



A Holiday Exploration  
at Harvard University:



*The Soap Bubble (c. 1739), Jean-Baptist Chardin*

# Scratching the Science of Surfaces

Saturday, December 14, 2002  
Science Center, Lecture Hall B



Sponsored by the Materials Research Science and Engineering Center (MRSEC), the Nanoscale Science and Engineering Center (NSEC), and the Division of Engineering and Applied Sciences (DEAS) at Harvard University.

# Program

## I. Experiments

The helpful glass rod

Paint brushes

Little drops

Water filled balloons versus drops

Solid surfaces are next

Floating and living on water

More strength than you think

Soaps make experiments different

## II. Conversations with visiting scientists

## III. A little bit about soap bubbles

### Upcoming Public Science Events

Saturday, February 15, 2:30–3:00 p.m. and  
Saturday, March 1, 2:30–3:00 p.m.

*Using Ultrashort Lasers to Manipulate Matter*  
by Professor Eric Mazur

Current Science and Technology Center  
Museum of Science, Boston  
[www.nsec.harvard.edu/calendar.htm](http://www.nsec.harvard.edu/calendar.htm)  
[www.mos.org/cst/](http://www.mos.org/cst/)

This lecture is modeled on a famous set of presentations given to children a century ago as part of the Royal Institution Christmas Lectures in London. It includes experiments in a tour of the forces associated with the surfaces that separate liquids and gases, and liquids and solids. The presentation is for ages 10 and up.

**Charles Vernon Boys** (1855–1944) was a physicist, inventor and outstanding experimentalist. He is best remembered for his marvelous book *Soap Bubbles*, which summarized his Christmas lectures at the Royal Institution in 1889–90.

**Agnes Pockels** (1862–1935) was born in Italy and raised in Germany. She conducted experiments in her home and measured the surface tension of liquids by using small buttons suspended from a balance. Her first scientific paper, published in *Nature*, followed her correspondence with Lord Rayleigh.

**Lord Rayleigh** (1842–1919) was one of the great scientists of all time. He worked in all areas of physics, including the topic of this morning’s presentation. In 1904 he won the Nobel Prize in Physics for his discovery of the inert gas argon (argon is Greek for “inactive”).

**Benjamin Franklin** (1706–1790), statesman, scientist, printer, inventor, etc. was a remarkable person who played crucial roles in the foundation of the United States. Although born in Boston, Philadelphia is considered his home. He was even a musician and built his own glass armonica, which generates sound by touching the edge of a spinning glass with wet fingers.

### Literature

1. *Soap Bubbles*, by Charles V. Boys
2. *The Science of Soap Films and Soap Bubbles*, by Cyril Isenberg
3. *On the Surface of Things: Images of the Extraordinary in Science*, by Felice Frankel and George M. Whitesides

### Links for more information:

[www.rigb.org](http://www.rigb.org)  
[www.mrsec.harvard.edu](http://www.mrsec.harvard.edu)  
[www.nsec.harvard.edu](http://www.nsec.harvard.edu)  
[www.eduprograms.deas.harvard.edu](http://www.eduprograms.deas.harvard.edu)  
[www.deas.harvard.edu](http://www.deas.harvard.edu)

The Materials Research Science and Engineering (MRSEC) and the Nanoscale Science and Engineering (NSEC) Centers at Harvard University actively promote education for undergraduate students with interests in the fields of materials science, chemistry, physics, engineering, biology, and geology.

Thanks to Linn Eichler, Renate D’Arcangelo, Maureen Armstrong, Xiao-Ping Liu, and the members of the Women in Science Program.

**Meghan Walbran** is currently teaching Advanced Placement and College Preparatory Physics at Marblehead High School in Marblehead, Massachusetts. She received her B.S. in physics from the University of Dallas in 1999. While at UD she participated in an REU (Research Experience for Undergraduates) program and for the past two summers has participated in our Center's education and research activities, including the preparation of today's Holiday Lecture, as part of our Research Experience for Teachers (RET) program.



**Daniel Rosenberg** (with hammer) and **Nils Sorensen** (sandwiched) are two of the talented lecture demonstration team in the Science Center whose creativity is on display each day in these lecture halls to elucidate the principles of science. Nils began the Holiday Lecture planning, working closely with Meghan Walbran and Howard Stone; he returned this semester to teaching high school physics in upstate New York. Daniel Rosenberg '84 is a Harvard College graduate and a chemist. Daniel and Nils have applied their passion for science in other venues such as the Ig Nobel Ceremony (shown left) held on campus.



Photo by Joe Chao, Harvard Gazette

**Howard Stone** is Professor of Chemical Engineering and Applied Mechanics and Harvard College Professor in the Division of Engineering and Applied Science at Harvard University. He holds degrees in Chemical Engineering from the University of California at Davis (1982) and Caltech (1988). After a postdoctoral position at Cambridge University, he joined the Harvard faculty in 1989. In 1994 he received the only two teaching awards given to faculty at Harvard University.



Photo by Eric Rhee, Harvard Gazette

**William Meikle** has spent more than twenty years being someone else to the satisfaction of his purse, prosperity, and sense of well being. By bona fides he has in two times garnered two Emmy awards. He is a noted thespian who has appeared in numerous venues in New England and nationally.



**Dudley Herschbach** is Baird Professor of Science at Harvard University. His teaching includes graduate courses in quantum mechanics, chemical kinetics, molecular spectroscopy, and collision theory, as well as undergraduate courses in physical chemistry and general chemistry for freshmen. He is engaged in several efforts to improve K-12 science education and public understanding of science. He has received many awards, including the Nobel Prize in Chemistry (1986), jointly with Yuan T. Lee and John C. Polanyi, and the National Medal of Science (1991). He was named by Chemical Engineering News among 75 leading contributors to the chemical enterprise in the past 75 years (1998).



**Robert Graham** serves as Director of the Gordon McKay Laboratory of Applied Sciences as well as Assistant Director of the Materials Research Science and Engineering Center (MRSEC) and Nanoscale Science and Engineering Center (NSEC). His background is in mathematics, physics and chemistry and he has received the Bok award for his undergraduate teaching from Harvard College.



### Invitation to Science Teachers

This lecture was developed with the assistance of Meghan Walbran during her Research Experience for Teachers (RET) activity at our Centers. If you are interested in participating in our RET summer program please contact us at: [eduprograms.deas.harvard.edu/reu\\_03ap.htm](http://eduprograms.deas.harvard.edu/reu_03ap.htm).