would cost \$972 million. One way to decrease turnaround time at airports is to decrease boarding time. Many airlines board passengers in groups based on seat location, letting passengers in the back of the plane board first. Using two separate methods, nonlinear integer programming and a genetic algorithm, we determine alternative strategies and evaluate them using a simulation. Our model shows that a simple back-to-front boarding strategy takes nearly 10 minutes more than random boarding. Our proposed boarding strategy balances efficiency and simplicity.

Mathematics Presentations continued

10:00 A.M. **Reception—Galileo Hall Foyer**

10:30 A.M. **Masanori Koyama: *Fast Fourier Transform for the Symmetric Group***

The double-sided decimation-in-frequency (DSDIF) fast Fourier transform, first suggested by Michael Orrison, is a promising algorithm for applying the discrete Fourier transform for the group algebra of the symmetric group over complex numbers. The asymptotic runtime of the algorithm, however, is unknown. By studying the bimodule structure of the group algebra, I have been attempting to compute the DSDIF's asymptotic runtime. In this talk, I present preliminary results of this research which allow me to compute crude bound on the runtime of DSDIF.

Faculty Advisors: *Michael Orrison Jr., Mathematics, and Nathan Ryan, Mathematics, UCLA*

11:00 A.M. **Eugene Quan: *Effective Cost Allocation for Deterrence of Terrorists***

For the last several decades, numerous terrorists have opted to attack multiple targets at once. Often, their strong determination to attack makes it impossible to completely deter terrorists from attacking altogether, and instead, counterterrorist units must consider how to defend targets effectively to minimize damages. I attempt to model a version of this scenario by presenting a two-target sequential game where two players try to attack and defend the targets respectively. The probability of successfully destroying a target is a function of resource allocations from both players, who are also subject to budget constraints. I attempt to find the defender's strategy that will minimize expected damages by first exploring the attacker's optimal strategy. I show that the attacker's strategy is dependent on the size of the attacker's allowed budget relative to other game parameters, and use that information to evaluate the defender's strategy.

Faculty Advisors: *Susan E. Martonosi and Francis E. Su, Mathematics*

11:30 A.M. **Chee Meng Tan: *Existence of Infinitely Many Radial Solutions to a Sub-super Critical Dirichlet Boundary Value Problem***

I consider a semilinear elliptic PDE that contains a non-linearity that is subcritical when the solution to the PDE is positive, and supercritical when the solution is negative. I have proven that when the domain of the PDE is radially symmetric, an infinite number of solutions exists.

Faculty Advisors: *Alfonso Castro and Jon Jacobsen, Mathematics*

Physics—Galileo Hall-Edwards

9:30 A.M. **Whitney Buchanan: *Effects of Ruthenium and Grain Size on Spin Valves with Ultra-thin Antiferromagnetic Layers***

By varying the grain size and adding a Ru layer between the antiferromagnetic material and the Ta capping layer, the exchange fields (H_{EX}), blocking temperatures (T_B) and GMR ratios of spin valves were manipulated. Two sizes of lateral grain size were examined, 10 nm and 30 nm. A Ru layer separating the AFM and Ta layers was present in one small grain set. The GMR ratio at 5 K was independent of the presence of the Ru layer, but was affected by grain size, with larger grain size having a larger GMR ratio. H_{EX} and T_B data showed a 4 Å magnetically dead layer formed at the interface between the Ta and IrMn. H_{EX} and T_B were independent of grain size.

Faculty Advisors: *James C. Eckert, Patricia D. Sparks and Chih-Yung Chen, Physics*

9:45 A.M. **Nick Alger: *Finite Element Modeling of Icy Crater Relaxation***

The structures of several craters on icy satellites of Jupiter and Saturn are poorly understood. Craters such as Ali Baba on Enceladus and Doh on Callisto contain large central domes that are comparable in height to the crater rim. I use the finite element method to simulate non-Newtonian low temperature ductile creep of icy craters under a range of conditions similar to those found on Enceladus.

Faculty Advisor: *Gregory A. Lyzenga '75, Physics*

Physics Presentations continued

10:00 A.M. **Reception—Galileo Hall Foyer**

10:30 A.M. **Devon Lafferty: *Comparing Models and Data in Time-resolved Second-harmonic Studies of Metal Surface States***

The Second Harmonic Generation (SHG) from 800 nm light incident on a gold surface is modeled. The SHG increases if the electron distribution in the gold is skewed or changed. A program was written that models the SHG as the electron distribution changes from an earlier pulse, taking into account e-e interactions, e-phonon interactions, and reflectivity. These results are then compared to experimental data.

Faculty Advisor: *Thomas D. Donnelly, Physics*

10:45 A.M. **Kevin Mistry: *Studying the Ultrafast Dynamics of Surface States in Metals Using Second Harmonic Generation***

I studied the thermalization and equilibration rates of electrons in metals by the changes in second-harmonic generation that are observed from a gold sample. Using a pump-probe technique, time resolved second-harmonic generation can be acquired with a photomultiplier tube. An ultrafast laser system with a pulse width of approximately 50 fs is used. Experimental results are compared with a computer simulation.

Faculty Advisor: *Thomas D. Donnelly, Physics*

11:00 A.M. **Michael Maindi: *Utilizing Ultrasonic Droplet Generation to Form Chitosan Nanoparticles***

I created chitosan nanoparticles of controllable size using a droplet generation device which employs ultrasonic Atomization. Using this piezo, I can create droplets of known size from fluids. I control both the concentration of chitosan in a solution and the droplet size in order to control the number of chitosan molecules expected within the droplet. By drying the droplet with a dryrite tube, I can form solid chitosan nanoparticles of consistent size. Currently, I am learning to predict and control the end result size of these particles. To test my results, I used a scanning electron microscope.

Faculty Advisor: *Thomas D. Donnelly, Physics*

11:30 A.M. **Emily Hogan: *Immunogold Labeling for the Visualization of Human Corneal Cells in 3-D Culture Using an Optical Coherence Microscope (OCM)***

I am tissue-engineering a corneal construct to serve as replacement tissue for damaged human corneas. Monitoring and ultimately controlling cell phenotype is important for achieving the necessary tissue transparency. I am developing an immunogold labeling process to visualize and determine the phenotype of corneal keratocytes in sterile 3-D culture using the OCM. I have characterized the conjugation of gold nanoparticles to secondary antibodies and report the progress in visualizing corneal keratocytes in monolayer culture using both OCM and confocal microscopy.

Faculty Advisor: *Richard C. Haskell, Physics*

11:45 A.M. **Samuel Skillman: *Correlation Functions in Non-Commutative Gauge Theory During Inflation***

During the first fractions of a second, the universe exponentially expands in a period of rapid inflation. Through this process, quantum fluctuations expand to form large-scale structure. In order to study the behavior of these fluctuations, I computed the correlation function in a non-commutative gauge theory. From this, I am able to determine the power spectrum, which can be used to determine the large-scale structure at late times such as what is observed in the Cosmic Microwave Background (CMB).

Faculty Advisor: *Vatche V. Sahakian, Physics*

Engineering—Galileo Hall-McAlister**10:30 A.M. E 158: Introduction to CMOS VLSI Design**

The CMOS VLSI Design class has designed a 32-bit MIPS microprocessor in collaboration with the University of Adelaide. In this session, students will present their chip and results.

Course Instructor: *David Harris, Engineering*

Microarchitecture Team: Carl Nygaard (team leader), Thomas Barr, Nathaniel Pinckney, Matthew Totino

Systems Team: Howard Chen (co-leader), Matthew McKnett (co-leader), Cassie Chou, Eddy Chavarria, Bart Oegema

Library Team: Justin Gries (team leader), Daniel LaValle, Nathaniel Schlossberg

Chip Team: Ted Jiang (team leader)

Datapath Unit: John Parker (team leader), Andy Chin, Cassie Chou, Jacques Favreau, Dane Lindblad, Michael Saldana, Nathaniel Schlossberg, Buck Schulze, Matthew Weiner

Control Unit: Daniel Pivonka (team leader), Austin Katzin, Matthew Weiner

Memory Unit: Stephen Brawner (team leader), Michael Dayringer, Richard Priddell, Anthony Weerasinghe

Coprocessor Unit: Ted Jiang (team leader), Nikhil Sonde

12:00 NOON**■ Lunch Break****1:15 P.M.–5:00 P.M.****■ Research Presentations**

1:15 P.M. **Chemistry Presentations, please see below**

1:15 P.M. **E 4-Introduction to Engineering Design Presentations, please see page 22**

1:15 P.M. **Mathematics Presentations, please see page 24**

1:15 P.M. **Physics Presentations, please see page 25**

2:45 P.M. **Humanities and Social Sciences Presentations, please see page 26**

Chemistry—Galileo Hall-Pryne

1:15 P.M. **Kathryn Poindexter: *Work Toward a Biomimetic Synthesis of Davanone***

Davanone is the major component of the essential oil of *Artemisia pallens* and possesses both spasmolytic and fungolytic activity. The proposed synthesis should be the shortest to date, as well as being enantioselective. It also offers a route to related natural products. The key steps of the synthesis are an anti-aldol reaction and a biomimetic cyclization to form a trisubstituted tetrahydrofuran ring.

Faculty Advisor: *David A. Vosburg, Chemistry*

Chemistry Presentations continued

1:30 P.M. **John-Andrew Kouzelos: Theoretical and Experimental Investigations of Titanium Amino-Alcohol Complexes**

I aimed to gain an understanding of how titanium amino-alcohol complexes can catalyze reactions with an enantiomeric excess. To meet these ends, I performed synthesis and characterization of the amino alcohol ligands used on these titanium catalysts, and will eventually obtain results from the catalysis reactions. I also performed computational studies using Density Functional Theory to gain an understanding of how these catalysts work by comparing the stability of possible mechanistic conformations for these titanium amino-alcohol complexes. Results of these investigations will be discussed herein.

Faculty Advisors: *Robert J. Cave and Adam R. Johnson, Chemistry*

1:45 P.M. **Kyle Zarzana: Solid-phase Synthesis of Porphyrin Oligomers**

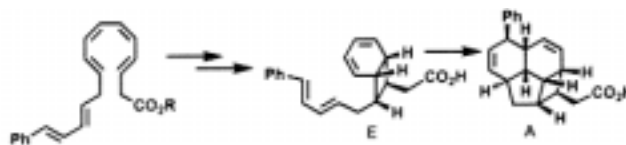
Metalloporphyrins are a class of molecules with a large number of applications. Individual porphyrin molecules can be used for chemical sensors, while porphyrin oligomers can be used to construct molecular wires. The length and composition of the oligomer have a large effect on the properties of the molecule, and so must be carefully controlled. The present work concerns the development of a synthetic method of producing porphyrin oligomers whereby the length and composition of the porphyrin chain can be precisely controlled.

Faculty Advisor: *Hal Van Ryswyk, Chemistry*

2:00 P.M. **James McDonough: Determination of Biologically Relevant Binary Lyotropic Liquid Crystalline Phase Diagrams Formed by Alkyl-glucosides in Water**

Alkyl-glucosides are environmentally and toxically safe surfactants with applications in drug delivery, oil recovery, and cosmetic preparations. Alkyl-glucosides in water form self-assembled, liquid crystalline nanostructures that depend on the water/glucoside ratio and temperature. For practical use of these liquid crystals, a detailed understanding of the binary phase diagram is crucial. Such diagrams have been studied by many techniques from X-ray to DSC, but the use of the fluorescence of the dye molecule prodan to probe the structures formed in these mixtures is new. Prodan's fluorescent signal depends on its environment. Visual inspection of the total fluorescence signal can qualitatively determine the structures present. Temperature-induced structural changes are detected by changes in the prodan signals. This new technique is very sensitive, allowing single and coexisting phase regions to be mapped carefully for the first time. The phase diagram of the lyotropic crystals formed by n-nonyl- β -D-glucoside/water mixtures will be discussed.

Faculty Advisors: *Kerry K. Karukstis and Gerald R. Van Hecke '61, Chemistry*

2:15 P.M. **Frances Hocutt: Toward a Biomimetic Synthesis of the Endiandric Acids**

The endiandric acids (e.g., E and A shown above) are a class of interrelated polycyclic carboxylic acids which are generally found in racemic mixtures in nature, although they may contain up to eight stereocenters. Their structures and the nature of their biosynthesis make them attractive targets for a biomimetic synthesis, in which acyclic polyenes are synthesized and undergo cyclization cascades to form complex fused architectures. Presented here is progress towards a shorter, more selective synthesis of the polyene precursors, including synthesis of organoboron and organozirconium intermediates.

Faculty Advisor: *David A. Vosburg, Chemistry*

Chemistry Presentations continued

2:30 P.M. **Amanda Hickman:** *Chiral Titanium Amino-Alcohol Catalysts for the Intramolecular Hydroamination of Aminoallenes*

Chiral titanium catalysts for the hydroamination reactions of di- and tri-substituted aminoallenes have been prepared from derivatives of amino acids. Methods for synthesis, purification and characterization of the ligands as well as the aminoallene substrate were optimized. Based on preliminary results for regio- and stereoselectivity of the catalysts using a benzaldehyde alkylation screening reaction, a third-generation tri-dentate ligand was designed to optimize enantiomeric excess.

Faculty Advisor: *Adam R. Johnson, Chemistry*

3:15 P.M. **Bio 198: Directed Reading on HIV/Aids**
Janina Moretti: *HIV Fusion Inhibitors*

In 2006, 2.9 million people died of AIDS and 39.5 million people were living with HIV. The development of highly active antiretroviral therapy has prolonged the life of patients in the developed world, but treatment regimens are expensive and resistance to currently available therapies is a growing problem. This lecture will discuss a new class of antiviral drugs that inhibit viral fusion to host cells.

Course Instructor: *Karl A. Haushalter, Chemistry and Biology*

Engineering 4—Galileo Hall-Edwards**Engineering 4: Introduction to Engineering Design**

1:15 P.M. **Delivering Power Packets to Rural Villages**

Galileo- **Client:** Pomona Valley Center for Community Development

Edwards **Liaison:** Tomas Ursua

Advisors: *Clive Dym, Eric Huang, Elizabeth Orwin '95, Bob Schaffer, Qimin Yang*

The Pomona Valley Center for Community Development (PVCCD) has provided basic social services to low income families in our area for 15 years. The PVCCD wants to explore a concept whereby one could deliver a sustainable cost-effective “power packet” to interested rural villages which could contribute to improving lives. This “pack” could be distributed to poor villages that are too distant to connect to a power grid, and obviously lack the amenities that urban people take for granted. This power packet would be used to provide a number of key services to a typical village of 100–200 persons, such as: running a portable water purification plant; providing power to a community learning center/school that uses cheap laptops, and other key “basic needs” services.

1:15 P.M. **Team A:** Ben Goldenberg, Michael Ho, Alex Krause, Brett Cooper

1:30 P.M. **Team B:** William Cho, Nik Floyd, Cidney Scanlon, Jessica Witt

1:45 P.M. **Team C:** Steven Dell, Trevor Ashley, Florian Scheulen, Brian Bosak

2:00 P.M. **Team D:** Wesley Ducey, Mobashwir Khan, Andrew Pozo, Clark Zhang

2:45 P.M. **Reception—Galileo Hall Foyer**

Engineering 4 Presentations continued

2:15 P.M. **Arm Restraint Device for Children with Cerebral Palsy**Galileo- **Client:** Danbury SchoolEdwards **Liaison:** Stephen Hamilton, Principal**Advisors:** Clive Dym, Eric Huang, Elizabeth Orwin, Bob Schaffer, Qimin Yang

The Danbury Elementary School of the Claremont Unified School District has a number of students with the diagnosis of cerebral palsy (CP), a neurodevelopmental impairment which causes disturbances of voluntary motor function. For these students, activities that require fine muscle movements (e.g. writing) are particularly difficult because of impaired motor control and coordination as a result of CP. There is ample evidence indicating that these students write more effectively when an instructor physically stabilizes either the hand or the elbow to reduce extraneous movement. A device that can achieve the same physical effect by counteracting the involuntary movement would be desirable since this would increase the students' functional independence.

2:15 P.M. **Team A:** Robert Best, Masanori Honda, Jaakko Karras, Alexander Kurtis2:30 P.M. **Team B:** Raffi Attarian, Nicholas Hasegawa, Austin Lee, Jennifer Osgood2:45 P.M. **Reception—Galileo Hall Foyer**3:15 P.M. **Team C:** Christina Kneen, Benyue Liu, Hufsa Ahmad, Megan Pham3:30 P.M. **Team D:** Corinne Cho, Jessica Wen, Karla Whitfield, Lou Zellinger3:45 P.M. **Cutting Gel-Coated Glass and Plastic**Galileo- **Client:** Professor David VosburgEdwards **Liaison:** Professor David Vosburg**Faculty Advisors:** *Clive Dym, Elizabeth Orwin '95, Bob Schaffer*

Chemists often use a technique called thin-layer chromatography (TLC) to separate and analyze compounds rapidly. Typically a thin layer of fine silica (SiO₂) is coated onto glass or plastic plates. It is economical to purchase these plates in a somewhat larger size than is actually used, so it then becomes necessary to have a reliable and efficient means to cut the plates into the desired sizes, which may vary. It is important that the cuts be clean and straight, not leaving jagged edges or odd angles. Large, commercial plates are typically 20 cm x 20 cm (plastic- or glass-backed) or 5 cm by 20 cm (glass-backed). Smaller, cut plates are generally rectangular and might be 5–10 cm long and 1–5 cm wide. Please design convenient and reliable solutions to this problem that do not rely heavily on the manual dexterity of the student operating the devices.

3:45 P.M. **Team A:** Arolyn Conwill (PO), Benjamin Margolis, Tarun Narayan, Michael Starr4:00 P.M. **Team B:** Daniel Bujalski, Carolina de Freitas, Joshua Ray, Alexander Young4:15 P.M. **Team C:** Robert Warren, Sarah Nitzan, Mike McNeece, Tara Maylyn Frankel

Engineering 4—Galileo Hall-McAlister**Engineering 4: Introduction to Engineering Design**

1:15 P.M. **Portable Door Prop for Theater Productions**

Galileo- **Client:** Etc. Players

McAlister **Liaison:** Victor Wang

Advisors: *Clive Dym, Eric Huang, Elizabeth Orwin '95, Bob Schaffer, Qimin Yang*

As a theatre company without a theatre, the Etc. Players often find themselves in need of portable sets and props. For example, it is challenging to build doors portably. Plays often call for doors that can be opened, shut, slammed, and that can sometimes even bear the impact of thrown shoes or a pounding fist. Furthermore, the group does not have much storage space, so any props would need to be stored in as small a space as possible.

1:15 P.M. **Team A:** Donald Bolton, Jonathan Hubbard, Raquel Robinson, Kevin Ryan

1:30 P.M. **Team B:** Alex Grammar, Angus Ho, Thomas Oh, William Terry

1:45 P.M. **Team C:** Jeffrey Anderson, Jin-Soo Jo, Kevin King, Daniel Pak

2:00 P.M. **Team D:** Stephanie Brockman, Jackie Lam, Kevin Lee, Jake Rowley

2:15 P.M. **Team E:** Alex Randall, Ian Bullock, Ben Smith, Michelle Fong

2:30 P.M. **Team F:** Marc Davidson, Chelsea Drenick, Nathan Jones, Alyssa Pierson, Sherwin Shiao

2:45 P.M. **Reception—Galileo Hall Foyer**

3:15 P.M. **Courtyard Screen System for Outdoor Playhouse**

Galileo- **Client:** HMC Literature 101

McAlister **Liaison:** Professor Jeff Groves

Faculty Advisors: *Clive Dym, Eric Huang, Elizabeth Orwin '95, Bob Schaffer, Qimin Yang*

Almost every spring semester, students from HMC Literature 110 produce a Shakespeare play and present it publicly in Thomas-Garrett Hall Courtyard. When the south side of the courtyard is closed off, the interior becomes a good approximation of a late-16th-century outdoor playhouse of just the sort Shakespeare's company used. Currently, the class uses a series of plywood flats (the result of an earlier E 4 design project) to close off the courtyard. These flats have several real benefits: they screen the courtyard visually from the surrounding campus; they help the acoustics in the courtyard slightly by reflecting actors' voices; they are rugged, durable, and can be assembled in about two hours. But they also have some serious liabilities: they are heavy, and it takes a substantial crew to put them up and take them down; they are bulky and difficult to store; they allow only several permutations of stage design; they do not reach to the ceiling of the covered walkway, and the flats are now rather old and "distressed."

3:15 P.M. **Team A:** Bryan Downs, Matthew Kurtis, Maryellen Moore-Simmons, Daniel Patterson

3:30 P.M. **Team B:** Chen Lim, Taiki Sakai, Jonathan Simkin, Jason Wang

3:45 P.M. **Team C:** Simon Yang, Ben Keller, Ross Merriam, Andrew Armas

4:00 P.M. **Team D:** Alan Gilder, Yoshi Hasegawa, Michael Lee, Bryan Teague

Mathematics—Beckman B126

1:15 P.M. **Ivan Ventura: *Radial Solutions to an Elliptic Boundary Valued Problem***

In this paper, I will attempt to characterize the solutions to superlinear elliptic equations involving a subcritical Sobolev-Hardy exponent. I will use a variety of methods found throughout the literature to try and prove that there are an infinite number of sign changing solutions for these equations.

Faculty Advisors: *Alfonso Castro and Jon Jacobsen, Mathematics*

Mathematics Presentations continued

1:45 P.M. **Daniel Walton: *A Tiling Approach to Chebyshev Polynomials***

I am presenting a combinatorial interpretation of Chebyshev polynomials. The n -th Chebyshev polynomial of the first kind, $T_n(x)$, counts the sum of all weights of n -tilings using light and dark squares of weight x and dominoes of weight -1 , and the first tile, if a square must be light. If we relax the condition that the first square must be light, the sum of all weights is the n -th Chebyshev polynomial of the second kind, $U_n(x)$. In this paper, many of the beautiful Chebyshev identities using the tiling interpretation are proven.

Faculty Advisors: *Arthur T. Benjamin and Sanjai Gupta, Mathematics*

2:15 P.M. **Nick Herman: *Investigating the Use of Brainfingers in Children with Cerebral Palsy for Spatial-motor Education***

Brainfingers is a device that allows a user to control a computer by reading surface electrical signals generated from muscle, eye movement and brainwave activity detected at the user's forehead. This device has been shown to be effective in allowing people with severe and multiple disabilities to control a computer. The goal of this current research project is to study how using Brainfingers with mathematical software can improve the spatial and motor abilities of elementary school students with cerebral palsy. The study involves students at Danbury Special Education School, an elementary school located in Claremont.

Faculty Advisors: *Maria Klawe, Computer Science, Debra Mashek, Humanities and Social Sciences, and Darryl H. Yong '96, Mathematics*

2:45 P.M. **Reception—Galileo Foyer**

3:15 P.M. **Hendrik Orem, Brian Rice: *Subspace Intersection Graphs***

A (d,e) -subspace intersection graph is a graph whose vertices can be identified with e -dimensional affine subspaces of d -dimensional euclidean space such that two vertices are adjacent if and only if the corresponding subspaces intersect. We describe our work this semester on the classification of $(3,1)$ -subspace intersection graphs, and on certain generalizations of subspace intersection graphs.

Faculty Advisor: *Michael Orrison Jr., Mathematics*

Physics—Jacobs B134

Physics 170: Computational Physics

Course Instructor: *Vatche V. Sahakian, Physics*

1:15 P.M. **Michael Maindi, Ethan Rubin, David Mar: *Simulating Percolation Theory with Computers***

We have developed a method of building up 2-D graphs from random cluster connections using Mathematica. The result of this might look something like a maze structure, consisting of open spaces and walls (an example of "bond percolation"). Using path-finding algorithms we were able to determine if open paths exist between any two locations in the graph. By varying attributes of a given graph, such as the probability of edges being turned "off" or "on" and the size extent of the graph we tested and verified some of the conclusions of percolation theory. As an example, we were able to determine the probability of an open path as a function of the path length and compare this to unproved suppositions about percolation theory. We constructed many graphs and used a statistical approach to measure characteristics such as cluster sizes and open path lengths.

1:45 P.M. **Whitney Buchanan, Samuel Skillman, Matthew Williams: *Modeling Fluid Flow using COMSOL***

In this work, we investigate the fluid flow around several different objects including cylinders and airplane wings in both the laminar and turbulent regimes. To do this, we use COMSOL Multiphysics, a commercial, grid-based, PDE solver. From the analysis, we are able to determine the time-dependent flows and resulting forces on the objects.

Physics Presentations continued

2:15 P.M. **Sean Meenehan, Jun Park, Kevin Zielnicki: *Exploration of Shallow Water Equation Model for Wave Propagation***

The shallow water equations are used to model a fluid where the horizontal scale is much greater than the depth, such as the Earth's oceans. Applications include tsunami propagation and Rossby waves in the oceans and atmosphere. We used COMSOL to solve finite element models of the shallow water equations in basins of various shapes and with various initial conditions.

2:45 P.M. **Reception—Galileo Foyer**

3:15 P.M. **Hovannes Dermenchyan, Will Tipton, Rueben Villagomez: *Forecasting Options Markets Using Mathematica***

We modeled the behavior of an options market using Black-Scholes. Through computational analysis, we created high predictive power to analyze trends in options pricing, and determined the correct option price to invest.

3:45 P.M. **Chris Byron, Tony Hutain, Michael Tauraso: *Computer Modeling of Rail-Gun Design***

There are many technical challenges in creating a technically feasible Rail-Gun. We use COMSOL, a physics simulation software package, to model various designs. We attempt to maximize energy efficiency and projectile speed by harnessing the basic forces of electromagnetism.

Humanities and Social Sciences—Joseph B. Platt Campus Center-Riggs Plaza

7:00 P.M. – **Music 48: *Electronic Music Ensemble***

7:45 P.M. **Musicians: Bill Alves, Steven Berler, Brian Dolphin (PZ), Nicholas Herman, Martin Hunt, Stephen Jones, Michael Lee, Michael Orrison, Ansel Schmidt (PZ), Jakob Spjut**

This is the inaugural concert for the Harvey Mudd College Electronic Music Ensemble, a group whose musical explorations are united by the use of amplification, audio processing and sound synthesis. We will perform a variety of works, including pieces by John Cage, David Borden, HMC faculty members Bill Alves and Michael Orrison, and student members of the ensemble.

Course Instructor: *William Alves, Humanities and Social Sciences*

8:00 P.M. **Dessert Reception—Joseph B. Platt Campus Center-Riggs Plaza**

7:45 P.M. – **Stephen Jones: *Two Dollar Suite***

8:15 P.M. **Musicians: Justin Kim (violin), Tim Sweda (violin), Matthew Jensen (viola), Peter Scherpelz (cello)**

Each movement of Two Dollar Suite is the musical equivalent of a small quantity of money, excepting the third movement, which is free. The first movement is the money in the hat of a street musician, the second, the price of two very inexpensive violins, and the final movement is a tango worth only the few coins left in your pocket. (Though the four movements add up to slightly less two U.S. dollars, the composer has chosen to round up for the sake of scansion.)

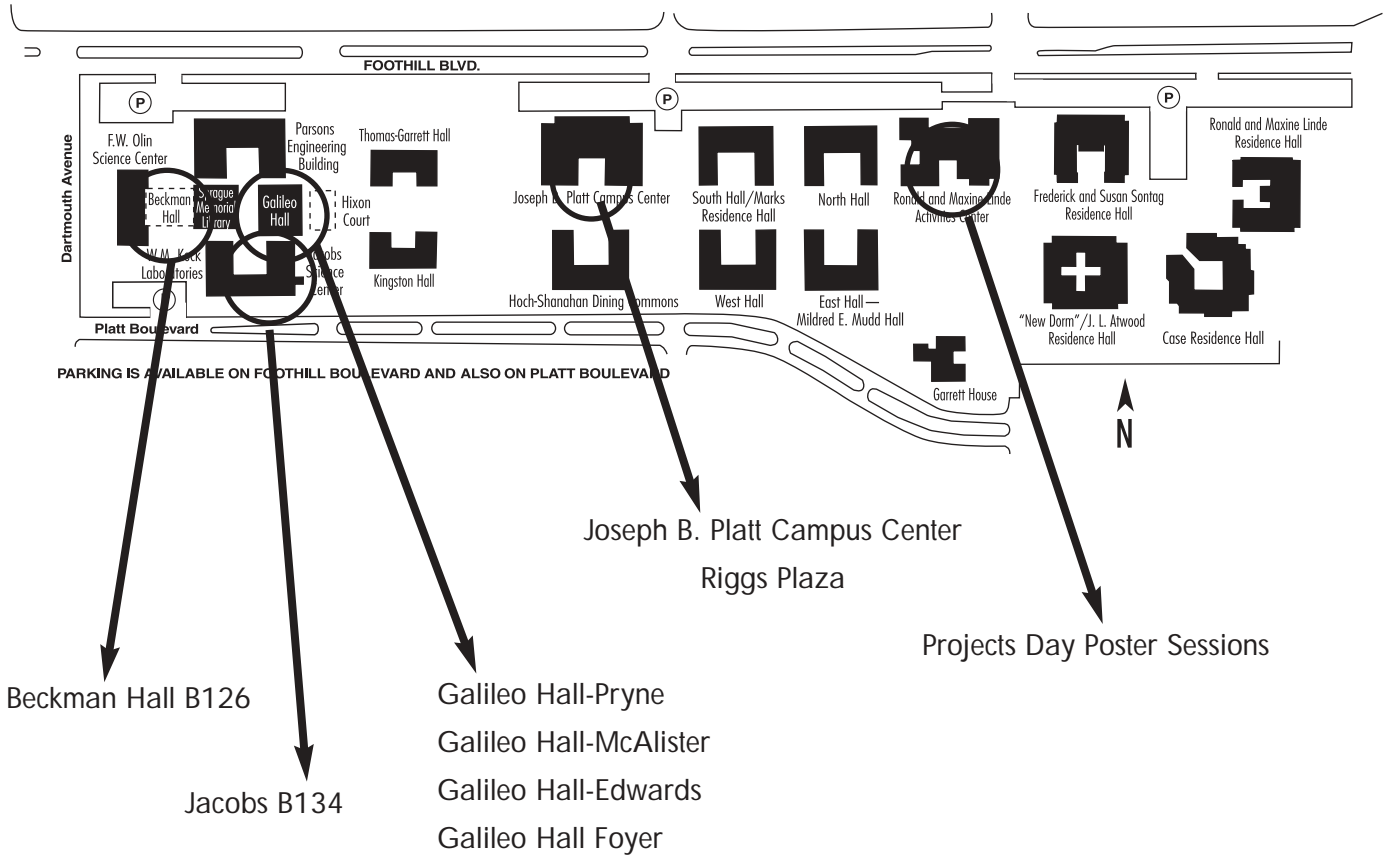
Faculty Advisor: *William Alves, Humanities and Social Sciences*

8:15 P.M. – **Music 84: *Jazz Improvisation—Music of Thelonious Monk***

9:30 P.M. **Musicians: Robert Best, Hillel Bocian (CMC), Bob Chen, Adam Curry (PO), Jerrah Holth, Steven Huntzicker, Robert Keller, Justin Kim, Stephen Lee, Alex Lynch, Max Myers, Stephen Rosenthal, Raphael Silva (PO), Joe Simons, Andrew Wong**

Students will improvise in small groups, on tunes of renowned jazz pianist Thelonious Monk.

Course Instructor: *Robert M. Keller, Computer Science*



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