

Presentation Days 2002

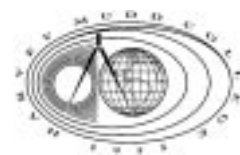


A Celebration of Student Projects

May 6, 7 & 8



Harvey Mudd College
Claremont, California



Harvey Mudd College
301 East 12th Street
Claremont, CA 91711-5990

Presentation Days 2002 A Celebration of Student Projects

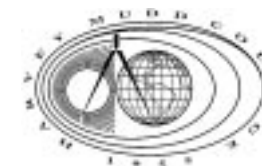
Research is an integral part of the education of all students at Harvey Mudd College. Research projects, as well as physical or virtual products, must be designed. The ability to conduct original investigations, to plan an approach to a problem, and to see it through are essential to success in any scholarly endeavor. We set time aside during the spring semester to celebrate the work of our students as they present their original projects in design or research. 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 more than 228 students are participating in Presentation Days. There are over 100 research talks from students in each of the majors. Students in the Department of Humanities and Social Sciences are examining print and American culture, presenting the results of their research on the role of basketry in indigenous culture, exploring the connections between music and abstract arts of color and space, and displaying their black and white photographs. The results of the Introduction to Engineering Design projects, involving 17 teams of freshman and sophomore students will be presented.

The keynote speaker for Presentation Days 2002 is Stanley Love '87, NASA Astronaut. Dr. Love will speak on "Little-known Benefits of Student Research," Monday, May 6, at 4:00 P.M. in Galileo Hall.

For more information, please contact the Office of the Dean of Faculty, Harvey Mudd College, (909) 621-8122.

The Presentation Days Committee consists of William Alves, Sally Rich Arroyo, Chih-Yung Chen, Eric Ditwiler, Weiqing Gu, Adam Johnson, Geoff Kuenning, Roberto Porras, Ruye Wang, and is chaired by Catherine McFadden.



Presentation Days 2002 Schedule

Monday, May 6

■ 9:00 A.M. Research Presentations Begin

	Biology <i>Galileo-Pryne</i>	Engineering <i>Galileo-McAlister</i>	Humanities and Social Sciences	Mathematics <i>Beckman Hall B126</i>	Physics <i>Galileo-Edwards</i>
9:00 A.M.			<i>Galileo Foyer All day</i>	M. Smukler	
9:15 A.M.	B. Akitake		Art 50/150/198:		
9:30 A.M.	C. Hoshibata		Photography Exhibition	C. Pries	S. Olmstead
9:45 A.M.	A. Walker				N. Breznay
10:00 A.M.	Mathematics and Biology Departments Reception—Galileo Foyer				
10:15 A.M.					
10:30 A.M.	M. Denby	Engineering 198:	<i>Sprague Library</i> On-Going	M. Gratton	D. Osborn
10:45 A.M.	T. Perfors	Advanced	American Studies 115: Print and		A. Brown
11:00 A.M.	K. Marlink	Problems	American Culture—Exhibition	A. Short	M. Blood
11:15 A.M.	N. Levin	in			
11:30 A.M.	J. Pennington	Engineering	<i>Galileo-Edwards</i> 11:30 A.M.	M. Dean	
11:45 A.M.			Anthropology 198: Directed		
12:00 P.M.	Lunch Break		Reading in Indigenous Basketry		

■ 1:15 P.M. Research Presentations Begin

	Chemistry <i>Galileo-Pryne</i>	Computer Science <i>Galileo-McAlister</i>	Engineering <i>Galileo-Edwards</i>	Mathematics <i>Beckman Hall B126</i>	Physics <i>Galileo-Edwards</i>
1:15 P.M.	C. Ho	S. DiVerdi, J. Wither	E. Henage	W. Turner	
1:30 P.M.	L. Perelman	M. Allen and	A. Malone		
1:45 P.M.	C. Jacquot	E. Miller	J. Schauer	L. Mercurio	
2:00 P.M.	O. Uche	L. Stoilova			
2:15 P.M.		J. Wither, S. DiVerdi		C. McLeman	E. Brown
2:30 P.M.	A. Mandel	A. McDonnell			S. Patel
2:45 P.M.	M. Nelson	T. Johnson		D. Boylan	N. Cappallo
3:00 P.M.	C. Yoo	E. Heitzman			M. Schubmehl
3:15 P.M.	C. Devereaux	R. Shea			
3:30 P.M.	Presentation Days Reception—Galileo Foyer				
3:45 P.M.					
4:00 P.M.	Presentation Days Address—Galileo-McAlister “Little-known Benefits of Student Research” Dr. Stanley G. Love '87, NASA Astronaut, NASA-Johnson Space Center				

Tuesday, May 7 Projects day 10:30 A.M.–5:30 P.M. Please See Projects Day Program for further details.

Wednesday, May 8

■ 9:00 A.M. Research Presentations Begin

	Chemistry <i>Galileo Foyer</i>	Chemistry <i>Galileo-Pryne</i>	Engineering <i>Galileo-McAlister</i>	Mathematics <i>Beckman Hall B126</i>	Physics <i>Galileo-Edwards</i>
9:00 A.M.	All Morning	T. Hanna	J. Chu, H. Tang	J. Greene	C. Vinson
9:15 A.M.	Chemistry	M. Ragudo	C. Newkirk		C. Wieland
9:30 A.M.	Poster	C. Hsia	G. Breed, M. Erler	T. Prescott	Z. Walters
9:45 A.M.	Session	A. Grossman	E. Reynolds, A. Stratton		J. Perry
10:00 A.M.	Chemistry and Physics Departments Reception—Galileo Foyer				
10:15 A.M.					
10:30 A.M.		E. Toberer	J. Pava, M. Phair	E. Norton	D. Cooke
10:45 A.M.		M. Mason	J. Imada, F. Lee		B. Kappus
11:00 A.M.		S. Daniels	N. Okumura, K. Ota	B. Forrest	
11:15 A.M.		E. Moore	R. Montgomery, M. Unemori		
11:30 A.M.	Lunch Break				

Presentation Days 2002 Schedule

Wednesday, May 8 continued

■ 1:15 P.M. Research Presentations Begin

	Biology <i>Beckman B126</i>	Computer Science <i>Galileo Foyer</i>	Computer Science <i>Galileo-McAlister</i>	Engineering <i>Galileo Hall</i>	Mathematics <i>Beckman Hall B126</i>
1:15 P.M.	M. Mattozzi	All Afternoon		E4 Design	
1:30 P.M.	J. Pava	Poster Session		Presentations	
1:45 P.M.	A. Kapasi	CS 155/181		<i>Galileo-Edwards</i>	
2:00 P.M.	N. Johnson	Computer Graphics		<i>Galileo-Pryne</i>	
2:15 P.M.	K. Drew	and Animation		See Below	
2:30 P.M.	E. Wolff				
2:45 P.M.	Engineering and Computer Science Departments Reception—Galileo Foyer				
3:00 P.M.					
3:15 P.M.		T. Winters, C. Lundberg		E4 Design	MCM and ICM:
3:30 P.M.		and R. Shea		Presentations	M. Schubmehl,
3:45 P.M.		CS 155/181 Computer		<i>Galileo-Edwards</i>	W. Turner, D. Boylan
4:00 P.M.		Graphics and Animation		<i>Galileo-Pryne</i>	
4:15 P.M.				See Below	
7:00 P.M.	Galileo-McAlister				
	Dr. Stanley G. Love '87, NASA Astronaut, NASA-Johnson Space Center “Return to the Moon—Stepping Stone to the Planets” Dr. Bruce J. Nelson '74 Distinguished Speaker Series Spring 2002 “Frontiers in the Exploration of Space”				
8:00 P.M.	Humanities and Social Science Department Reception—Hixon Court				
8:30 P.M.	Music 127s: Screening of Final Projects—The Harmony of Sound and Light				

■ 1:15 P.M. Engineering 4: Introduction to Engineering Design—Galileo Hall

1:15 P.M.	Redesign of a System for Adjusting Pole Vault Heights
Galileo-Edwards	Team 1: J. Gabster, M. Knapp, J. Onuminya, S. Svetlick Team 2: K. Ihara, S. Petesch, A. Utter, J. Webb Team 3: E. Hall, C. Marsh, J. McClure, M. Sarvestani Team 4: J. Chow, K. Chu, B. Greer, N. Von Gersdorff

1:15 P.M.	Design of a Device to Help Wheelchair Users Carry Items while Shopping
Galileo-Pryne	Team 1: J. Brenion, A. Caridis, G. Kwofie, D. Lee Team 2: M. Falcetti, S. Huynh, J. Petrie, H. Vega Team 3: B. Boatman, B. Chu, C. Walls, E. Whitlock

2:00 P.M.	Design of a Greenhouse for Education and Heating
Galileo-Pryne	Team 1: G. Chui, St. Friedman, V. Krafft, J. Lee Team 2: S. Desai, A. Kim, J. Kunkle, J. Shepherd

2:15 P.M.	Design and Implementation of a Drainage System for an Animal Shelter
Galileo-Edwards	Team 1: R. Gullet, J. Nguyen, R. Patterson

2:45 P.M. Engineering and Computer Science Departments Reception

3:15 P.M.	Design of a Light System for Doctors
Galileo-Edwards	Team 1: D. Gruver, K. Kelley, J. Kim, M. Locascio Team 2: T. Leung, J. Tan, E. Wright, M. Yi Team 3: A. Cole, D. Pederson, P. Seaton, J. Spjut Team 4: K. Alley, A. Burd, J. Pinheiro, G. Yoshinaga

3:15 P.M.	Design of a Film Screening Room
Galileo-Pryne	Team 1: J. Ahmad, H. Chen, D. Woo, J. Lin Team 2: S. Jeun, J. Lee, K. Lee, M. Neher Team 3: L. Allen, K. Knepper, D. Roche, E. Temkin

Monday, May 6 2002

9:00 A.M.–12:00 P.M.

■ **Research Presentations**

9:00 A.M. **Humanities and Social Sciences Presentations please see page 5**

9:00 A.M. **Mathematics Presentations please see page 6**

Biology—Galileo-Pryne

9:15 A.M. **Bradley Akitake: *Characterization and Analysis of Conserved Intron Sequences in Model Organisms***

Introns are stretches of non-coding DNA, traditionally considered “junk DNA,” which interrupt the coding sequence in eukaryotic genomes. Introns harbor transcription factors, repeated sequences, even complete genes, and have recently been suggested to serve a regulatory function. My research focuses on identifying introns with a high level of sequence conservation through intra- and inter-species BLAST searches. Analysis of the 6,152 introns in *Mus musculus* show a large number of highly conserved subsequences within the mouse genome as well as high levels of similarity between the introns of the mouse and those of other mammalian species. My current work expands this analysis to the nearly 400,000 remaining introns in the intron database.

Faculty Advisor: *Nicholas Schisler (Pomona College, Biology)*

9:30 A.M. **Courtney M. Hoshibata: *CAN Cell Migration and Axon Termination in the mig-10(ky178) Mutant of C. elegans***

We are investigating possible guidance cues of the Canal Associated Neurons (CANs) in *C. elegans* through characterization of cell migration and axon termination in organisms lacking functional *mig-10*. Using a green fluorescent protein (GFP) reporter transgene, the positions of the CAN cell body and axon termini were observed in wild-type and *mig-10(ky178)* mutant worms. Results should provide further insight into the general mechanisms utilized by migratory cells to achieve their proper positions.

Faculty Advisor: *James R. Manser, Biology*

9:45 A.M. **Andrew M. Walker: *Characterization of the Effects of Two mig-10 Mutations on the Development of Neuronal Processes in the Nematode Caenorhabditis elegans***

Loss-of-function mutations in the *C. elegans mig-10* gene have been shown to significantly affect long-range cell migration during embryonic development, specifically in the canal-associated neurons (CAN cells). In many cases, the neuronal processes that extend from these neurons in the posterior direction after migration were also shortened. I used two different *mig-10* mutant strains and crossed them with three strains of *C. elegans* expressing green fluorescence protein reporter genes and then examined the effect of these mutations on the development of the overall nervous system, as well as the anterior and posterior process formation from two non-migratory cells.

Faculty Advisor: *James R. Manser, Biology*

10:00 A.M. **Mathematics and Biology Departments Reception—Galileo Foyer**

10:30 A.M. **Melissa Denby (CMC): *Nitrate Leaching into Groundwater from Fertilization of Turfgrass on the Harvey Mudd Campus***

Nitrogen is a vital nutrient for healthy plant growth, but nitrogen fertilizer not used by plants can leach into groundwater and pollute public drinking water supplies, causing health problems. A prior study showed that fertilization of the campus lawn at Harvey Mudd College contaminated groundwater with nitrate. In this experiment I tested a new fertilizer regime to determine whether I could reduce or eliminate nitrate leaching while obtaining an aesthetically acceptable appearance. The groundwater of Liquidambar Mall, a plot of Kikuyu grass, was sampled and tested for excess nitrate after the application of an organic fertilizing regime based on a soil analysis of the site.

Faculty Advisor: *Nancy V. Hamlett, Biology*

Biology Presentations Continued

10:45 A.M. **Tracy Perfors: *Edge Effects at Bernard Field Station***

To determine how well conservation areas preserve natural habitats, biologists may look at edge effects, or changes in the habitat as one approaches the habitat edge. In an effort to quantify how the development around the 5C's Bernard Field Station (BFS) affects the coastal sage scrub habitat inside the southwest corner, I tested the strength and distance of three types of edge effects. Specifically, I measured plant species diversity, soil nitrates and the number of exotic plants in 44 plots at different distances from the BFS fenceline. Knowing the strength of these edge effects will help in planning the future of development in the Bernard Field Station.

Faculty Advisor: *Catherine S. McFadden, Biology*

11:00 A.M. **Katherine Marlink: *Characterizing the Metabolic Processes of the Microbial Community in pHake Lake***

The physical, chemical, and biological profile of a lake can be useful in determining ecological structure. Though lakes are generally thought to be homogeneous masses of water, they are extremely heterogeneous physically, chemically, and biologically. By evaluating a few of its chemical and physical properties the entire structure of a lake can be ascertained. In pHake Lake the levels of dissolved O₂ concentration, pH, temperature, NO₂⁻, NO₃⁻, S₂⁻, chlorophyll *a*, and bacteriochlorophyll will be measured as a means to establish the physical and metabolic processes at work within the lake throughout the year.

Faculty Advisor: *Nancy V. Hamlett, Biology*

11:15 A.M. **Noah Levin: *Investigating the Malarial Parasite, Plasmodium mexicanum, in the Western Fence Lizard, Sceloporus occidentalis, at the Bernard Field Station***

The malarial parasite, *Plasmodium mexicanum*, causes a rather benign infection in the western fence lizard, *Sceloporus occidentalis*. In my study, I quantified the presence of malaria in fence lizards at the Bernard Field Station. I then examined whether the prevalence of malaria varied with physical and ecological factors, including sex, size, habitat type, and vector population.

Faculty Advisor: *Stephen C. Adolph, Biology*

11:30 A.M. **J. Daniel Pennington: *Imaging Early Development in the Frog with Optical Coherence Microscopy***

Optical Coherence Microscopy (OCM) is capable of imaging non-invasively the early development of individual organisms. We have followed the dynamic process of gastrulation in the frog (*Xenopus laevis*). We will present time-lapse movies taken at both 850 and 1300 nm and discuss their implications for current models of gastrulation.

Faculty Advisors: *Richard C. Haskell, Physics and Mary E. Williams, Biology*

Humanities and Social Sciences—Galileo Foyer

All Day **Art 50: *Beginning Black and White Photography—Exhibition of Best Work***
Michael M. Ragudo, Angela M. Hsueh, Katrina J. Ray, Charles M. Hastings, Erika M. Wolff, Erin E. Moore

Each student will exhibit 6–8 of his/her best photographic images from the semester. Images will be displayed aesthetically. Each student will provide a brief discussion of artistic objectives, including some discussion of the images themselves.

Course Instructor: *Tad A. Beckman, Humanities and Social Sciences*

All Day **Art 150: *Intermediate Black and White Photography—Exhibition of Photo Projects***
Matthew D. Mason, Paul M. Paradise, Gautam S. Thatte, Jeffrey L. Werbin, Heather M. Bryan, Melissa M. Federowicz

Each student will exhibit 6–8 photographic images from his/her semester project. Images will be displayed aesthetically. Each student will provide a brief discussion of artistic objectives, including some discussion of the project objectives and images themselves.

Course Instructors: *Tad A. Beckman, Humanities and Social Sciences and Jan Volz (Claremont Graduate University, Arts)*

Humanities and Social Sciences Presentations Continued

All Day **Art 198: Independent Study in Digital Photography—Exhibition of Best Work**
Charles M. Hastings, Ralph I. McNall, Jonathan R. Morley, Olisambu U. Uche, Stephen A. Friedman, Brandt D. Erickson

Each student will exhibit 6–8 photographic images from his/her best works of the semester. Images will be displayed aesthetically. Each student will provide a brief discussion of artistic objectives, including some discussion of the digital techniques used and the images themselves.

Course Instructor: *Tad A. Beckman, Humanities and Social Sciences*

Humanities and Social Sciences—Sprague Library Circulation Area

On-Going **American Studies 115: Print and American Culture—Exhibition**
Adam Bush, David Gleich, Jessica Hoover, Aaron Stratton, Curtis Vinson, Zachary Walters, Titus Winters

Students in **American Studies 115: Print and American Culture** spent part of the semester researching American print artifacts from Special Collections of the Libraries of The Claremont Colleges. The fruits of their research are on display in the Sprague Library circulation area.

Course Instructor: *Jeffrey D. Groves, Humanities and Social Sciences*

10:00 A.M. **Mathematics and Biology Departments Reception—Galileo-Edwards**

Humanities and Social Sciences—Galileo-Edwards

11:30 A.M. **Anthropology 198: Directed Reading in Indigenous Basketry—Presentation of Web Site on Basketry**
Allison Burce and Sarah J. Stetina

Students will present the results of their research on indigenous basketry manufacture, materials, styles, uses, and cultural factors. This work is presented through a Web Site they have constructed.

Course Instructor: *Tad A. Beckman, Humanities and Social Sciences*

Mathematics—Beckman B126

9:00 A.M. **Micah J. Smukler: Symmetrizing Multiaffine Polynomials**

Given a multiaffine polynomial (that is, a multivariate polynomial which is of degree 1 in each of its variables), it is often useful to find a related multiaffine polynomial which has the additional property of being invariant under a permutation of the variables. One way to do so uses a specific type of set of permutations, known as a *symmetrizing set*. We will present several results on the size and structure of symmetrizing sets, as well as a brief description of an algebraic method of studying them, using previously known results from the field of representation theory.

Faculty Advisor: *Weiqing Gu, Mathematics*

9:30 A.M. **Christopher J. Pries: Examples of Cayley Manifolds**

We present several families of Cayley 4-dimensional manifolds in the real Euclidean 8-space. Such manifolds are of interest because Cayley 4-manifolds and Cayley 4-cycles in Calabi-Yau 4-folds and Spin(7) holonomy manifolds are supersymmetric cycles that are candidates for representations of fundamental particles in String Theory. Moreover, some of the examples of Cayley manifolds presented here have applications in mirror symmetry. We apply the classic results of Harvey and Lawson to find Cayley manifolds which are graphs of functions from the set of quaternions to itself and which are invariant under certain three dimensional subgroups of Spin(7).

Faculty Advisor: *Weiqing Gu, Mathematics*

10:00 A.M. **Mathematics and Biology Departments Reception—Galileo Foyer**

Mathematics Presentations Continued

10:30 A.M. **Michael Gratton: Mixing in Helical Pipes**

We investigate the mixing of dye in loosely coiled helical pipes, developing a set of differential equations and a Poincaré map to describe the motion of individual dye particles. Using numerical simulation, we show that the longitudinal mixing occurs slower for smaller values of torsion in the helix. We also discover that the mixing operates on a linear time scale, rather than a square root timescale, for times smaller than the inverse of the diffusivity. Averaging the dye concentration along streamlines, we are able to explain this mixing behavior analytically.

Faculty Advisor: *Andrew J. Bernoff, Mathematics*

11:00 A.M. **Anne G Short: Elliptic Curves and L-functions**

An elliptic curve over a field K is a nonsingular cubic curve in two variables. For elliptic curves over \mathbb{Q} , the rational points form a finitely generated abelian group, $E(\mathbb{Q})$. This talk will explore the relationship between $E(\mathbb{Q})$ and the L-function attached to an elliptic curve.

Faculty Advisors: *Christopher Towse (Scripps College, Mathematics) and Gautam Chinta (Brown University, Mathematics)*

11:30 A.M. **Mark Dean: Randomizing the 15-Puzzle**

I studied the rate of convergence for randomizing the 15-puzzle, and in general, the $n \times n$ -puzzle; essentially, how many random moves does it take to make the puzzle itself random? This puzzle is nice to deal with as the rules at any point in time are solely determined by the position of the puzzle: how the puzzle got there does not affect the future of the puzzle. I will discuss which configurations are possible, and show that the challenge Sam Boyd set when the puzzle originated is impossible. I will demonstrate methods to obtain bounds for certain variations of the puzzle, and discuss difficulties in applying these methods. Specific bounds will also be presented.

Faculty Advisor: *Francis E. Su, Mathematics*

Physics—Galileo-Edwards

9:30 A.M. **Sarah Olmstead: Creation of Nanoscopic Magnetic Structures in Exchange Biased Systems**

Using diblock copolymers of poly(styrene)-poly(methyl methacrylate) (PS-PMMA) we fabricated polymer templates for nanolithography on antiferromagnetic/ferromagnetic (AF/FM) bilayers. The polymer films are spin-cast on the magnetic layers and annealed so that the polymeric domains self-assemble into PMMA cylinders of about 35 nm diameter in a PS matrix. The cylinders are chemically removed leaving a nanoporous network used as a template for reactive ion etching into the top or both layers. The characteristic domain sizes of AF/FM materials are similar to the size of the porous features. Nanostructures were created on a variety of substrates, and the stability of the template to the RIE and solvents was characterized.

Faculty Advisor: *Shenda M. Baker, Chemistry*

9:45 A.M. **Nicholas Breznay: Investigation and Modeling of Ultrafast Electron Dynamics in Metals**

Electron dynamics in metals are relatively unexplored in the femtosecond time regime. We investigate the behavior of laser-heated electrons with an optical technique, second-harmonic generation, using a pump-probe geometry. In addition, we present a statistical model of electron dynamics in this timescale, which simulates both electron-electron and electron-phonon interactions. This model relaxes a perturbed electron distribution in time, and allows us to make quantifiable predictions which can be tested in future work.

Faculty Advisor: *Thomas D. Donnelly, Physics*

10:00 A.M. **Mathematics and Biology Departments Reception—Galileo Foyer**

Physics Presentations Continued

10:30 A.M. **Daniel Osborn: *Eclipsing Low Mass X-Ray Binary Systems***

Low Mass X-Ray Binary systems consist of a very dense Neutron Star or a Black Hole accreting material from a lighter solar-type star. In some systems, the normal star may periodically eclipse the X-ray emission region near its compact companion. Theoretical predictions for the number of such eclipsing LMXBs have historically overestimated how many systems are actually observed. I have calculated a revised expected number of eclipsing systems with Neutron Star and Black Hole companions which I compare to the observed number.

Faculty Advisor: *Ann Esin, Physics*

10:45 A.M. **Austin Brown: *Modeling the Lightcurve of an X-Ray Binary in M33***

A bright source of x-ray emission in M33, X-7, is known to be an eclipsing binary system. Material from a large star is believed to be accreting onto a compact companion, most likely a neutron star. This accretion process produces X-rays. The optical counterpart to the system is not known. I seek to identify the object in optical, as well as explain the light curve observed. Modeling focuses on two potential sources of variations, X-ray heating of the mass donor star, and gravitationally induced changes in its shape.

Faculty Advisor: *Ann Esin, Physics*

11:00 A.M. **Marty Blood: *Doppler Tomography of Dwarf Nova T Leo***

Dwarf novae are binary systems composed of a white dwarf accreting matter from a low-mass star. I use Doppler tomography to obtain a map of one such system, T Leo, from emission spectra obtained at various orbital phases. I begin with a short introduction to Doppler tomography, and discuss why it is interesting to apply this method to T Leo. I then present my findings, and discuss their implications.

Faculty Advisor: *Ann Esin, Physics*

Engineering—Galileo-McAlister**Engineering 198: Advanced Problems in Engineering**

Course Instructor: *B. Samuel Tanenbaum, Engineering*

10:30 A.M. **Tonya Icenogle, Aileen Ng, Andrew Yip, Ken Dye, Joe Checkelsky, Charles Matlack: *Lizard Racing***

A system was developed to precisely measure the times at which a lizard traverses 25cm intervals on a 2.5m long straight raceway. Collimated beam-break sensors can detect the presence of animals varying in height, size, and posture. A microcontroller performs A/D conversion and relays sensor data to an intuitive PC-based software interface. The graphical interface manipulates and graphically displays recorded data and allows the user to adjust the sensors' triggering threshold, program different track configurations, and test the system's performance.

10:45 A.M. **William Berriel, Brett Bissinger, Ryan Carpenter: *Merlin's Magic Square***

Merlin's Magic Square was a handheld electronic game of the '70s that can be used to model elementary concepts in linear algebra. Professor Benjamin asked the team to recreate the toy in a way that he could easily display in lecture. The device also includes a hint feature to implement a simple algorithm for solving the puzzle. Using a controller and digital logic, *Merlin's Magic Square* reacts to user input using both lights and sounds.

Engineering Presentations Continued

11:00 A.M. **Damian Small, Deborah Meduna, Nikhil Reddy, Gene Lee, Elizabeth Lee-Su, Leonardo DelCampo: *Reliable Clock System for HMC***

In the past few years, Harvey Mudd's clock system has become highly unreliable, especially with the recent power outages. We will present our solution: a reliable clock system unaffected by power outages, and requiring little or no maintenance.

11:15 A.M. **Jason Komadina, Stephen MacVicar, Keith Miyake: *Analysis of Solar Power at Harvey Mudd College***

Our project is to monitor and analyze the power output of the solar array installed on Case Dorm and display real-time statistics on a web site. Additionally, we explore the feasibility and cost-benefit of additional solar arrays on other buildings on the Harvey Mudd Campus.

11:30 A.M. **Genevieve Breed, Warren Katzenstein, Joseluis Espinosa: *Feasibility Study of a Combined-Cycle Power Plant for The Claremont Colleges***

The cost of electricity for The Claremont Colleges has more than doubled following last year's electricity crisis in California. A combined-cycle power plant located in "the pit" east of Claremont Boulevard has been shown to be an economical and sensible option for The Claremont Colleges to generate their own electricity with minimal impact on the campuses or the surrounding neighborhood.

12:00 Noon■ **Lunch Break****1:15 P.M.—5:00 P.M.**■ **Research Presentations****Chemistry—Galileo-Pryne**1:15 P.M. **Catherine Kin Yan Ho: *Synthesis and Investigation of Diastereomeric Titanium Complexes***

Two chiral ligands were synthesized in a three-step procedure from L-phenylalanine ethyl ester and added to $\text{TiCl}(\text{NMe}_2)_3$ to form the titanium complexes. The two diastereomeric Ti(IV) complexes synthesized are $\text{Ti}(\text{Cl})(\text{NMe}_2)[\eta^2\text{-OCH}_2\text{CH}(\text{CH}_2\text{Ph})\text{N}(\text{C}_6\text{H}_{11})]$ and $\text{Ti}(\text{Cl})(\text{NMe}_2)[\eta^2\text{-OCH}_2\text{CH}(\text{CH}_2\text{Ph})\text{N}(\text{iPr})]$. X-ray crystallography results have shown that both complexes are actually dimers, bridging through the alkoxide oxygens. The dimethylamide ligand on the complex can be replaced with an aryloxy ligand such as 2,6-dissopropylphenol by protonolysis to form $\text{Ti}(\text{Cl})(\text{O}-2,6\text{-iPr}-\text{C}_6\text{H}_3)[\eta^2\text{-OCH}_2\text{CH}(\text{CH}_2\text{Ph})\text{N}(\text{iPr})]$, however dimerization still occurs.

Faculty Advisor: *Adam R. Johnson, Chemistry*

1:30 P.M. **Loren Perelman: *Formation of Highly Ordered Nanoporous Structure Using Diblock Copolymer***

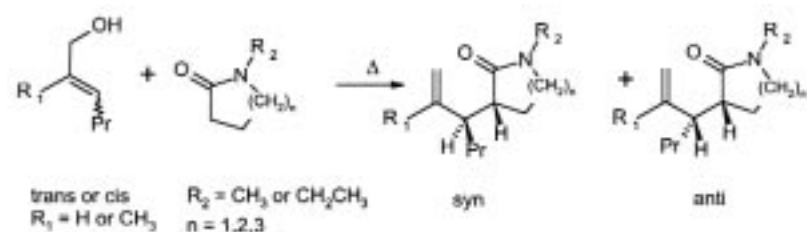
At various volume ratios of each block, an amphiphilic diblock copolymer, such as polystyrene (PS)-polymethylmethacrylate (PMMA), will self assemble into phase-segregated structures such as spheres, cylinders and lamellae. Our study focuses on the formation of hexagonally close-packed polymethylmethacrylate cylinders within a polystyrene matrix in a thin, spun-cast film. UV exposure and chemical treatment removes the PMMA cylinders and cross-links the remaining PS matrix. The resulting nanoporous structure can be utilized in a number of novel applications, such as a substrate for biomembranes for biosensors or template for highly ordered nanowire fabrication.

Faculty Advisor: *Shenda M. Baker, Chemistry*

Chemistry Presentations Continued

1:45 P.M. **Cyril Jacquot: Stereoselective Studies of the Amide-Acetal Claisen Rearrangement**

Allylic alcohols and acetals of cyclic N-methyl amides undergo the Claisen rearrangement to produce products containing two new stereogenic centers. The partitioning of the reaction through chair and boat topologies can be determined directly from the *syn/anti* selectivity of the reaction. *Trans* disubstituted allylic alcohols gave primarily the *syn* isomer with selectivities between 80 and 90%, while the *cis* isomer gave a mixture of both isomers in about the same amount. *E* trisubstituted alcohols give *syn* selectivities exceeding 8:1, while *Z* trisubstituted alcohols give *syn/anti* mixtures. All products were characterized by IR, NMR, and mass spectral analysis.



Faculty Advisor: G. William Daub, Chemistry

2:00 P.M. **Olisambu Uche: Neutron Reflectivity and Atomic Force Microscopy Studies of a Model DNA Microarray Surface Prepared with a Poly(ethyleneimine) Linker**

A DNA microarray surface was prepared at different stages of surface preparation. A highly branched polymer, poly(ethyleneimine) (PEI), (Mw=70 kD) is used to increase the volume of amine sites available for attachment of probe oligonucleotides. PEI was covalently bound to the surfaces by cyanuric chloride and the probe oligonucleotide was covalently attached to the PEI by cyanuric chloride. Hybridized target oligonucleotides bind to the probe by electrostatic forces and hydrogen bonds. Neutron reflectivity and atomic force microscopy studies were used to characterize the depth profile of molecules and probe/target binding sites on the microarray surfaces.

Faculty Advisor: Shenda M. Baker, Chemistry

2:15 P.M. BREAK

2:30 P.M. **Alexander Mandel: Total Synthesis of an Anti-Malarial Cordypyridone**

The total synthesis of a naturally occurring cordypyridone was addressed. The complete structure has 4 stereocenters and is an atropisomer. The main component in its synthesis is the Carbon-Carbon bond formation between cyclohexane and the pyridone ring for which a Palladium catalyzed heck reaction was used. In order to address stereochemical and reactivity issues, several simpler analogs were created to test the crucial heck addition.

Faculty Advisor: Thomas G. Minehan, Chemistry

2:45 P.M. **Michael Nelson: Analysis of Lyotropic Liquid Crystalline Systems using Differential Scanning Calorimetry and Polarized Light Microscopy**

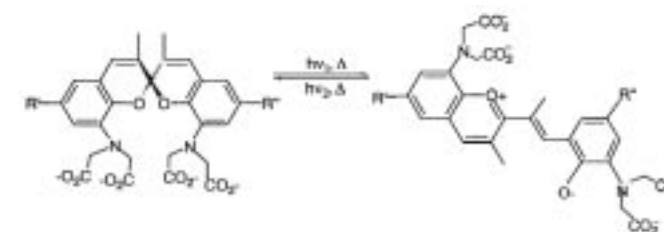
In our continuing studies of lyotropic liquid crystal systems using DSC and microscopy, we are analyzing the binary system of water and dodecyl maltoside with the goal of creating a phase diagram. Existing literature data for this system is inconsistent, possibly due to dodecyl maltoside being highly air and moisture sensitive. Our data agrees with some, but not all, literature values, possibly due to different procedures regarding the handling of the dodecyl maltoside in order to prevent exposure to air. However the general trends of the literature results compare favorably with our results.

Faculty Advisor: Gerald R. Van Hecke, Chemistry

Chemistry Presentations Continued

3:00 P.M. **Christine Yoo: Synthesis and Characterization of Photoreversible Calcium Binder—A Study of Biological Phenomena at a Molecular Level**

Calcium has been observed in a number of physiological processes including signaling pathways, standing calcium waves, and a calcium gradient in certain cells. However, the mechanisms of these phenomena are yet to be explained. We propose the use of an organic molecule that can bind or release calcium ions upon irradiation at different frequencies, producing a similar occurrence to what is seen *in vivo*. Synthesis of derivatives of the model molecule is presented.



Faculty Advisor: Alison McCurdy, Chemistry

3:15 P.M. **Caitlin Devereaux: Controlling the Aggregate Morphology of Primarily Hydrophobic Diblock Copolymers**

Diblock copolymers are useful in a variety of industrial applications due to their self-assembling properties. This research involved the study of a primarily hydrophobic poly(styrene)-poly(ethylene oxide) (PS-PEO) diblock copolymer. The Langmuir-Blodgett technique was used to deposit a monolayer of the polymer on a silicon substrate, and the morphologies of the polymer aggregates were examined using atomic force microscopy (AFM). Shear force was explored as a technique for controlling the alignment of the polymer features. Additionally, the effects of deposition solvent on feature morphology were studied.

Faculty Advisor: Shenda M. Baker, Chemistry

Computer Science—Galileo-McAlister

1:15 P.M. **Stephen DiVerdi and Jason Wither: Development of a Head Tracking, Face Recognizing System**

Many techniques have been developed to handle various aspects of object recognition and tracking through time. The goal of this semester project was to implement a large sampling of these techniques and integrate them into a final package that can recognize faces and track their 3D position and orientation. With this information, a 3D model can be rendered to mimic the motions and facial expressions of the face it's tracking.

Faculty Advisor: Zachary Dodds, Computer Science

1:30 P.M. **Michael Allen and Edward Miller: MeaseL—Putting the Ease in ML**

The functional programming language Standard ML is used in several CS courses at HMC and elsewhere, but the compilers available are not very friendly. This can make programming in SML rather frustrating. This can be contrasted with Scheme, which has been championed as a good first programming language. The free DrScheme development environment provides excellent support for editing and debugging. A typed language like SML can catch many programming errors which in Scheme lead to run-time failures, and so ought to be even more pedagogically useful. However, there is currently no supporting environment analogous to DrScheme for ML. The long-term goal of the MeaseL project is improved programming environments for typed languages like SML.

Faculty Advisors: Christopher A. Stone and Joshua S. Hodas, Computer Science

Computer Science Presentations Continued

2:00 P.M. **Lubomira Stoilova: *Efficient Implementation of Proof Search in Linear Logic***

In programming languages based on linear logic, the program can grow and shrink in a nearly arbitrary manner over the course of execution. Properly accounting for this behavior complicates the proof procedure considerably. Since the introduction of the I/O model of proof search [Hodas and Miller, 1994], a number of refinements have been proposed with the intention of reducing the degree of non-determinism in proof search. Unfortunately each of these systems has had some limitations. In this talk I describe some of the challenges faced by the implementer and some of the proposed solutions, including a new system developed with Professor Hodas, Jeffrey Polakow '96, and Pablo Lopez of the University of Malaga, Spain

Faculty Advisor: *Joshua S. Hodas, Computer Science*

2:15 P.M. **Jason Wither and Stephen DiVerdi: *Specular Inclusive Radiosity***

Radiosity is a photo-realistic rendering technique that incorporates a model of light transmission based on a mechanical engineering model of energy transfer. Traditional radiosity techniques handle diffuse lighting very well, but have no mechanism for handling specular lighting. Specular reflections are generally added after radiosity rendering with a traditional ray tracer. Our goal was to research methods for extending traditional radiosity algorithms to handle specular lighting.

Faculty Advisor: *Elizabeth A. Sweedyk, Computer Science*

2:30 P.M. **Andrew McDonnell: *Building Accurate Maps from Inaccurate Data***

While building environmental maps from raw sensor data is a skill we perform continuously and unconsciously, it is a difficult task to automate, especially when the data available are noisy and/or incomplete. This talk will examine some of the probabilistic techniques used to build accurate maps from inaccurate data.

Faculty Advisor: *Zachary Dodds, Computer Science*

2:45 P.M. **Thomas Johnson: *Emergent Properties of a Discrete Artificial Chemistry***

An Artificial Chemistry is an abstract system that attempts to simulate some of the essential qualities of chemical reactions. We demonstrate an original implementation of one such system, and discuss the results obtained from a limited set of experiments done within the system. These experiments focused on the viability and evolution of self-replicating structures.

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

3:00 P.M. **Eric Heitzman: *A Linux-Based Digital Audio Recorder***

The design, creation, and evaluation of a rack-mounted, Linux-based, digital audio recorder will be discussed. Besides having a practical use, this project was an attempt to create a system from the design phase through implementation and use.

Faculty Advisor: *Michael A. Erlinger, Computer Science*

3:15 P.M. **Roy Shea: *Evaluations of the BEEP and IDXP Protocols***

An evaluation of the integration of two recent IETF protocols: an application level transport protocol, BEEP, and a particular application level protocol, IDXP. Implementation and testing issues are evaluated and solutions sought.

Faculty Advisor: *Michael A. Erlinger, Computer Science*

Engineering—Galileo-Edwards

1:15 P.M. **Emily Henage: *Measurement of Stress and Strain in an In Vitro Corneal Model***

In an effort to grow corneal cells under similar conditions that exist in the human eye, I am researching the mechanical properties of the collagen sponges used as a scaffold for an in vitro corneal model. To reproduce in vivo conditions we need to know both the in-plane and intraocular pressures present in the native cornea. We also need to be able to measure the stress and strain exerted by the keratocyte cells on the collagen sponges without destroying the cells. This project includes researching current work done in these areas, ordering equipment for measuring, and testing and monitoring the cell/sponge cultures.

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

1:30 P.M. **Amanda Malone: *The Response of Collagen Sponges Seeded With Corneal Cells to Applied Stress***

This study looked at improving the transparency of a corneal construct grown in vitro by attempting to mimic the normal physiological environment of the cells. The keratocyte cells were grown on collagen sponges, half of which were put in tension using ring clamps designed for this purpose. This tension was meant to duplicate the in plane stresses found in the human eye. The transparency of the cell cultures was evaluated at days 1, 7, 14 and 21 using the light scattering information obtained by viewing the tissue with an optical coherence microscope and the cell phenotype was determined by staining with markers for cellular differentiation.

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

1:45 P.M. **Justin Schauer: *HMC Open Source Floating Point Project***

My project is testing an open source floating point adder written in Verilog. I developed a test plan involving my hardware adder and a software adder written in Java by Hang Tang. I debugged the hardware adder and software adder often simultaneously using proven correct cases. I tested multiple precisions and modes. The end result is a fully debugged hardware adder and a fully debugged testing program for that adder.

Faculty Advisor: *David Harris, Engineering*

Mathematics—Beckman B126

1:15 P.M. **Wesley Turner: *An Algebraic Approach to Program Analysis***

There are many different methods of analyzing program execution. One of these methods acts as an interpreter, evaluating terms as it steps through the program. Another assigns a value to each term based upon an assumed underlying mathematical structure. It is interesting to compare whether these two methods of analysis will be able to prove the same equivalences between terms of a particular language, regardless of the details of the underlying mathematical structure. In this talk, I will develop the mathematical background of initial algebras and coalgebras with an eye to reasoning about terms with regard to a shared structure.

Faculty Advisor: *Joshua S. Hodas, Computer Science*

1:45 P.M. **Lara D. Mercurio: *Searching for Special Lagrangian Manifolds***

M-Theory postulates that we live in an eleven-dimensional universe, and that the forces we experience in our four dimensions are merely the results of the vibrations of manifolds. It is believed that special Lagrangian manifolds are candidates for representations of fundamental particles in M-Theory, and thus are crucial elements for describing the world. Finding such manifolds is non-trivial, however, and we will make use of the Method of Calibration, first presented by Harvey and Lawson in 1981, in our search for families of special Lagrangian manifolds.

Faculty Advisor: *Weiqing Gu, Mathematics*

2:15 P.M. **Cameron McLeman: *p-adic Dynamics and Formal Groups***

When do two polynomials commute under composition? How about two power series? Worried about convergence issues? We analyze this topic via p -adic numbers, a setting in which series converge in ways you only *wished* they would in high school. Surprisingly, the issue of commutability will be related to formal groups, which are two-variable power series which act like group laws. Concrete examples will be given to introduce and link these topics.

Faculty Advisor: *Christopher Towse (Scripps College, Mathematics)*

Mathematics Presentations Continued

2:45 P.M. **Daniel M. Boylan: Translation Averaging in the Space of Dyadic Vanishing Mean Oscillation Functions**

Families of functions in the space of dyadic vanishing mean oscillation (VMO) functions can be modified by the process of translation averaging. We investigate translation averaging and whether or not it has an improving effect on the dyadic VMO functions. Specifically, is the translation average of a family of dyadic VMO functions actually a function of true vanishing mean oscillation? An analogous effect is known to exist for families of dyadic bounded mean oscillation (BMO) functions. We attempt to apply these methods to the dyadic VMO space, and also attempt to construct counterexamples.

Faculty Advisors: *Lesley A. Ward, Mathematics and Melissa O'Neill, Computer Science*

Physics—Galileo-Edwards2:15 P.M. **Eric Brown: Designing an Experiment to Measure the Geometric Absorption of Electromagnetic Angular Momentum—Generation of Circularly Polarized Microwaves**

Circularly polarized electromagnetic fields carry angular momentum. We have designed an experiment to transfer this angular momentum from microwave radiation to a macroscopic object under the mechanism of geometric absorption. I have designed the mechanism for getting circularly polarized microwaves to a target object. We use a microwave generator to produce linearly polarized waves in a rectangular waveguide, which is coupled to a circular waveguide to produce circularly polarized waves.

Faculty Advisor: *Chih-Yung Chen, Physics*

2:30 P.M. **Seema Patel: Designing an Experiment to Measure Geometric Absorption of Electromagnetic Angular Momentum—Experimental Apparatus and Physical Constraints**

Both classical and quantum mechanics show that circularly polarized electromagnetic fields carry angular momentum. The focus of this research was to design an experimental apparatus to investigate the transfer of angular momentum from microwaves to a macroscopic object. In this portion of the research an experimental chamber and macroscopic object were designed, and materials for construction selected. The experimental components were determined by the physical constraints, which will be discussed quantitatively.

Faculty Advisor: *Chih-Yung Chen, Physics*

2:45 P.M. **Nathan K. Cappallo: Designing an Experiment to Measure Geometric Absorption of Electromagnetic Angular Momentum—Optical Detection Systems**

The fact that electromagnetic waves carry angular momentum is predicted by both classical and quantum theories. Our experiment is designed to measure the macroscopic effect of the torque exerted by circularly polarized microwaves. The optical detection system will measure how far the object has rotated in a given time under illumination of the circularly polarized microwaves, which will give us the total torque applied on our object by the microwaves.

Faculty Advisor: *Chih-Yung Chen, Physics*

3:00 P.M. **Michael P. Schubmehl: The Droplet Source Project**

Generating sub-micron water droplets with a controlled size distribution is important for laser fusion and fluid dynamics research. Ultrasonic atomization is an attractive approach to nebulization, but additional theoretical and experimental work is required to explore this alternative. We summarize our recent research and results in this area and outline future goals

Faculty Advisor: *Thomas D. Donnelly, Physics*

3:30 P.M. **Presentation Days Reception—Galileo Foyer**

4:00 P.M.

■ **Presentation Days Address****Galileo-McAlister****Welcome:**

F. Sheldon Wettack, Vice President and Dean of Faculty, and Professor of Chemistry

Introduction:

John S. Townsend, Bruce and Susan Worster Professor of Physics and Chair, Department of Physics

Keynote Speaker:

Dr. Stanley G. Love '87, NASA Astronaut, NASA-Johnson Space Center

"Little-known Benefits of Student Research"

While training and working toward his first space flight, NASA Astronaut Stan Love '87 serves as a mission specialist candidate, working on spacecraft engineering and supporting launches and landings at Cape Canaveral. As a Space Station capcom, he sits in Mission Control and communicates to the Station during International Space Station missions. "It's a great job, but there's a capcom in the control center whenever the crew's awake, and since the crew's on Greenwich time, that means a lot of hours on the graveyard shift."

Dr. Love received his bachelor of science degree in physics from Harvey Mudd College in 1987. He received master of science and doctor of philosophy degrees in astronomy from the University of Washington in 1989 and 1993, respectively. As a graduate teaching assistant at the University of Washington in Seattle beginning in 1987, he taught and led laboratory sections for planetary astronomy and other undergraduate courses. He worked as a graduate research assistant at the University of Washington from 1989 to 1993 on a variety of projects, including space propulsion and energy storage, stellar photometry and spectroscopy, analysis of space-exposed surfaces, hypervelocity impact and particle capture, atmospheric entry heating of micrometeoroids, infrared imaging of the zodiacal light, and electron microscopy of interplanetary dust particles. He moved to the University of Hawaii in Honolulu in 1994 for a postdoctoral research appointment modeling the formation of meteoritic chondrules and the collisional evolution of asteroids, and investigating the possibility of meteorites from the planet Mercury.

In 1995, he was awarded a prize postdoctoral fellowship at the California Institute of Technology, where he worked on computational fluid dynamic simulations of asteroid collisions, calibration of the Cassini spacecraft dust particle impact detector, and experimental shock compression of the mineral calcite. He was transferred to the Jet Propulsion Laboratory in 1997 to work on computer models and simulations of spacecraft optical instrument systems and to participate in a Laboratory-wide process re-engineering effort. Dr. Love was selected by NASA in June 1998 and reported for training in August 1998. He will serve in technical assignments until assigned to a space flight.

Dr. Love is married with two children and resides in Houston, Texas. His recreational interests include flying, alpine hiking, bicycling, snorkeling, alternative music and animation.

Tuesday, May 7 2002**PROJECTS DAY****HMC Computer Science, Computer Science/Engineering, Engineering, Mathematics and Physics Clinics**

Please see Projects Day Program for further details or visit <http://www.hmc.edu/acad/clinic/>

10:30 A.M.

■ **Registration and Poster Sessions:**

Ronald and Maxine Linde Activities Center

1:15 P.M.

■ **General Session:****Galileo-McAlister**

Welcome: President Jon C. Strauss

Remarks: Joshua S. Hodas, Director, Computer Science Clinic

Milestone Awards: F. Sheldon Wettack, Vice President and Dean of Faculty, and Professor of Chemistry

Program: Robert D. Hopkins '01/02

2:00 P.M.-5:30 P.M.

■ **Clinic Presentations:**

Classrooms, Galileo Halls and Labs

Wednesday, May 8 2002

Chemistry Poster Session—Galileo Foyer (for concurrent Chemistry Presentations see page 17)
All Morning **Chemistry Research Posters Presented at the American Chemical Society Meeting**

David E. Garcia: Spectroscopic Analyses of Self-assembling Copper(II)-Starburst PAMAM Dendrimer Supramolecular Complexes

We have used absorbance spectroscopy to analyze aqueous complexes of copper(II) with oxygen- and nitrogen-coordinating ligands in full- and half-generation Starburst PAMAM dendrimers. Coordinating sites include surface primary amino groups and internal tertiary amines in full-generation dendrimers (G1-G4) and surface carboxyl and internal amino groups in half-generation dendrimers (G 0.5-G 3.5). This spectroscopic approach permits the detection of several absorbing complexes simultaneously present in solution and also enables determinations of the metal-to-ligand stoichiometry using a Job's method approach.

Faculty Advisor: Kerry K. Karukstis, Chemistry

Tamara Hanna: Synthesis of diastereomeric titanium Complexes with a Chelating bis-amide ligand Derived from L-phenylalanine

(please see abstract Wednesday, May 8 at 9:00 A.M. on page 17)

Cyril Jacquot: Stereoselective Studies of the Amide-Acetal Claisen Rearrangement

(please see abstract Monday, May 6 at 1:45 P.M. on page 10)

Tyrel McQueen: Characterization of Catanionic Vesicles Composed of Asymmetric Surfactants

We have characterized unilamellar vesicles composed of the asymmetric single-tailed surfactants sodium octyl sulfate (SOS, C₈) and cetyltrimethylammonium bromide (CTAB, C₁₆). Light scattering measurements reveal variations in vesicle size (e.g. from 20–80 nm) over long periods of time (500–1000 hours or more). A rapid increase in aggregate size occurs initially. Fluorescence variations in the anionic fluorescence probe TNS reflect vesicle formation, “flip-flop” of surfactant monomers across the vesicle bilayer, and vesicle fusion. Fluorescence data further demonstrate that the CTAB micelle-to-vesicle transition occurs without an intermediate.

Faculty Advisor: Kerry K. Karukstis, Chemistry

Loren Perelman: Ordered Assembly of Azo Dyes on Dendritic Surfaces

Our spectroscopic investigations of the electrostatic binding of aromatic azo dyes to the surface of Starburst poly(amidoamine) dendrimers provide evidence of the formation of highly-ordered dye aggregates. Absorption spectra suggest that the size and substitution patterns of the aromatic rings joined to the azo functionality affect the relative orientation of the electrostatically-bound azo dyes. Several parameters control the type and extent of dye aggregation observed by dictating the proximity of attached azo dyes and the ability of intermolecular forces between dyes to operate.

Faculty Advisor: Kerry K. Karukstis, Chemistry

Courtney F. Rotstan: A Spectroscopic Characterization of Simultaneous Copper(II)-Starburst Dendrimer Complexes

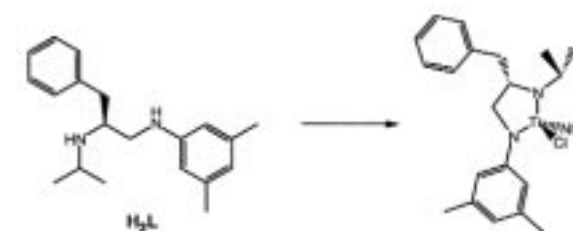
We have used a spectroscopic approach to examine the complexes that form as copper(II) metal ions interact with full- and half-generation Starburst poly(amidoamine) dendrimers. To coordinate with metal ions, the dendrimer structure provides tertiary amines within the dendrimer core and primary amines or carboxylate ligands at the dendritic surface (depending whether full or half-generation, respectively). We have varied pH to control ligand ionization, thereby modifying the binding capabilities of the metal ion and affecting the complexes observed. The choice of dendrimer generation also alters the accessibility of the copper ion to the inner dendritic core.

Faculty Advisor: Kerry K. Karukstis, Chemistry

Chemistry—Galileo-Pryne

9:00 A.M. **Tamara Hanna: Synthesis of Diastereomeric Titanium Complexes with a Chelating Bis-amide Ligand Derived from L-phenylalanine**

We are interested in carrying out stereospecific C-C bond formation reactions using chiral titanium complexes with π -donor ligands derived from naturally occurring amino acids. Natural amino acids are ideal ligand precursors because they can be converted to a four-membered N-N chelate via a few short, high-yielding steps, can have variable substitution on the amino nitrogens, are inexpensive, and are of high enantiomeric purity. The synthesis of the bidentate ligand (H₂L) starting from L-phenylalanine will be described. The deprotonated ligand reacts with TiCl₂(NMe₂)₂ to form the diastereomeric titanium complex LTi(NMe₂)₂, with loss of two equivalents of LiCl. All syntheses and complexes will be characterized by ¹H and ¹³C NMR spectroscopy.



Faculty Advisor: Adam R. Johnson, Chemistry

9:15 A.M. **Michael M. T. Ragudo: Spectral Analysis of Cationic Azo Dye Aggregation on Half Generation Dendrimer Surfaces.**

Starburst PAMAM dendrimers are branched dendrimers comprised of an ethylenediamine core and repeating branches that double with every generation. Full generation dendrimers are characterized by amine terminal groups, while the half-generations have carboxyl terminal groups. The interaction of the half-generation dendrimers with cationic azo dyes is examined through UV/Vis spectroscopy. These experiments stem from work conducted with full generation dendrimers and anionic azo dyes. Phase shifting due to the H or J aggregation caused by dye-dendrimer electrostatic interactions is examined by changing functional substituents on the azo dyes.

Faculty Advisor: Kerry K. Karukstis, Chemistry

9:30 A.M. **Clara Hsia: Investigation of the Utility of Indium Enolates for Carbon-Carbon Bond Formation in Aqueous Media**

Currently, most organic reactions conducted in academia or industry require the use of organic solvents as reaction media. Many organic solvents are hazardous to human health and toxic to the environment and their safe disposal can be costly. Aqueous solvent offers several advantages over organic solvents: water is safe, environmentally friendly, and cheap. The goal of this study was to explore new methods to generate water-stable, “organic-reactive” substrates and their effective use in aqueous carbon-carbon bond formation reactions. Specifically, I studied the hydrolytic stability of Indium (I) and (III) enolates and their reactivity with aldehydes and ketones in aqueous media.

Faculty Advisor: Thomas G. Minehan, Chemistry

9:45 A.M. **Andrew Grossman: Determination of Excess Gibbs Energy Measured by Laser Light Scattering**

In binary liquid mixtures, the existence of non-zero intermolecular interactions is manifest by non-zero Gibbs potential of mixing. The Gibbs potential of mixing can be determined by laser light scattering, refractive index, and density measurements. Light scattering data are treated by Rayleigh ratios that depend on density and concentration fluctuations in liquid mixture. Previous studies had to approximate the density dependent Rayleigh ratio. We will report using piezooptic coefficients for the density Rayleigh ratio, a procedure not requiring approximations. We focus on anisole-alcohol solutions looking to understand how the Gibbs potential varies with alcohol used.

Faculty Advisor: Gerald R. Van Hecke, Chemistry

Chemistry Presentations Continued

10:00 A.M. **Chemistry and Physics Departments Reception—Galileo-Foyer**

10:30 A.M. **Eric Toberer: *Bimodal Polymer Brush Morphology under Shear Flow in a Good Solvent***

Recent neutron reflectivity experiments of polystyrene (PS)-polyethylene oxide (PEO) diblock copolymers at a quartz-good solvent interface under laminar shear flow shows that no change occurs until a critical shear desorbs much of the monolayer. This result suggests that a bimodal brush system, having brush ends with much larger radii of gyration than the previous system, should desorb at a lower shear rate. Neutron reflectivity measurements were conducted to confirm that shear does not change brush length, and to investigate the desorption of bimodal brush systems under shear.

Faculty Advisor: *Shenda M. Baker, Chemistry*

10:45 A.M. **Matt Mason: *Unnatural Peptide Synthesis—Study of the Cation-Pi Interaction in Bovine Pancreatic Trypsin Inhibitor Protein.***

The cation-pi interaction is an attractive interaction between positively charged ions and pi-bonded systems (i.e. aromatics). The folded structure of the protein Bovine Pancreatic Trypsin Inhibitor (BPTI) contains positively charged and aromatic amino acid sidechains located as to cause 2 potential cation-pi interactions. Unnatural mutant fragments of BPTI have been synthesized to disrupt the cation-pi interaction when incorporated into BPTI. The energetic contribution of these cation-pi interactions to BPTI protein folding can then be determined by comparison of the mutant BPTI proteins to natural BPTI by Differential Scanning Calorimetry.

Faculty Advisor: *Alison McCurdy, Chemistry*

11:00 A.M. **Sarah Daniels: *The Examination of Aggregation of Polymers in Solution Using Dynamic and Static Light Scattering***

Previous investigations of the kinetics of diblock copolymer adsorption suggest indirectly that for the copolymer poly (ethylene oxide)/ poly (styrene) micelles may be formed at moderate concentrations in solution. We are examining the aggregation of various types of polymers, including the copolymer poly (ethylene oxide)/poly (styrene). Static and dynamic light scattering is used to find the hydrodynamic radius of the polymers. They are placed in different conditions by varying concentration (0.01mg/ml–1.0mg/ml), solvent (including toluene, carbon tetrachloride, and cyclohexane), and temperature (25–35° C) in order to examine the effect on aggregation.

Faculty Advisor: *Shenda M. Baker, Chemistry*

11:15 A.M. **Erin E. Moore: *Surface-confined Metalloporphyrin Oligomers***

Surface-confined, stacked metalloporphyrin oligomers were constructed using a modular approach. Each oligomer consisted of two metalloporphyrins, either meso-tetraphenylporphyrinatoruth-enium(II) or octaethylporphyrinatoruthenium(II), linked axially with various ligands. The resulting stacked structures were characterized with cyclic and square-wave voltammetry. The electronic properties were altered by the linker ligand and the fraction of porphyrin sites on the monolayer surface. The data suggest that each porphyrin coupled to the gold surface, regardless of the oxidation state of the porphyrin attached below it in the stack.

Faculty Advisor: *Hal Van Ryswyk, Chemistry*

Engineering—Galileo-McAlister

Engineering 158: Introduction to CMOS VLSI Design

Course Instructor: *David Harris, Engineering*

9:00 A.M. **Joshua Chu, Hang Tang: *Booth Multiplier***

9:15 A.M. **Chris Newkirk: *Fast Adders***

9:30 A.M. **Genevieve Breed, Matthew Eler: *Hangman Game***

9:45 A.M. **Elizabeth Reynolds, Aaron Stratton: *Programmable FIR Filter***

10:00 A.M. **Chemistry and Physics Departments Reception—Galileo Foyer**

10:30 A.M. **Justin Pava, Mark Phair: *PLA Generator and Adventure Game***

10:45 A.M. **Jason Imada, Frank Lee: *ROM Generator and Soda Machine Change Dispenser***

11:00 A.M. **Neal Okumura, Kevin Ota: *Unsigned Array Multiplier***

11:45 A.M. **Renee Montgomery, Mark Unemori: *Serial/Parallel Multiplier***

Mathematics—Beckman B126

9:00 A.M. **Josh Greene: *Generalizations of Kneser's Conjecture and Tucker's Lemma***

In 1955, Kneser formulated a graph coloring problem that resisted solution for over twenty years, until Lovasz proved it through a surprising application of algebraic topology. In this talk, we provide a novel proof of Kneser's conjecture and discuss current progress on a recent stronger conjecture due to Ziegler. Our approach relies on proving a generalization of Tucker's Lemma, which is currently the focus of joint work with Tim Prescott and Francis Su.

Faculty Advisor: *Francis E. Su, Mathematics*

9:30 A.M. **Timothy Prescott: *A Generalization of Tucker's Lemma to a Branched Sphere***

Tucker's Lemma is a statement about the existence of certain labels in a labeled triangulation of the sphere. A branched sphere is a generalization of the usual sphere to complex space, allowing more connections and branching into different directions. I will discuss the above concepts, as well as a generalization of Tucker's Lemma to the branched sphere and potential applications.

Faculty Advisor: *Francis E. Su, Mathematics*

10:00 A.M. **Chemistry and Physics Departments Reception—Galileo Foyer**

10:30 A.M. **Elizabeth Norton: *Data Compression on the Symmetric Group***

The regular representation of the symmetric group S_n is a vector space of dimension $n!$ with many interesting invariant subspaces. The projections of a vector onto these subspaces may be computed by first considering projections onto certain basis elements in the subspace and then recombining later. If all of these projections are kept, it creates an explosion in the size of the data, making it difficult to store and work with. I am working on techniques to compress this computed data such that it is of the same dimension as the original vector.

Faculty Advisor: *Michael Orrison, Mathematics*

Mathematics Presentations Continued

11:00 A.M. **Bradley T. Forrest: *Modeling Faraday Excitation for Viscous Fluids***

Faraday Excitation is the occurrence of surface waves when a fluid is subjected to periodic forcing. Given a fluid, Faraday excitation will occur for some, but not all, values of forcing frequency and amplitude. This thesis models a viscous fluid with the Navier-Stokes equation and yields predictions for the conditions when Faraday Excitation will occur.

Faculty Advisor: *Andrew J. Bernoff, Mathematics*

Physics—Galileo-Edwards

9:00 A.M. **Curtis Vinson: *Quantum Singularities in Cylindrically Symmetrical Static Spacetimes***

While classical singularities have been well-studied, the question of quantum mechanical singularities is more open. Horowitz and Marolf (Phys. Rev. D 52, 5670 (1995)) proposed a criterion for determining when a spacetime is quantum mechanically singular: when the evolution of the appropriate wave equation fails to be deterministic. My research involves analyzing the classical and quantum singularities of certain cylindrically symmetrical static spacetimes using this technique. Of these spacetimes, all of those with classical singularities have proven to be quantum mechanically singular as well.

Faculty Advisor: *Thomas M. Helliwell, Physics*

9:15 A.M. **Christopher Wieland: *Quantum Mechanical Singularities in Relativistic Spacetimes***

In general relativity, a geodesically incomplete spacetime is said to be classically singular. Since classical test particles follow the geodesics, this description is logical since after some finite time the further evolution of the particle is not properly defined. An analogous definition proposed by Horowitz and Marolf [Phys. Rev. D 52, 5670 (1995)] is used in this paper to define a quantum mechanical singularity. A spacetime is quantum mechanically nonsingular if the timelike evolution of a state is uniquely defined for all time. A static cylindrically symmetric spacetime, describing an infinite line mass [Bonnor and Martins, Class. Quan. Grav. 8, 727 (1991)] is found to be quantum mechanically singular for all values of the governing parameter except for that which corresponds to flat space.

Faculty Advisor: *Thomas M. Helliwell, Physics*

9:30 A.M. **Zachary Brett Walters: *Quantum Singularities in Classical Spacetimes***

Classical physics runs into many problems when it attempts to describe the time evolution of particles in a singular space. This is because it is impossible to extend the geodesic trajectories followed by the particles past a singularity in a unique way. Thus, particles can have many equally valid futures, or none. In 1995, Horowitz and Marolf showed that if only one of the two solutions to the quantum mechanical wave equation is square integrable near the origin, the space is well-behaved quantum mechanically. I apply this result to a class of cylindrically symmetric spacetimes.

Faculty Advisor: *Thomas M. Helliwell, Physics*

9:45 A.M. **James Perry: *Implementation of Motion Sensitivity in a 3-D Optical Coherence Microscope***

Our 3-D optical coherence microscope (OCM) has a lateral resolution of 5 microns and a depth resolution of 10 microns, appropriate for non-invasive imaging of highly scattering biological tissue. A dedicated digital signal processor (DSP) has been programmed to analyze the fringes at the output of the OCM interferometer. By measuring changes in the phase of the fringe signal, we are able to detect motion of scatterers in the sample, both directed motion and random (Brownian) motion. OCM images of frog gastrulation demonstrate the increased contrast in the images provided by this motion sensitivity.

Faculty Advisor: *Richard C. Haskell, Physics*

10:00 A.M. **Chemistry and Physics Departments Reception—Galileo Foyer**

Physics Presentations Continued

10:30 A.M. **Dave Cooke: *Magnetic Stripe Domains in Cobalt Films***

We will be examining the stripe domain structures of thermally evaporated cobalt films to complement research done thus far on other ferromagnetic materials. Comparing the periodicity and shape of the domains for different films, we hope to uncover relationships with deposition rate and film thickness and perhaps also inspect the behavior of the domain structures on a macroscopic level.

Faculty Advisor: *Patricia D. Sparks, Physics*

10:45 A.M. **Brian Kappus: *Magnetic Stripe Domains in Nickel Films***

Films of thermally evaporated nickel can have a magnetic stripe domain structure. The stripe period increases as the thickness increases. Previous research showed that this domain structure was limited to films of thickness greater than 45 nm but we observe these domains in films with thickness of 20 nm. We will report the characteristics of the domains for varying parameters such as deposition rate, thickness and nickel purity.

Faculty Advisors: *Patricia D. Sparks and James C. Eckert, Physics*

11:30 A.M.

■ Lunch Break

Biology—Beckman B126

1:15 P.M. **Matthew de la Peña Mattozzi: *Reporter Gene Systems to Study Glutamine Synthetase Regulation in Arabidopsis thaliana***

Cytosolic glutamine synthetase (GS1), a key enzyme in nitrogen catabolism in all organisms, adds ammonium to glutamate. In *Arabidopsis* GS1 activity is transcriptionally inhibited by organic nitrogen and activated by sucrose in a negative feedback loop. To better understand this metabolic transcriptional regulation, β -glucuronidase (GUS) and green fluorescent protein (GFP) reporter gene systems were designed using the *gln1;2* gene, which codes for GS1 in *Arabidopsis* roots. These transgenic lines express GUS and GFP where the *gln1;2* is transcribed to allow visual study of nitrogen uptake metabolism. These transgenic lines may be crossed with other mutants to study nitrogen responsive transcriptional regulation of *gln1;2*.

Faculty Advisor: *Mary E. Williams, Biology*

1:30 P.M. **Justin Pava: *Genetic Analysis of Lateral Root Mutant***

Previous studies into the *Arabidopsis thaliana* 4(4,2) lateral root mutant have characterized it as a recessive auxin-response mutation phenotypically similar to the *F-box tir1* mutation. CAPS-PCR mapping of the 3rd chromosome suggested that the *ARM* gene, a potential F-box homologue, could be the site for this mutation. I have performed a series of PCR-mapping and gene sequencing experiments on the *ARM* gene in order to test this hypothesis. I have also undertaken gene complementation experiments by transforming 4(4,2) mutants with *Agrobacterium tumefaciens* T-DNA containing the wild-type *ARM* gene.

Faculty Advisor: *Mary E. Williams, Biology*

1:45 P.M. **Anokhi Kapasi: *Site-directed Mutagenesis of Charged Residues in Voltage Sensor DIIIS4 of the Human Skeletal Muscle Sodium Channel***

Action potentials are an important component of how cells transmit information in the nervous system. The voltage-gated sodium channel mediates electrical excitability in nerve and muscle cells. While it has been shown that the 4th segment of Domain 4 (DIVS4) of the sodium channel has unique roles in fast inactivation and deactivation, little is known about DIIIS4. In this research, I designed the primers for charge neutralizing constructs in DIIIS4 of the human skeletal muscle sodium channel (hNav1.4) using PCR site-directed mutagenesis to investigate how channel transitions are regulated by outer and central charged residues (K1, R4, R5) in this voltage sensor.

Faculty Advisor: *James R. Groome, Biology*

Biology Presentations Continued

2:00 P.M. **Nicholas Johnson: *Molecular Taxonomy of Soft Corals***

Genus level relationships in the soft coral family Alcyoniidae are uncertain due to the highly plastic nature of exhibited morphological traits. Previous studies have suggested that mtDNA sequences may be effective in determining genus level relationships among soft corals. By comparing phylogenetic trees, I discovered that the MSH gene has sufficient variation for the construction of a phylogeny for the family Alcyoniidae. I will present an expanded phylogeny including additional species that I have sequenced.

Faculty Advisor: *Catherine S. McFadden, Biology*

2:15 P.M. **Katherine Drew: *Characterization of the mer Operon in a Marine Bacterium Bacillus sp.***

Mercury resistance in bacteria is conferred by a suite of genes known as the *mer* operon. Most of the research on this system has been done in terrestrial, gram-negative species. In 1999, Professor Hamlett's lab sequenced the mercuric reductase (*merA*) gene from a gram-positive, marine species of bacteria, *Bacillus sp.* 6A3. The goal of my project was to use this sequence and a technique called multiplex restriction site PCR (mRS-PCR) to amplify and sequence the DNA immediately upstream and downstream of the *merA* gene in *Bacillus sp.* 6A3.

Faculty Advisor: *Nancy V. Hamlett, Biology*

2:30 P.M. **Erika Wolff: *Characterization of the mer Operon in Mercury-Resistant Marine Bacillus sp. 6A3***

The mercury-resistant marine isolate *Bacillus sp.* 6A3 contains a novel *mer* operon, for which only a partial *merA* sequence has been obtained. PCR primers were designed from *Bacillus* species *merB* and *merR* consensus sequences and combined with *merA* primers to attempt to amplify additional regions of the 6A3 *mer* operon. DNA sequences of the amplified regions can be used to identify the genes in the 6A3 operon and determine the degree of homology with other *Bacillus* species' *mer* operons.

Faculty Advisor: *Nancy V. Hamlett, Biology*

Computer Science Poster Session—Galileo Foyer

All Afternoon **Computer Science 155/181 Computer Graphics and Animation Poster Session**

2:45 P.M. **Engineering and Computer Science Departments Reception—Galileo Foyer**

Computer Science—Galileo-McAlister

3:15 P.M. **Titus Winters, Chris Lundberg, Roy Shea: *TinkerNet—A Low-cost Research Network***

TinkerNet is a cluster of network controllable x86 PCs (nodes). These nodes are capable of remotely receiving commands regarding which operating systems (kernel images) to boot. The nodes have both Linux (RedHat 7.1) and FreeBSD (4.4 release) installed on them, and are capable of booting any Multiboot compliant kernel image. TinkerNet is intended to allow dynamic allocation of resources, divorcing systems research and computer experiments from the physical machine it is conducted on. In this way, research activities can be separated from each other, allowing for more complex projects to be performed on a larger scale. TinkerNet is currently being used as a platform for CS 125 laboratory experiments. The talk will discuss the creation of TinkerNet and its use.

Faculty Advisor: *Michael A. Erlinger, Computer Science*

3:45 P.M. **Computer Science 155/181: *Computer Graphics and Animation*
Rob Adams, Justin Basilico, Nathaniel Dirksen, Steve DiVerdi, Ethan Drucker, Adam Fischer, Joshdan Griffin, Peter Henry, Andrew McDonnell, Jon Morley, Tom Plewe, Eric Ong, Morgan Wagner, Jason Wither, Steve Yan, Neilsen Yu, Ben Zeckel**

Students will demonstrate projects from computer graphics and animation including schooling fish, cloth simulation, cloud animation, water simulation, and non-photo-realistic rendering effects. Animated short films produced by students will also be shown.

Course Instructor: *Elizabeth Z. Sweedyk, Computer Science*

Engineering—Galileo Hall

Engineering 4: Introduction to Engineering Design

Course Instructors: *Lori C. Bassman, Donald S. Remer and James Rosenberg, Engineering*

1:15 P.M. **Redesign of a System for Adjusting Pole Vault Heights**

Galileo-Edwards Client: Claremont-Mudd-Scripps Track and Field
Liaison: John Goldhammer

Initial Problem Statement: Design and build a system to allow the pole vault apparatus to be shifted from a low height to a high height within 90 seconds. Currently the entire system must be taken down to make the adjustment and this is time consuming. This improvement would make it less time disruptive for the women pole vault competitors.

Team 1: Jeffrey Gabster, Malcolm Knapp, John Onuminya, Stephanie Svetlick

Team 2: Ko Ihara, Steven Petesch, Alexander Utter, Joshua Webb

Team 3: Eric Hall, Colin Marsh, Jesse McClure, Madina Sarvestani

Team 4: Jay Chow, Kevin Chu, Bradley Greer, Nicolas Von Gersdorff

1:15 P.M. **Design of a Device to Help Wheelchair Users Carry Items while Shopping**

Galileo-Pryne Client: Pomona Valley Hospital Physical Therapy Department
Liaison: Joseph Baumgaertner

Initial Problem Statement: It is desirable to enable wheelchair-bound individuals to function as independently as possible in their everyday lives. Among the many challenges to this independence is grocery shopping. For the wheelchair-bound, pushing a shopping cart is often difficult or impossible, and most wheelchair users resort to using either one of the store-provided plastic baskets resting on their laps, or bringing some sort of bag from home. Bags can be inconvenient because the contents cannot be easily seen, and the bag may not be easy to hold. Baskets that simply rest on the user's lap can be a problem for both wheelchair users with limited sensation in their legs (they can't tell without looking whether or not the basket is slipping off their lap) as well as a restriction for wheelchair users who have some use of their legs, and use them to assist in moving the chair. Design an inexpensive, rugged, convenient device that will be suitable for a wide variety of wheelchair users.

Team 1: Jefferey Brenion, Alyssa Caridis, Gabriel Kwofie, Don Lee

Team 2: Melissa Falcetti, Sophia Huynh, Joshua Petrie, Hector Vega

Team 3: Brianne Boatman, Barbara Chu, Cassie Walls, Elizabeth Whitlock

2:00 P.M. **Design of a Greenhouse for Education and Heating**

Galileo-Pryne Client: Pomona Valley Center for Community Development (PVCCD)
Liaison: Tomas Ursua

Initial Problem Statement: PVCCD has recently taken ownership of a facility that was formerly used as a nursing home. The site will be used for a multi-use community center and a charter school in Pomona. The charter school will have an aim of providing hands-on education to its students, and one area for this education will be agriculture. Sliding glass doors that have been removed from the nursing home rooms are available for construction of a greenhouse. Additionally, situation of the greenhouse along a south-facing wing of the building could provide heating for the building and reduce energy costs for the center. Design a greenhouse to meet these multiple goals.

Team 1: Galen Chui, Stephen Friedman, Victoria Krafft, Jonathan Lee

Team 2: Shireena Desai, Abram Kim, Jamie Kunkle, Jack Shepherd

Introduction to Engineering Design Continued

2:15 P.M. **Design and Implementation of a Drainage System for an Animal Shelter**
Galileo-Edwards Client: West End Animal Shelter
 Liaison: Barbara Marsh

Initial Problem Statement: West End Shelter is a no-kill animal shelter in Ontario. They have a number of caged areas in which dogs are housed. These areas must be regularly washed with a hose. When one such area adjacent to a central courtyard is hosed down, the run-off pools and makes the courtyard muddy and unusable. Design and implement a drainage system for this area. Because of the limited resources of the shelter, the system must be extremely low-cost.

Team 1: Robert Gullet, Joseph Nguyen, Ryan Patterson

2:45 P.M. **Engineering and Computer Science Departments Reception—Galileo Foyer**

3:15 P.M. **Design of a Light System for Doctors**
Galileo-Edwards Client: Beckman Laser Institute (BLI)
 Liaison: Dr. Brian Wong

Initial Problem Statement: The current light sources that doctors wear on their heads during examination of patients are quite expensive (about \$500). Medical students and doctors in developing countries do not easily have access to such resources. BLI would like to develop a low-cost head light that could be widely used. The light should be small (to fit in a pocket) and provide good illumination of a 1-2 inch region of interest at a distance of 1-2 feet from the doctor's face.

Team 1: Daniel Gruver, Kyle Kelley, Joseph Kim, Mark Locascio

Team 2: Tommy Leung, Johannes Tan, Edwin Wright, Max Yi

Team 3: Andrew Cole, Daniel Pederson, Philip Seaton, Jakob Spjut

Team 4: Kevin Alley, Aurora Burd, Jacob Pinheiro, Gwen Yoshinaga

3:15 P.M. **Design of a Film Screening Room**
Galileo-Pryne Client: dA Center for the Arts
 Liaison: Michael Meyka

Initial Problem Statement: The dA center for the Arts has a basement space in which they would like to be able to screen films to small audiences. Because of the low ceiling clearance in the basement, a conventional front-projection system will not work well, so they will need to use a rear-projection system. Since a rear-projection screen must be located well away from a wall, and since the basement space is a multi-use space, the screen (or screens—they may want to have more than one for some multi-media events) should be on rollers or tracks so that it can be stowed away when it is not in use. They may wish to have some stowable room partitions for acoustic and aesthetic reasons as part of the equipment for the screenings.

Team 1: Jacqueline Ahmad, Henry Chen, Daniel Woo, Jeffrey Lin

Team 2: Sharon Jeun, Jasper Lee, Karen Lee, Maryke Neher

Team 3: Lindsay Allen, Kristina Knepper, Daniel Roche, Elliot Temkin

Mathematics and Interdisciplinary Competitions in Modeling Presentations—Beckman B126

3:15 P.M. **Michael P. Schubmehl, Wesley Turner and Daniel Boylan: "I'm Sorry, But We're Overbooked!"**

Historically, airlines know that only a certain percentage of passengers who have made reservations on a particular flight will actually take that flight. Consequently, most airlines overbook; that is, they take more reservations than the capacity of the aircraft. Occasionally, more passengers will show up for a flight than the capacity of the plane, leading to one or more passengers being bumped. We discuss a model for determining an optimal booking and overbooking strategy. This model takes into account the fact that not all passengers pay the same fare for the same seat, and allows various overbooking schemes to be evaluated in terms of their impact on the airline's revenue.

Faculty Advisors: *Michael E. Moody, Mathematics and Ran Libeskind-Hadas, Computer Science*

**"Return to the Moon: Stepping Stone to the Planets"—Galileo-McAlister
 Dr. Stanley G. Love '87, NASA Astronaut, NASA-Johnson Space Center**

7:00 P.M. Dr. Stanley G. Love '87 is the tenth and final speaker in this year's Dr. Bruce J. Nelson '74 Distinguished Speaker Series. Lecturers have addressed myriad topics relating to "Frontiers in the Exploration of Space" from September 2001 through May 2002 on the Harvey Mudd College campus.

8:00 P.M. **Humanities and Social Sciences Department Reception—Hixon Court**

Humanities and Social Sciences—Galileo-McAlister

8:30 P.M. **Music 127s: Screening of Final Projects—The Harmony of Sound and Light**

In the Harmony of Sound and Light, students explore the connections between music and abstract arts of color and space. For their final projects, students create mind-bending abstract computer animations with music. These videos will be publicly screened here for the first time.

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

