New England Section Newsletter

Volume 11 **Number 15** **Spring 2000**

2000 Spring Meeting of the New England Sections of the American Physical Society and the American Association of Physics Teachers

Rhode Island College, Providence Rhode Island, April 14 and15, 2000

The Spring 2000 Meeting of the New England Sections of the American Physical Society (NES/APS) and American Association of Physics Teachers (NES/AAPT) will be held at Rhode Island College (RIC), on Friday and Saturday, April 14 and 15, 2000. RIC is located in the Mount Pleasant section of Providence. The topics of discussion at the meeting are Physics, Industry, and Society on Friday afternoon, and Teaching Physics on Saturday morning. A reception and banquet will take place Friday evening at the Faculty Center.

The program for Friday includes Relation Between Academe and Industry by Dr. Peter Mumola (Zygo Corporation), Applications of Nuclear Physics to Interdisciplinary Research and to Industry by Dr. Jeff Schweitzer (Adjunct Professor, UConn), and Science in the New Millennium: Where Is Washington Headed? by Dr. Michael Lubell (Office of Public Affairs, APS). The after dinner speaker is Professor John Stachel of Boston University. We will have an Einsteinian time..

The program for Saturday has A New Approach to Authoring Interactive Curricular Material by Prof. Wolfgang Christian (Davidson College), The Teaching of Physics for Music: New Themes and New Audiences by Prof. George Gibson (UConn), and Physics for Allied Health Students by Prof. Howard Goldick (University of Hartford). Morning becomes afternoon during a round table discussion How to Increase the Interest of Students in Physics organized by George Rawitscher. The panel will be secondary school teachers and APS members.

To get to RIC from north or south, take circumferential route 295 to US 6 east. Exit at Killingly Street (RI 128), turn left and continue to end, turn right on Manton Ave and follow to traffic light, turn left at traffic light (uphill) onto Fruit Hill Ave, bear right at church. The campus north entrance is one half mile on right. Follow orange AAPT signs and look for greenhouse next to Clarke Science Building. From west, follow US 6

east to Killingly Street, then continue as described above. Registration will be in the Clarke Science Building starting Friday noon and starting again Saturday 8 am. Pre-registration by April 7 will avoid a late fee.

The local organizing committee is Peter Glanz (pglanz@ric.edu; pglanz@earthlink.net; 401 456 9644; Rhode Island College, Providence 02908). The co-chair for APS activities is George Rawitscher of UConn. The co-chair for AAPT activities is Doyle Davis of New Hampshire Community Technical College. The committee welcomes contributed and poster papers. Follow the usual rules for submission, specifying either Friday afternoon or Saturday morning. The national office of APS has requested an early deadline for electronic submission through them. Students who present papers will have their registration fee waived. For other information contact the people named in this paragraph. Fall 1999 Meeting at Colby College

The 1999 Fall Meeting of the New England Section of the American Physical Society was held at Colby College on November 5 and 6. The Friday afternoon session was on quantum technology and had two talks. William Wootters (Williams College) spoke on "Quantum Entanglement as a Resource for Communication." His topics were dense coding (a classical message using a quantum medium), teleportation (sending a quantum state using a classical transmission), and pooling data (classical, classical). Thomas Weinacht (U of Michigan) spoke on "Coherent Control of Atoms and Molecules," describing two experiments he has done as a member of Phil Bucksbaum's group. The first, sculpting of wave functions, uses ultrafast (100 fs) laser pulses with programmable pulse shapes to alter amplitudes and phases of the various basis states to create a wavefunction with a particular shape. This technology is said to develop a "quantum register" for storing large numbers in one atom. The second, called "implementation of a genetic algorithm," is analogous to natural selection in biology. In it, increasing the fitness of a shaped laser pulse (with respect to its selectable shape) is used to achieve a certain desired experimental outcome. For example, one could activate only a specific vibrational mode in a molecule or break one bond rather than another to control the path of a chemical reaction.

After the reception and banquet, the after dinner talk and slide program was given by Gary Chanan on "Phasing the Keck Telescope." There are two Keck telescopes on a mountain in the pleasant and happy air of the big island of Hawaii. Each one is huge and heavy and would suffer distortion under its own weight if it did not consist of a large number of identical sub-units acting together to obtain good images. This feature presents the problem of obtaining and maintaining the proper phase relations for each mirror within a telescope. The talk described this project and its successes. Phasing the two telescopes together is a different problem and, while it is being done, was not discussed.

On Saturday morning there were two invited sessions along with seventeen oral and poster presentations. The first invited session was on physics for elementary and middle schools. Bob Prigo and Gregg Humphrey (Middlebury College) described their program for pre-service and in- service education of elementary school teachers in western Vermont in a talk entitled "Physics, Inquiry, and Professional

Development K-8." From the many workshops they used, they conclude that to effect change in elementary teaching requires a sustained effort, more than fifteen years in their case. Steven Davis (Physical Sciences Incorporated) described several optics experiments using recently available red, green, and blue LEDs that are so bright they can be projected on a wall. Perhaps the most amazing experiment is modulating the beam with an AM radio and sending the light through a fiber to detector, amplifier, and speaker.

Two talks made up the second invited session. Lewis Rothberg (U of Rochester) spoke on "Organic Semiconductor Photophysics." He gave both the rationale behind looking to organic LEDs for flexibility and simplicity in materials processing, and then the experimental understanding of the superiority of organic molecules in solvents over those lying dried on a surface. Shelby Nelson (Colby College) spoke on "Organic Thin Film Transistors." She described progress she and her collaborator, Thomas Jackson (Penn State U), have made in creating and understanding organic field-effect transistors. While the devices are not yet practical (the gate voltages needed are still too large), advances have occurred and the charge transport mechanisms are being elucidated.

Charles Conover, Chair
Department of Physics
Colby College

What Else I Learned About Maine

Maine entered the Union in 1820 (our twenty third state). Mainers are called "Down-Easters", although they are "up" from the other 47 contiguous, a term going back to the days when Maine was officially part of Massachusetts and the only way to get there was by sailing down the prevailing west wind. It happens that Colby is older than Maine in that the college began before 1820 as one of the several in Massachusetts when Massachusetts was really big. The college started in what is now downtown Waterville and moved to its present expanded location.

If you travel several times from meetings in central Maine back home to eastern Connecticut, you learn how easy it is to pass through New Hampshire. In fact, you might say it is mandatory to do so. A bit out of the way, but well worth it, is Manchester NH, home of the Currier Gallery of Art, a splendid place. The weekend the Colby meeting ended was the one the Maxfield Parrish exhibit opened. I am an unabashed fan of his sparkling art. Among his subjects, he painted both his teenage daughter and his girlfriend nude, but not his wife. This exhibit is soon at the University of Rochester. It then travels for the warm months to the Brooklyn Museum of Art.

A Bit of Language

In the preceding issue of the newsletter, I quoted a silly statement I heard on Public Radio. The programs of the Chicago Symphony Orchestra are taped by WFMT and replayed around the country. They don't have

commercials but they do have announcements, like this one: "Energy. It's more than a force. It's power, the power to build economies." It is instructive to render this line in other languages. Commonly used German employs the same word for force and power. Energie = energy, no problem. But Krafteinheit = unit of force, Kraftfeld = field of force, Schwerkraft = force of gravity, Kraftantrieb = power drive, Kraftwerk = power plant, Kraftquelle = power source, Kraftverbrauch = power consumption, Kraftmesser = dynamometer (one version anyway). Macht also means force or power. Both Kraft and Macht have many English equivalents, but Kraft suggests strength (perhaps athletic) and Macht suggests might (perhaps military). The things you learn.

DM

Whatever Happened to Schrodinger's Cat?

Whatever happened to Schrodinger's cat? We used to locate him just like that.
He might be off chasing a bat or a rat. Whatever happened to Schrodinger's cat?

He probably occupied here and there. He possibly occupied everywhere.
He didn't elude our persistent stare. He's vanished to vacuum or very thin air.
Whenever we managed to pin him down, he dashed as madly as a circus clown.
When we let him spread out all around, he settled in without a sound.

We liked to star him in experiments, especially those that made little sense.
Then suddenly they weren't so dense, as we gained lots of experience.
We relished the tests we had a choice in, the ones the cat had little voice in.
The nuke decay we took such joys in triggered the pellet that held the poison.

So whatever happened to Schrodinger's cat? Nine times he survived no matter what.
He may have grown thin or may be so flat that he's able to hide from all eyes we have got.
The tenth try might be the one to get hot. What in the world is with Schrodinger's cat?

PDQ

The World In a Few Books

The Story of a Number by Eli Maor, Princeton University Press
A History of Pi by Petr Beckmann, St. Martin's Press
The Nothing That Is (A Natural History of Zero), by Robert Kaplan,

As a teenager, I went around crowing about a wonderful discovery I had made. Of course, it was not at all new in the history of the world but to me it stirred a passion. No, it is not the primal entry into adulthood that causes youngsters to suspect their own parents. I was mathematically mature but socially -- let's not go into it. My newfound revelation is expressed: e to the i pi plus one equals zero. I chanted it the way some people go ommmmmm.

All who read this newsletter know that this compact and revered formula was developed by Euler from an insight of De Moivre. It contains the most important mathematical objects and procedures: e, i, pi, 1, and 0, along with equality, addition, multiplication, and exponentiation. Kasner and Newman, in Mathematics and the Imagination, declare: "It appeals equally to the mystic, the scientist, the philosopher, the mathematician." They could have added the kid who knew trying out for the Yankees was out of the question.

The three authors are quite different in style but similar in their wideranging interests. Maor is artistic in much of his language. Some of his applications of math include molluscs and flowers (nature's artistry) and folk decorations and Escher's sophisticated patterns (mankind's artistry). He discusses musical intervals in various traditions. Beckmann's prose is more athletic. Often it has the directness of a police interrogation. He presents more rigor in his proofs or outlines of proofs, demanding a great deal of the reader. He relates the history of math to the political events of the last few thousand years, while showing that military conquest and religious fanaticism have been incompatible with intellectual accomplishment. Kaplan is the most literary of the three. There is poetry in language and in sensibility in his writing. He tries the hardest to get into the minds of his subjects: the Mayans, for example, who independently invented the zero and used it to develop a most unusual counting scheme, astronomy, and calendar that fit into their worldview. Try doing math using Roman numerals; the Romans couldn't.

Through these books we learn which problems survived many centuries and traversed most continents. Squaring the circle and working out the value of pi are two classics. The first is impossible (if limited to compass and straightedge), and the second requires successive approximations (excellent ones using highspeed computers). Uninformed amateurs are still submitting solutions to the first to journals (understandably not accepted). Hordes of hackers are contributing to the millionth (or is it the billionth?) digit of pi. Another chestnut is the world's largest known prime number, which changes more rarely but in larger steps than the number of McDonald hamburgers consumed.

We learn the biographies of mathematical dynasties. Most notably, several generations of Bernoullis take center ring in the family circus. In their case, family feud is more like it, in that they tried to outcompete and even undermine their own brothers and sons. It worked in a sense. No family made more contributions than theirs. But think of how they might have done, had they cooperated and reinforced one another. The most successful recent sit-com on network TV was avowedly about nothing. In

their mock interview with NBC executives, while trying to sell their idea of a sit-com, the characters of Seinfeld boast "it's about nothing." Kaplan shows that the world needs even less than a grain of sand. It needs the nothing of a zero.

DM

Section Advisor's Report on the Fall 1999 APS Council Meeting

The Council Meeting was held in Seattle on November 14, 1999. Perhaps the item of greatest interest for our Section is the proposed reduction in the size of the National Council. Part of the change adopted by the Council would replace the current five nonvoting section representatives by two voting representatives. The manner of selection of these two is still not set, and the proposal will take effect only after procedures implementing the needed constitutional changes are completed. So for the next two Council meetings in 2000, I expect no real changes in how we operate. Thereafter NES and other sections will continue to fill the office of Section Advisor to the Council, as we are doing, but that person will be a voting member (for a four year term) only when it is our turn to hold that office. In other years NES will send that rep to the Council meetings as an observer, perhaps not seated at the same table as the Council members.

The Council, on behalf of the APS, adopted a resolution expressing grave concern about the decision by the Kansas Board of Education removing references to the Big Bang and to evolution from its State Education Standards and Assessments. The text of the APS resolution is found on the APS web page under **/statements** , where you will also find an APS statement "What Is Science?" adopted at the meeting. Memorial minutes were read to mark the passing of Arthur L. Schawlow and Rep. George E. Brown, Jr. A motion urging the timely completion of the Spallation Neutron Source also passed.

A matter of interest to many of us is that the APS has decided to establish a differential pricing scheme for its journals for institutional subscribers, based on the Carnegie classification of institutions. Because large institutions like LBL, with many users on line and otherwise, would benefit more from a subscription, they will be charged more than a small college with fewer users. Individual subscription prices are not affected by this policy change.

K. Jagannathan, Section Advisor

A Celebration of Martin Klein

Last June, after 32 years as a Professor of the History of Physics at Yale, Martin Klein retired from active teaching. This spring the Yale Physics Department is organizing "A Celebration of Martin Klein" to honor Martin for all those years of excellence in service and scholarship. We are planning a two-day symposium at Yale on Friday and Saturday, April 14 and 15, featuring 8-10 speakers, colleagues of his from the History of

Science, and including a reception and dinner on Friday night at the New Haven Lawn Club. The present list of speakers includes Diana Barkan (CalTech), Jed Buchwald (MIT), Peter Galison (Harvard) (to be confirmed), Gerald Holton (Harvard) (to be confirmed), Russell McCormmach (Oregon), Alan Shapiro (Minnesota), Daniel Siegel (Wisconsin), and Roger Stuewer (Minnesota). Individuals interested in attending any part of this Celebration should consult the Yale Physics Department WebPage (**www.yale.edu/physics**) and then follow prompts to "calendar and upcoming special events," or else go directly to **www.yale.edu/physics/special.cfm** . The details of this symposium and celebration should be posted at the cited site before end of February. One may contact **diane.altschuler@yale.edu** or **peter.parker@yale.edu** directly.

Peter Parker, Yale University

News From APS News

Alan Chodos of Yale is the new Editor of APS News. He is replacing Barry Ripin in the position of Associate Executive Officer of The American Physical Society. He will move from New Haven to the Washington area. David Markowitz of UConn will have a column in APS News.

Mathematics of the NCAA Basketball Tournament

We will soon applaud, endure, ignore, or lament "March madness." I am not concerned with the grace, intensity, or strategy of play. Nor is my subject the manly art of sitting through a triple header, ignoring fire or flood. But how about the numerics of the tournament scheme?

There are 64 teams arranged in four equal regions. It is significant that these numbers are powers of two. The NIT version (a sort of consolation) has 48 teams and loses the pretty symmetry of the larger array. (If you do not know what these initials stand for, imagine how the typical fan would react to QCD or TOE.) There are as many rounds of play as are needed to establish the national champion. In each round all teams remaining unbeaten play. Thus it is single elimination. Teams are ranked in each region from 1 (the best) to 16 (the worst). The idea is to give the presumably best teams the chance to play each other at the end of the tournament. (Remember 1 is high and 16 is low.) The men's NCAA and women's NCAA tournaments have identical structures. The patterns are gender neutral.

The entire scheme is laid out in advance. It is independent of who wins. The first round in each region pits the highest and lowest ranked teams, the next highest and next lowest, and so on. Gauss at the age of four would have seen instantly that the sum of the ranks of each pair of opponents is 17. Half the teams are eliminated in the first round. In the second round the winner of 1 vs 16 plays the winner of 8 vs 9, and so on. If the higher ranked team wins each game (almost always when it is 1 vs 16, half the time when it is 8 vs 9), then the new sum of ranks is 9. Play proceeds in this way from the round of 32 to the "sweet sixteen", to the

"elite eight", to the "final four", the first round in which regional survivors play each other, to the championship game.

There is a fast (elegant, Gaussian) way and a slow (plodding, non-Gaussian) way to answer questions like these: How many games are played? How many games does the national champion win? What is the minimum sum of ranks of a pair of opponents in each round? Here is a hard one for your computer to figure out. If the relative probabilities of opponents winning a particular game is inverse to their respective ranks, what is the probability a given number one team will play in the final four? What is the probability all four final teams will be number ones?

Here is something for you to puff on. Usually some of the best and some of the almost best teams make it to the final four. But sometimes a lower team, called a Cinderella, accomplishes a few upsets to win the whole thing. At any rate, there is the phenomenon called the office pool. Anyone wishing to enter pays the fee. You then choose the winner of each game, and this is important, before the first round of the tournament. Each result you get wrong costs you a (negative) point. You lose a bunch if a team you pick to stick around blows the first round. Do you select all the favorites or do you bow to personal sentiment? (I have not exercised any sentiment in my selections, and I have not won yet. The tournament has been going on for a very long time.)

DM

NEW ENGLAND SECTION EXECUTIVE COMMITTEE MEMBERSHIP 2000

June Matthews, Chair
Physics Department
MIT
Cambridge, MA 02139
(617) 253-4238
FAX (617) 253-5440
MATTHEWS@MITLNS.MIT.EDU

Harvey Gould, Vice Chair
Physics Department
Clark University
Worcester, MA 01610
(508) 793-7485
FAX (508) 793-8861
HGOULD@PHYSICS.CLARKU.EDU

John Calarco, Immediate Past Chair
Physics Department
University of New Hampshire
Durham, NH 03824
(603) 862-2088
FAX (603) 862-2998
CALARCO@UNH.EDU

Kannan Jagannathan, Section
Advisor -2001
Department of Physics
Amherst College
Amherst. MA 01002
(413) 542-2346
KJAGANNATHAN@AMHERST.EDU

Laurence I. Gould,
Secretary/Treasurer
Physics Department
University of Hartford
West Hartford, CT 06117
(203)768-4307
FAX: (203) 768-5244
LGOULD@MAIL.HARTFORD.EDU

David Markowitz, Newsletter Editor
Physics Department U46
University of Connecticut, Emeritus
Storrs, CT 06269-3046
(203) 486-4286
FAX: (203) 486-3346
DM@PHYS.UCONN.EDU

Peter K. Lemaire, Member-at-Large
97-00
Department of Physics
Central Connecticut State
University
New Britain, CT 06050
(203) 827-7341
FAX (203) 827-7877
LEMAIRE@CCSU.CTSTATEU.EDU

George Rawitscher, Member-at-Large
97-00
Physics Department
University of Connecticut
Storrs, CT 06269
(203) 486-4377
FAX (203) 486-3346
RAWITSCH@UCONNVM.UCONN.EDU

Jefferson Strait, Member-at-Large
1997-2000
Department of Physics
Williams College
Williamstown, MA 01267
(413) 597-2008
JSTRAIT@WILLIAMS.EDU

Nalini Easwar, Member-at-Large
1998-2001

Department of Physics
Smith College
Northampton, MA 01063
(413) 585-3887
NEASWAR@SOPHIA.SMITH.EDU

Steven Davis (Temporary)
Physical Sciences Inc.
20 New England Business Center
Andover, MA 01810
(508) 689-0003
SDAVIS@PSICORP.COM

THE LAST BANG or Where Have All The Gaiim Gone?

In the last The Last Bang I reported my disappointment with the book The Third Culture by John Brockman. This culture consists of those scientists and other empirical thinkers who are replacing traditional intellectuals (the ones in humanities) as spokespersons for our world. The world they bite on ranges from the smallest sub-unit of matter, energy, and information to the vast reaches of everything that's out there. That's too much to chew, and the folks sitting at the same table don't seem able to converse meaningfully. Not a successful dinner party.

Among the grand ideas tossed from one to another is "Gaia" or "Earth is an Organism." This was originally proposed by James Lovelock in Gaia. A New Look at Life on Earth (1979) and The Ages of Gaia. A Biography of Our Living Earth (1988), both Oxford University Press.

I ran across this idea again in Margaret Wertheim's Pythagoras' Trousers. God, Physics, and the Gender Wars. Her subject is large, with the organismic Earth a small part of it. In a few words, Mathematical Man has injured women and the rest of the world. It will take a transformation in the way science is done to turn things around. In her final chapter, The Ascent of Mathematical Woman, she tells how that may be done. Physics lags behind chemistry, which lags behind biology, in trying to take the turn. Regarding biology (with italics hers) she says:

> Above all, since women have come into the field they have altered the culture of biological science so that not only women, but also men, seek to understand the organic realm in new ways. James Lovelock, the architect of the Gaia theory of the earth, is an excellent example. A colleague of Margulis, Lovelock has developed a view of the entire biosphere as a single holistic organism, which he calls Gaia. The Gaia theory proposes that not only all animals and plants, but also the atmosphere, the oceans, and the soil, are bound together in complex webs of interdependency. This way of seeing has led to important developments in the scientific understanding of chemical cycles in the soil, water, and atmosphere. The point is that when significant numbers of women participate in a science they alter the intellectual climate so that some practitioners of both sexes are enabled to see in new ways.

There is a lot to swallow here. Gaia is an Earth Goddess, but is the theory feminine? Masculine, feminine, or neuter, is it at all correct? Is the Earth a single organism? I chatted with some of my colleagues, and the most common suggestion is that Lovelock actually says the Earth is like a single organism. There is a world in a word.

Now I don't want to get off on a rant here, but being a single organism is a model whose validity can be tested. It's not so bad to be wrong. Being like a single organism is a metaphor (a simile, according to my English teacher) which has no scientific standing. It is bad to be trivial. Sure, being like an organism implies a complex open system with feedback loops. In that sense, my bridge club is like an organism, and so what?

I'm afraid I'm much more with Flannery O'Connor on this one than I am with James Lovelock. That remarkable author of fiction was the most devout Catholic, hence an inhabitant of a totally different Hilbert space from mine. But there is a matrix element connecting the two: her writing. She was asked in an interview whether Catholicism, her only subject, was metaphor or literal truth. Her response was that her Catholic faith knew only literal truth. She continued: "If Christianity is nothing more than metaphor, then I say the hell with it." If the Earth is an organism and we cherish organisms, then we work to preserve it. If it is like an organism, why bother? Of course, that's just my opinion. I could be wrong.

DM

Extras

Some sayings for ultramodern times

- A meal without wine is like a day without email.
- I am improving my hand-icon coordination.

It cannot fail to occur to the reader of this newsletter that there are two spaces available for your name and documentation to appear with the implication you will accept the duties and associated prestige that go along with it. We hope that volunteerism is alive and thriving in the New England Section of The American Physical Society.

New England Section Home Page **Units Home Page** **APS Home Page**