

FACULTY newsletter

CPMS Physical and Mathematical Sciences



As the holiday season is approaching, we wish you all a very Merry Christmas, and a happy New Year. Happy holidays from CPMS!

A Solid Model of Success



Above: Dr. Tom Sederberg, computer science professor and associate dean.

The College of Physical and Mathematical Sciences is proud to congratulate Thomas W. Sederberg, an associate dean of the college, for receiving the prestigious Pierre Bézier Award. This award is given by the Solid Modeling Association and is one of the highest honor a person can receive within the geometric modeling community.

To honor the achievements of Pierre Bézier, the award's namesake, the Bézier award is given to those who uphold the Bézier legacy. The award

recognizes research contributions of lasting, technological importance in the fields of solid, geometric, and physical modeling and applications. Sederberg was nominated for his revolutionary work on topics ranging from algebraic techniques and free-form deformation (FFD) to subdivision and T-splines.

"FFD is a technique I invented in 1985 that allows an artist to easily alter the shape of any geometric object defined in a computer," Sederberg said. "FFD

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General Motors Foundation Donates \$20,000 to CS Animation

The General Motors (GM) Foundation donated \$20,000 to the Brigham Young University Center for Animation on October 28, bringing GM's recent donations to more than \$90,000.

"For us, it's a token of our support to the program to continue to help fund the programs that are here and to provide some opportunity," Clay Dean, Director of GM Global Advanced Design, explained to the animation students. "We're wanting to make sure that you have the means to develop yourselves and to accomplish your dreams."

Dean shared his own design work from GM with students of the Center

for Animation—part of the Department of Computer Science—and then invited students to share their work.

Brent Adams, Director of the Center for Animation, expressed gratitude on behalf of the Center. "A lot of what we [have done] over the last few years has come because of support from the General Motors Foundation," he said.

The General Motors Foundation hopes that their investment will help further the careers of animation students who may work for GM in the future. "We're here to find leaders," Dean said. "We're here to find the truly creative; we're here to find people who provide



Above: Clay Dean, Directory of GM Global Advanced Design.

a different point of view—and it's fun to see how they develop."

Dean's own experience at BYU (BFA, Industrial Design) helped launch his

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BYU Alumna Sue Allen to Women in CS: "Go Geek!"



Above: Computer Science alumna Sue Allen.

A group of computer science students met with BYU alumna Sue Allen last Friday afternoon. Allen, a member of BYU's first graduating class of computer science (CS) students, discussed the image of women in the technology industry and the career opportunities that await them.

Allen worked as a programmer for five years to support her husband in grad school and then spent 23 years raising her children, where she applied

her problem-solving skills to everyday life; Allen even developed a program to organize PTA records for her kids' school district.

Allen discussed the images and stereotypes of CS students. "[CS] is not your whole life. Women in CS need to help define that and help broaden that," Allen said. She played band and traveled abroad in her free time; those who attended have various interests outside of the CS program as well.

Krista Purser, a senior in the animation emphasis, is also pursuing a minor in visual arts. "To be someone who codes but also knows how to make things look good is a big deal. There are a lot of jobs for things like that in the entertainment industry," Purser said.

Allen also inspired the young women to be role models. BYU's CS department currently has no female profes-

sors because so few pursue PhDs in CS, but Christine Kendall, president of BYU Women in CS, plans to change that. She wants to get a PhD specializing in human robotics interaction and then teach at BYU. "I feel like it's really important for girls to have role models they can look up to and someone who they can envision themselves becoming," Kendall said.

Knowing that BYU alumni such as Allen succeeded in CS helped Kendall see that "there are other women who have done it and [she] can do it too."

For more information about women in CS at BYU, visit womenin.cs.byu.edu.

by Madison Parks

Turning Up the Heat

Magnetic Resonance Imaging (MRI), a technique better known for its role in medical diagnostics, can now be used to image the temperatures inside a catalytic reactor.

Scott Burt and collaborators at UCLA developed an MRI technique that produces a temperature map of gases in heterogeneous reactions. Their work was published in the leading scientific journal, *Nature*, on October 23.

This is not the first time that Burt has developed techniques for obtaining images of microreactors. As a graduate student at UC-Berkeley, Burt and his colleagues demonstrated the first application of para-hydrogen to imaging heterogeneous microreactors.

"Louis Bouchard and I ran the initial para-hydrogen microreactor experiments together," Burt said. "After Louis started his research at UCLA, we continued to collaborate on the para-hydrogen project."

Burt and Bouchard developed a novel method to create temperature maps of the gas molecules in the reactor.

"This is the first time that MRI has been used to directly measure the temperature of the reacting gases," Burt said. "Being able to measure temperature at the gas-solid interface is huge."

The technique is novel because previous MRI techniques were developed for liquids or relied on tracer molecules. Curiously, the researchers observed trends opposite of current theories about the temperature dependence of the MRI signal. Bouchard is currently developing an exact theory for gases based on their findings.

The team originally submitted their results to *Nature* in the spring of 2012 and has been working for a year to provide additional control experiments and some basic theory. This publication, while a long-time coming, is an honor for the researchers.

"I think it's really exciting," Burt said.



Above: Chemistry professor Scott Burt.

"We have been working on this for several years. It's really gratifying to know that other scientists think this is as important and exciting as we do."

by Meg Monk

Announcements

Nominations for College Awards DUE in College:

Wednesday, January 15 at 5 p.m.

Nominations for University Awards DUE in College

Friday, January 31 at 5 p.m.

Faculty Profile Updates DUE to University

Friday, February 28 at 5 p.m.

Students Shine at Four Corners Meeting

The Department of Physics and Astronomy was well represented at this fall's meeting of the Four Corners section of the American Physical Society.

Around thirty students traveled with several professors to the conference in Denver on October 18 and 19 where they had the opportunity to present research and network with professional physicists. This year the Conference was hosted by the University of Denver and in 2014 it will be hosted by Utah Valley University.

Several students from Utah Valley University and Utah State University were also able to attend with the BYU group. Students enjoyed the opportunity to attend the conference, practice their presentation skills, and renew their enthusiasm for their studies.

"After two days I was exhausted from head to toes but immensely happy and with renewed energies and desires to become an astrophysicist," said Pamela Lara, a physics student from UVU who attended with the BYU group, and recipient of one of the two awards for best presentation of the meeting. Lara presented research performed last summer as a participant in the Research Experience for Undergraduates program at BYU.

This year the Four Corners section invited four Nobel Laureates to attend the conference and talk about their accomplishments.

"It's good for the students to see these people who have been recognized internationally for the level of their research and special contributions to science. It is nice for the students to be able to approach them and talk to them," said physics professor Victor Migenes, who attended the conference with the students.

Migenes explained that the conference is also an opportunity for both undergraduate and graduate students to showcase their research and practice their presentation skills.

"Having to justify and explain your



Above: Physics' annual Four Corners meeting took place at the University of Denver October 18 and 19.

research . . . is a wonderful experience for students to have at the undergraduate and graduate levels," Migenes said, adding that he has been very impressed with the quality of undergraduate presentations in the past several years.

Another award recipient, Physics major Derek Ostrom, decided to attend the conference on a whim. While he enjoyed the conference immensely and has already planned to attend again, his favorite part came when he was unexpectedly named one of the winners of the research poster session.

"It was definitely a surprise," he said. "We had been joking before that I definitely wouldn't win."

Physics professor Dr. Karine Chesnel has been attending the conference with students since she began teaching at BYU in 2008. Chesnel feels this regional conference is a good opportunity for students to have a first exposure to the broader physics research community outside the university, first experiences with presenting research to professors and students at other universities, and a great milestone before presenting at broader international meetings.

"Every year, this APS Four Corners meeting is a highly enjoyed opportunity for the students in my group," Chesnel said. "This year's conference, with inspiring presentations from Nobel laureates, was one of the best we have attended."

by Meg Monk

Upcoming Events

Annual College Awards Banquet
Friday, January 24 from 6 to 8 p.m. in WSC Ballroom

CPMS "3-Minute Thesis" (3MT) event for graduate students
Friday, January 31, 12:00-1:30 p.m.
3rd floor commons, Hinckley Center

STEM Fair Preview
Wednesday, February 12 at 4 p.m. in 1170 TMCB

STEM Career Fair
Thursday, February 13 from 9 a.m. to 3 p.m. in WSC Ballroom

University "3-Minute Thesis" (3MT) event
Wednesday, February 26
<http://gss.byu.edu>

2014 Utah Conference on Undergraduate Research (UCUR)
Friday, February 28
Register by Wednesday, January 15
www.UCUR.org

2014 Student Research Conference (SRC)
Saturday, March 15, JKB

College Grants

Mathematics

[Michael Dorff](#)

Sponsor: Mathematical Association of America (NSF)

Title: Preparing Mathematical Sciences Students for Business, Industry, and Government Careers (Pre-BIG)

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is now used in almost all major computer aided design and computer animation programs. T-Splines is a technology for defining free-form surfaces that I invented in 2003. My son and some of my students formed a company to commercialize it, and the company was purchased by Autodesk in 2011."

These processes can be applied to many items that are used in everyday life.

"Most of my research focuses on geometry for use in computer graphics or computer aided design," Sederberg said. "Nearly everything you see in a Pixar animation involves a geometric description. Likewise, nearly every car, airplane, or consumer product is created using computer aided design, and geometric shape description is at the

heart of those designs."

Sederberg received this award on November 12 at the Society for Industrial and Applied Mathematics (SIAM) Conference on Geometric and Physical Modeling in Denver. At this conference, he also gave an invited lecture titled "The Pursuit of Beauty" that reviewed Sederberg's research contributions and the beauty that significant research results can often exhibit.

"I had not been able to attend many conferences for about seven years because my wife's health required me to attend to her," Sederberg said. "So it was particularly gratifying to know that my research has been appreciated even though I had not been able to attend conferences."

by Caroline Smith

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career at GM. "I look back to the opportunity that came to me," he said. "From my point of view, my influence within General Motors is to continue to push us in the directions and places—the non-conventional places to go—to seek for diversity in terms of the types of students."

Thanks to the generosity of the General Motors Foundation, the BYU Center for Animation will have additional funding to continue their quest to produce skilled leaders and animators.

by Eve Hart Smith



Above: Clay Dean discusses the importance of educational funding.

College Publications

Chemistry & Biochemistry

C.I. Rogers, J.B. Oxborrow, R.R. Anderson, L. Tsai, G.P. Nordin, [A.T. Woolley](#), "Microfluidic valves made from polymerized polyethylene glycol diacrylate," unpublished manuscript. Retrieved from <http://www.sciencedirect.com/science/article/pii/S092540051301191X>.

M. M. Konnick, S.M. Bischof, [D.H. Ess](#), R.A. Periana, B.G. Hashiguchi, "Base accelerated generation of N₂ and NH₃ from an osmium nitride," unpublished manuscript. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1381116913003920>.

J. Kister, [D.H. Ess](#), W.R. Roush, "Enantio- and Diastereoselective Synthesis of syn- β -Hydroxy- α -vinyl Carboxylic Esters via Reductive Aldol Reactions of Ethyl Allenecarboxylate with 10-TMS-9-Borabicyclo[3.3.2]decane and DFT Analysis of the Hydroboration Pathway," *Organic Letters*, 2013, volume 15/issue 21, pp. 5436-5439.

Q. Xu, H. Gao, M. Yousufuddin, [D.H. Ess](#), L. Kürti, "Aerobic, Transition-Metal-Free, Direct, and Regiospecific Mono- α -arylation of Ketones: Synthesis and Mechanism by DFT Calculations," *Journal of the American Chemical Society*, 2013, volume 135, pp. 14048-14051.

J. R. Shelton, [M. A. Peterson](#), "Efficient Synthesis of 5'-O-(N)-Carbamyl and Polycarbamyl Nucleosides," *Tetrahedron Letters*, 2013, volume 54, pp. 6882-6885.

B.L. Barney, R.T. Daly, [D.E. Austin](#), "A multi-stage image charge detector made from printed circuit boards," *Review of Scientific Instruments*, 2013, volume 84, pp. 114101 (1-6).

S. Kumar, J. Xuan, [M.L. Lee](#), [H.D. Tolley](#), [A.R. Hawkins](#), [A.T. Woolley](#), "Thin-film microfabricated nanofluidic arrays for size-selective protein fractionation," *Lab Chip*, 2013, volume 13, pp. 4591-4598.

K. Liu, [H.D. Tolley](#), J.S. Lawson, [M.L. Lee](#), "Highly crosslinked polymeric monoliths with various C₆ functional groups for reversed-phase capillary liquid chromatography of small molecules," *Journal of Chromatography A*, 2013, volume 1321, pp. 80-87.

Geology

[J. Radebaugh](#), "Dunes on Saturn's moon Titan at the end of the Cassini Equinox Mission," *Aeolian Research*, volume 11, pp. 23-41.

L. Burgener, [S. Rupper](#), L. Koenig, R. Forster, [W. F. Christensen](#), J. Williams, M. Koutnik, C. Mieke, E. Steig, D. Keeler, L. Riley, "An observed negative trend in West Antarctic accumulation rates from 1975 to 2010: evidence from new observed and simulated records," *Journal of Geophysical Research-Atmospheres*, 2013, volume 118, pp. 4205-4216, doi: 10.1002/jgrd.50362

Mathematics

[W. Barrett](#), S. Fallat, H. T. Hall and L. Hogben, "Note on Nordhaus-Gaddum problems for Colin de Verdiere type parameters", *Electron. J. Combin.* 20(3), 2013, 9 pages.

[W. Barrett](#), A. Lazenby, N. Malloy, C. Nelson, W. Sexton, R. Smith, J. Sinkovic, and T. Yang, "The Combinatorial Inverse Eigenvalue Problem: Complete Graphs and Small Graphs with Strict Inequality",

Electron. J. Linear Algebra. 26, 2013, pp. 656-672.

[J. C. Dallan](#), [E. J. Evans](#), [C. P. Grant](#), and [W. V. Smith](#), "Cell Speed Is Independent of Force in a Mathematical Model of Amoeboidal Cell Motion with Random Switching Terms", *Math. Biosci.* 246, 2013, pp. 1-7.

Physics and Astronomy

C. J. Howard, [B. J. Campbell](#), [H. T. Stokes](#), M. A. Carpenter, R. I. Thomson, "Crystal and magnetic structures of hexagonal YMnO₃," *Acta Cryst.* B69, 534-540 (2013).

Statistics

S. Kumar, J. Xuan, [M.L. Lee](#), [H.D. Tolley](#), [A.R. Hawkins](#), [A.T. Woolley](#), "Thin-film microfabricated nanofluidic arrays for size-selective protein fractionation," *Lab Chip*, 2013, volume 13, pp. 4591-4598.

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