

# AMERICAN PHYSICAL SOCIETY

## *New England Section Newsletter*

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### **In this issue:**

[1996 JOINT SPRING MEETING ANNOUNCEMENT](#)

[FALL 1995 MEETING AT BOWDOIN COLLEGE](#)

[SCIKU](#)

[ANGULAR MOM AND LINEAR DAD](#)

[VI](#)

[COMMENTS FROM CHAIRMAN GERALD PETERSON](#)

[NEWS FROM UCONN AND UMASS](#)

[GRABBING KIDS AND NOT LETTING GO: AN APS INITIATIVE FOR  
ELEMENTARY SCHOOL SCIENCE](#)

[FUNCTIONS](#)

[PHYSICS ENTERS THE MAINSTREAMS](#)

[REFERENDUM FOR MEMBERS](#)

[NEW ENGLAND SECTION EXECUTIVE COMMITTEE MEMBERSHIP 1996](#)

[PHYSICS, MUSIC, AND OTHER LANGUAGES](#)

[CONNECTICUT](#)

[THERE'S ALWAYS TOMORROW EXCEPT ONCE](#)

[THE LAST BANG](#)

### **1996 Joint Spring Meeting of the New England Sections of The American Physical Society and the American Association of Physics Teachers and Zone 1 of the Society of Physics Students**

The 1996 Spring Meeting of the New England Section of the American Physical Society will be held at the Massachusetts Institute of Technology, Cambridge, Massachusetts, on Friday and Saturday, April 26 and 27. This will be a joint meeting with the New England Section of the American Association of Physics Teachers and with the New England Zone of the Society of Physics Students. The APS plenary sessions will be held on Friday afternoon and Saturday morning. Each session will begin with talks suitable for all three (APS, MPT and SPS) audiences. In addition, there will be a pre-meeting tutorial session on Friday morning designed to introduce the physics in the plenary sessions to students, high school teachers, and other non-experts .

The topic of the Friday afternoon plenary session will be "Imaging." The speakers will be Will Happer (Princeton) on "Magnetic Resonance Imaging of Lungs with Laser Polarized

Gases," Michael Feld (MIT) on "Imaging Disease Inside the Body with Pulses of Light," Michael Crommie (Boston University) on "Imaging Two-Dimensional Electrons with a Scanning Tunneling Microscope," and Thomas Herring (MIT) on "The Global Positioning System." The topic of the Saturday morning plenary session will be "Relativity in Astrophysics: General and Applied." The speakers will be Nobel Laureate Russell Hulse (Princeton) on "The Discovery of the Binary Pulsar," Robert Kirshner (Harvard) on "Taking the Measure of the Universe," David Shoemaker (MIT) on "The Search for Gravitational Waves by Laser Interferometry" and Jacqueline Hewitt (MIT) on "Detecting Dark Matter with Gravitational Lenses."

The banquet for all meeting attendees will be held Friday evening, followed by an address by Philip Morrison (MIT) on "Solar Systems: Plural at Last!" Following the Saturday morning session we will offer a visit to the MIT-Bates Linear Accelerator Center, in Middleton, MA. Box lunches will be available and transportation will be provided. Upon arrival at the Center, participants will be given a tutorial overview of the 1-GeV electron accelerator laboratory and its research program in nuclear and particle physics, and will have the opportunity to tour the facility.

Contributed papers in any area of physics are solicited for oral or poster presentation on either Friday afternoon or Saturday morning. Abstracts of these papers should follow the standard APS format (see, e.g., pages M27-M28 in Section 2 of the January, 1996 issue of APS Meeting News). Authors should specify an oral or a poster presentation. Those who wish their abstracts to be published in the APS Bulletin must enclose a check for \$35 (made out to APS/NES). Abstracts should be sent before April 12, 1996 to: Ms. Anne B. MacInnis, APS/NES Abstracts, MIT-Bates Linear Accelerator Center, P.O. Box 846, Middleton, MA 01949. The local chair is Prof. June Matthews, APS/NES Local Chair, Room 26-433, MIT, 77 Mass. Ave., Cambridge, MA 02139, phone: (617) 253-4238, fax: (617) 258-5440, e-mail: [MATTHEWS@MITLNS.MIT.EDU](mailto:MATTHEWS@MITLNS.MIT.EDU).

### **FALL 1995 MEETING AT BOWDOIN COLLEGE**

The Physics Department at Bowdoin College hosted the annual Fall Meeting of the New England Section of the American Physical Society on October 6 and 7, 1995, with approximately 100 meeting attendants. The Friday afternoon session was on The History of Physics, celebrating the 100th anniversary of the discovery of X-rays and radioactivity. The speakers were Erwin N. Hiebert (Department of the History of Science, Harvard), Susan Quinn (author of "Marie Curie: A Life"), Will Andrewes (curator, Collection of Historical Scientific Instruments, Harvard), and Robert G. Arns (University of Vermont). A reception preceded the banquet dinner, and Guy T. Emery (Bowdoin) gave the banquet address on what ties the physics community together in "Centenaries, Communities, and Communication."

The Saturday morning session was organized around the theme of the Physics of Magnetic Recording Technologies. It provided a fascinating glimpse of the next steps in high density data storage, and the physics behind these improvements in technology. The

invited speakers were Mark Kryder (Carnegie Mellon Data Storage Systems Center), Mark Stiles (National Institute for Standards and Technology), and Jagadeesh Moodera (MIT Francis Bitter Magnet Laboratory). The weather and the first in a now-familiar series of threatened government shutdowns kept the organizers in Bowdoin's Physics Department on their toes up to the last minute, but both threats thankfully turned out to have minimal impact on the meeting.

*Dale Syphers*

## **SCIKU**

In absence of force  
a body maintains motion  
strictly unchanging.  
So, OK, then what?  
Well, next,  $F = ma$ .  
Elasticity precedes  
-boink -plasticity.  
Use antidises-  
tablishmentarianism  
in a haiku. Can't.

As stress grows larger  
so strain grows in proportion.  
There it is: we're hooked.  
Forgive, unforgive.  
That's what. Puff on that.  
Action, reaction:  
they're equal and opposite.  
Leaner than poetry.

## **ANGULAR MOM AND LINEAR DAD**

In all sorts of collisions where particles swerved, it's a safe bet that angular mom was conserved. Inventing invariants isn't the least bit bad, but what in the world could we mean by linear dad?

## **VI**

I would not countenance having another do my walking for me.  
I would not take the chance of having another do my talking for me.  
(True, I sometimes let my fingers do the walking and I sometimes let my voicemail do the talking, but that doesn't count.)  
It doesn't make very much sense to let someone do my drinking for me,  
But I exhibit virtual intelligence when I let a machine do my thinking for me.

PDQ

## **COMMENTS FROM CHAIRMAN GERALD PETERSON**

In these difficult times of diminishing resources for our profession, it is imperative that we join hands in regional cooperation at all levels. It is heartening to note that our forthcoming Spring Meeting at MIT is a move in this direction. This is to be a joint meeting with the New England Section of the American Association of Physics Teachers, as we have done in the past, but it also includes the Society of Physics Students. This should give us the opportunity to discuss our problems at various levels, from the points of view of the student, the teacher, the industrial and government physicist, and the academic research physicist. Our difficulties are clearly interrelated: The scarcity of academic positions, the overproduction of Ph.D.'s for the job market, the reduction of funding for research, the placement of B.S. recipients in industry, the lack of teachers trained in physics, the misunderstanding of science by the public, and many other problems in physics education. The list can go on and on. So I strongly encourage you to attend our Spring Meeting. Professor June Matthews and her organizing committee have developed a truly outstanding program. For those of you who are in a position to encourage student participation, I strongly urge you to do so. For graduate and undergraduate students, this meeting can serve as an introduction to the professional world of the physicist with all of its excitement, its challenges, its promises, and its difficulties.

Looking ahead, the Fall Meeting for 1996 will be held at the University of Vermont on October 19 and 20 with a program emphasizing condensed matter and biophysics. The Spring Meeting for 1997 will be held at the University of Maine and is tentatively scheduled for April 18 and 19. In an effort for industrial outreach with the important connection to physics education and the employment of physicists, the Fall Meeting for 1997 will be held at Hanscom Field

Your ideas about future directions and activities for your New England Section can be sent to me via e-mail at [PETERSON@PHAST.UMASS.EDU](mailto:PETERSON@PHAST.UMASS.EDU), or you can phone (413) 545-2008. Letters to the editor can be sent to David Markowitz, Physics Department, U 46, University of Connecticut, Storrs, CT 06269-3046, phone (203) 486-4286.

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In the feature article entitled [GRABBING KIDS AND NOT LETTING GO: AN APS INITIATIVE FOR ELEMENTARY SCHOOL SCIENCE](#), Jim Dolan of Southern Connecticut State University describes an APS science teaching initiative that addresses some of the concerns expressed by Gerry Peterson.

### **NEWS FROM UCONN AND UMASS**

Phil Mannheim and Ed Chang, professors at UConn in Storrs and at UMass in Amherst, respectively, have been performing an unusual exchange interaction. Rather than trading places for a period of time, they decided to be at the same place at the same time. They both spent the fall 1995 term at UMass, and now both are spending the spring 1996 term at UConn. At present Ed is working with Bill Stwalley's group at Storrs. Both investigators do research in astrophysics, Phil through his interest in high energy theory and Ed arriving via his interest in atomic processes. The two have also had teaching

duties at the other's institution. The arrangement allows each to learn the course structure and teaching methods of the other's department. This experience has resulted in suggestions for changes that may improve the effectiveness of some courses. An advantage of the reasonable geographical closeness of the two campuses is that the participants have not had to uproot their residences. Keeping your home is often a kindness to your family.

### **GRABBING KIDS AND NOT LETTING GO: AN APS INITIATIVE FOR ELEMENTARY SCHOOL SCIENCE**

In January 1995, I was lucky enough to attend the first week-long Workshop on Systemic Reform of Elementary Science Education given by the APS Office of Education, directed by Dr. Ramon Lopez. This was part of the Teacher-Scientist Alliance initiated by Dr. Lopez, who also does astrophysics at the University of Maryland. The Workshop was held in Washington and involved both elementary school teachers and administrators, as well as physicists and other scientists and engineers from around the country, about forty participants in all. The Alliance has already been described in some detail in both the APS Forum on Education newsletter for Spring 1995 and The APS News of December 1994 and March 1995. Its aim is to deploy physicists and other scientific professionals in activities that have proven potential for advancing science education at the district level. The first step is to prepare scientists to work effectively within the Alliance's very sophisticated and quite specific framework for systemic reform.

The January Workshop was focused on elementary school science, which is a departure for many academic physicists, who have more often been concerned with supporting high school teaching, where physics is a distinct subject. The objective for the Alliance is to support the classroom elementary teacher, who is still a generalist with responsibility for all subject areas. The college science background of these teachers varies a lot, but the vast majority have never taken any science beyond a one-semester non-mathematical survey course. Even in states that now require more science training for their teaching candidates, the requirement is merely to take one such survey course in each of the four traditional school science areas. The usual result is that these teachers simply omit science from what they teach. A typical figure for the time spent on science and technology in an elementary school classroom is about half an hour per week, which may be devoted entirely to science-related current events

When the commonly used science materials and curricula are examined, the omission of science from the schedule may be a blessing. This especially applies to the textbooks, which are generally worse than useless. There may be exceptions, but texts districts frequently buy are, first of all, wrong. Page after page. Not over-simplified. Wrong. Given the multitude of errors, perhaps we should be grateful that they are also boring and superficial so children refuse to read them at all. Mario Iona of the University of Denver has for years chronicled the blunders in school science books in *The Physics Teacher*. His monthly column is ample evidence that anyone hoping to improve school science using conventional textbooks has no chance.

There are other problems connected to the way districts manage their schools. In many places, closets are filled with dusty remnants of lab kits left over from the sixties, abandoned because there was no mechanism for replenishing the consumables or repairing broken apparatus. Scattered about the country are districts where superficial standardized tests pushed the curriculum towards memorization of science vocabulary. Other districts were pressured to use ineffective pedagogical approaches or to teach unscientific beliefs to support political or religious agendas. Some districts and universities have simply given up on the subject matter side of preparing teachers to teach science. Instead, they turn to the expedient of endless in-service methodology workshops, which has spawned a sort of industry that depends on continuing demand for these programs. The lack of useful content insures that the problems will persist; this is then used to justify more methodology workshops. Not that teachers don't need help with new methods -in fact, it can be just as wasteful to present pure subject matter without showing how it can be brought into the classroom. The most worthwhile teacher training programs include both and they have been very rare.

With elementary school science in such bad shape, I arrived in Washington extremely skeptical that anyone had any clear idea how to make progress. The Workshop totally changed my outlook. Not only were there intelligent strategies for positive change, there were actually places where they were working!

Among other things, the presentations, which were generally given by exceptionally skilled speakers, convinced me that grades 1 -6 are where the potential for effective reform is greatest. That is not to say that the need is greatest in those grades -the situation is probably worse in grades 7 and 8. However, it is on this level that both the need and the necessary resources are great. It is on this level that the children's curiosity can be stimulated most readily and also the time when it is most tragic and lasting if it is suppressed. And, while they are in use in few districts, there are excellent new materials for scientifically and pedagogically sound curricula.

The Alliance considers three programs to incorporate the necessary attributes of effective hands-on inquiry-based science for grades 1 -6: FOSS, developed at the Lawrence Hall of Science, Insights, from Education Development Center, and Science and Technology for Children (STC), developed by the National Science Resources Center (NSRC). Each is available in the form of prepackaged kits from commercial vendors. The aim is to give children the experience of learning science by doing science. It is simple science, science at the right level for the mind of a six year old or an eight year old or a ten year old, but it is science. The kits are fully complete, minimizing the need for the classroom teacher to bring additional supplies from home. Each unit kit is designed to provide about 8 weeks of activities on a single theme, like "Floating and Sinking" or "Magnets and Motors." Presentations on each of these three programs were accompanied by sessions in which we participants did some of the experiments or activities ourselves. They were impressive - substantive, interesting, enjoyable, well suited to the recommended grade level, and reasonably easy to set up and clean up. The parts were simple and durable enough for kids to use. Each of the programs has a well-balanced sequence of units that span biology, chemistry, physics, earth sciences and engineering. They get progressively more

sophisticated as the grade levels advance. This is the raw material on which a terrific science program could be built.

It is not mysterious why these kits are so good. They were developed by very capable people at well-funded organizations, that were able to spend years and millions of dollars on the project. The STC program is a good example. Its home organization, the NSRC, is a joint project of the National Research Council and the Smithsonian Institution. Each lesson in the program was reviewed not only by classroom teachers but by working scientists and pedagogical experts as well. Everything is field tested and revised and tested again. The tests avoided the dread "pilot program" study bias, that guarantees positive outcomes by testing only in hand-picked classrooms staffed by volunteer teachers enthusiastically committed to the approach being "tested." The project was also free of the "not invented here" curse. Clever ideas for experiments and apparatus have been adopted from older programs and merged with new insights into learning, along with more efficient approaches to teacher preparation and material management. This sort of comprehensive effort is probably beyond the means of even the largest districts or individual university departments. The old practice was to devote resources to creating home-made materials. Now it is more productive to introduce these highly refined kits into the schools, train the teachers to teach with them, and establish mechanisms to maintain the kits over time.

The in-service training of teachers to use the kits is one of the areas in which the Alliance seeks the direct involvement of scientists. It has a model for participation based on thoughtful analysis of past projects. It begins with a district that is committed to systemic reform and volunteer scientists in that district who wish to help the process succeed. Local lead teachers will be trained in the new curriculum; they will be the principal trainers for the other teachers. After completing a preliminary workshop to prepare them for their work, scientists will assist the lead teachers. The APS can assist with arrangements for the preliminary workshop, including providing mailing lists of APS members in the district to facilitate recruiting participants. This training process for classroom teachers is not a one-time event. Many districts have significant turnover of staff from year to year, so there will always be new teachers to be trained. Teachers also frequently change grade level; they will need to become acquainted with new units. Teachers also benefit from repeated opportunities to deepen their knowledge of the topics.

Scientists have other crucial roles to play at the district level. It is they who can best persuade school boards to move towards a hands-on curriculum. They now have a powerful tool for this work because the National Research Council has just released its final National Standards for Science Education. The final version is little changed from the draft released earlier for public comment. That document called for hands-on, inquiry-based science teaching to replace textbook-oriented passive science instruction, and described many changes that will be needed to make this possible. These recommendations followed a nationwide study of science education, involving thousands of teachers, many scientists, and all the major scientific societies, including the APS and the MPT. The ultimate document is a large, dense book which covers a huge range of issues connected with reforming science education from kindergarten through high

school. It is addressed to several different audiences, including teachers, administrators, school boards, university faculty, non-academic scientists, and the general public. There will be no enforcement mechanism to sanction applications of the Standards, no national review board or "standards police," just a very big book written by very smart people. Someone has to read this book and urge the local schools or state departments of education to take H -all of it -seriously. The hope, basically, is that you will. Here is what to do. Purchase the 262 page book priced at \$19.95 by the National Academy Press. Internet <http://www.NAS.EDU> or phone 1-800-624-6242.

Scientists in several districts around the country have made key contributions to building support structures for the use of hands-on materials. One example discussed at the Workshop was Huntsville, Alabama, where aerospace engineers and managers worked with University of Alabama faculty to create an infrastructure that refurbishes the kits for the surrounding schools. This insures that teachers can concentrate on teaching instead of scrounging supplies. This sort of mechanism has turned up consistently in the hands-on programs that have enjoyed long term success. Interestingly, several individual districts widely scattered through the nation independently arrived at this model for a centralized facility that collects the kits, replenishes consumables, makes repairs as needed, and warehouses a kit until it is returned to the classroom.

The Workshop participants spent one day on a field trip to the re-supply facility for the Montgomery County, Maryland, school system, and to several elementary school classes where kits were in use. This one day, complete with transportation by yellow school bus and peanut butter and jelly brown-bag lunches, was a spectacularly useful experience. It gave a clear picture of the investment, effort and organization required to implement a real science curriculum. It also made clear that it can be done. Moreover, districts need not create the structure and procedures for doing it from scratch. The main message that I took away from the Workshop was that a sound, demonstrably effective strategy for systemic reform exists, that there is help available for districts that want to apply that strategy, and that physicists need to be part of this process.

Although not part of the Workshop program, pre-service training of teachers is also a factor in the long-term prospects for wide-spread systemic reform. Those of us at colleges or universities with certification programs can support effective science teaching by offering hands-on inquiry based physics courses to education students. The lecture-based survey courses most of them take now are demonstrably less likely to lead to lasting understanding of the subject. An inquiry based approach can also give them direct exposure to the educational techniques that they should later use as teachers. The hands-on experience will make them more confident in setting up experiments and handling apparatus. This is also in line with the NAS Standards. At least two major projects have been undertaken to produce materials suitable for such courses: *Powerful Ideas in Physical Science* from the MPT and *Physics by Inquiry* from the University of Washington Center for Physics Education.

Here at SCSU, we are offering a course for elementary and middle school certification candidates that will meet for one class hour and five hours of lab per week. The

experiments will be drawn from several sources, including two complete units from the STC program. These units have been found to be informative for adult learners as well as middle school students. They deal with material that our pre-testing in conventional courses reveals very few freshmen know. An experienced teacher from the New Haven district will collaborate in planning and teaching the course. The SCSU students will make visits to her classroom to apply what they learn. For most of the students in this course, it will be the first time they put their own knowledge to work as teachers. We expect this to motivate our students to take full advantage of the course.

We will also host a year-long Dialogue program centered on the NAS Standards and their implementation. This is sponsored by Project CONNSTRUCT, Connecticut's NSF-funded Statewide Systemic initiative, administered by the Connecticut Academy for Education in Mathematics, Science and Technology. The Dialogue sessions will bring teachers from New Haven and other districts together with faculty from SCSU and other institutions, to hear experts and discuss issues raised by the Standards. We hope this will generate continuing collaborations to put the Standards into practice around southern Connecticut. We welcome the participation of scientists from other organizations in the Dialogue series. Anyone who is interested can contact me directly: Physics Department, Southern Connecticut State University, 501 Crescent Street, New Haven, Connecticut 06515; phone (203) 392-6453; fax (203) 392-6297; [dolan@scsu.ctstateu.edu](mailto:dolan@scsu.ctstateu.edu).

*Jim Dolan*

	)	
	y	
F(x,y)	,	F ( x , y )
A Regular Function	x	Expanding a Function
	(	
	F	
	A Singular Function	

### **PHYSICS ENTERS THE MAINSTREAMS**

Physics is in trouble. We need to be more like other groups in our society. Why the plural on "streams"? Can there be several majorities? As anyone knows who has put away a few sixpacks with friends, the outcome is at least a leftstream, a centerstream and a rightstream, of ideas and opinions. So let us join them.

The Legal Profession or Physics Discovers Advertizing: Don't get burned twice. Your experiment has failed to produce the desired result. It's not your fault. It's the equipment. It's the manufacturer. They didn't do the job. Sue them. Physics Legal Aid will handle your case. Remember, if you don't get paid, we don't get paid. And we always get paid.

The Medical Profession or Physics Discovers Billing: Someone has a sick experiment. That's your cue and a cue for all other physicists within hearing. You simply show up one morning, read the thermometer, and mail in a bill for two hundred dollars. It works like magic. And most patients recover. The insurance company pays and we all feel better.

Televangelism or Physics Discovers an Easier Route than Granting Agencies: You say you want to be saved from Darkness. You say you yearn for the Light. Verily, I tell thee thou canst learn Physics. Place the text (perhaps H is Halliday & Resnick in one of its New Testaments) next to your heart and lean your forehead upon the screen. With this hand I give assurance. You will learn Physics. Simply send your donation in any amount larger than you can afford, to me in care of this station. And remember, Physics loves you.

Major League Sports or Physics Discovers Free Agency: (Be careful; this strategy works best for twenty game winners or thousand yard rushers, in other words Nobel Prize candidates.) My client has worked through his contract and is now free to sign with any other school run by millionaires. So bid him up. Maybe when all bids are in he'll re-sign with the same school for ten times his former salary. Plus incentives. Multi-year offers only.

Talk Radio or I'd Rather Be Right Wing than Be Left Behind: You want to know what's wrong with physics? I'll tell you what's wrong with physics. It's all these folks saying there's something wrong with physics. That's what's wrong. They say Better Living Through Chemistry. I say Nonsense. Those people are cheminazis. It's physics; H's not chemistry. And you notice how they never agree with each other? But everyone who phones in agrees with me. Or I hang up.

The Hallowed Halls or Physics as a Social Science: So you believe that there is one Physics. But you're wrong. Consider this. Physics is heading for smaller and smaller systems. One atom in one cavity. It's isolating. Also colder and colder systems. Nanokelvins. It's impersonal. I'll tell you what it is. It's white male science. Now consider the opposite. Many atoms, the more the better. (New Age music begins to play in the background.) It's inclusive. It's nurturing. It's motherly. Of course, H could be a mother of any gender or color. Get in touch with your inner electrons. (Pardon me while I go wipe my eyes.)

The Gazillion Dollar Corporation or Physics Discovers Downsizing: (This is a story about, let's call H, James Monroe University as reported by National Public Radio.) The Physics Department was very large and probably very good, but the stock was a dud. Why was that? Maybe there were just too many guys nicknamed Bubba. So they fired half the team. Lo and behold, the stock doubled. A neat relationship. Maybe they should fire half the remainder. Maybe the stock will double again. Oh oh, trouble. Keep doing that and pretty soon there is an odd number of players. Should they cut the baby in half? Isn't that what King Solomon suggested? Or was H Jonathan Swift? I'm a bit rusty on that point. But I know what I want to do. I want to be the only one left and to be worth quadrillions. (After the first report JMU changed its mind and did not downsize. Instead

DUMMY did it. See Dummy Does Downsizing, NYT Feb 30. Also see The Oracle at Adelphi, same issue.)

Physics R Us or Ken & Barbie on the Other Side of the Hill: The two Action Dolls will soon be over 35 and have a career change to research physicists. Anatomically correct, Barbie has spread (she was a 10; now she's a 20) and forgotten how to dress, while Ken is slightly stooped (even at 35; it's been a tough life) and very nearsighted. Parents may purchase any of a number of miniature labs, including low temperature, MRI or nuclear reactor. Each one fills the floorspace of a typical child's bedroom and costs only one million dollars. These are shrunken 1996 dollars. In other words, tiny money buys tiny toys of comparable value.

Marketing or Physics Finally Learns How to Write a College Catalog Entry: (Physics 101, in competition with comparable courses of other science departments, is a Quantitative Lab Science Elective for non-science majors.) Students, listen up. You don't want to get acid burns on your clothes. You don't want to cut up frogs. You don't want to spend your days cracking rocks in the vain hope that the inside will differ from the outside or your nights freezing on the roof waiting for the clouds to pass so you can peek at the moon. I didn't think so. Take Physics 101. The objective is to learn a little useful science and get a grade you and I can both live with without either of us suffering too much. Sound good?

Telemarketing or Physics Discovers Matchmaking: Have I got a physicist for you? She's fresh out of school, our latest product. She programs in many languages. She builds equipment. She can pull a vacuum with the best of them. And don't worry, fans, she checks for hidden leaks and repairs them. But that's not all. Your ginsu physicist takes data, analyzes it, fits  $H$  to standard models. That's still not all. At the command WRITE she will type your paper meeting the requirements of PHYS REV. Attractive enough to be in your own home yet sufficiently durable for the laboratory, this physicist will make you the envy of your friends. And she is almost willing to share housework or babysitting 50/50. Make that 25/75 and you do the cooking. Not sold in stores.

Reader's Digest Condensed Books or Physics Discovers True Compactification: (And you thought physics did not waste words.) Momentum changes on impulse. Action, reaction? Equal and opposite. In a collision momentum conserved. Angular momentum too. Is it elastic? Kinetic energy survives intact. (By continuing in this vein, physics makes the foremost cultural discovery of the decade, which is that rap is a Reader's Digest Condensed Book recited to the beat of an overstimulated heart.)

TV Drama or Physics Discovers that PD Can Compete with ER: (The trouble with science lab is that nothing happens. TV packs ten lifetimes into a fifty minute hour.) Doctor, your experiment is on fire, your student's visa has expired, and your child has just been kidnaped. What should we do? (Doctor wipes his brow.) First of all, we remain calm. Second, we take a commercial break. PD will be right back. (Out of hearing.) Help!

TV Comedy or It's Just Your Typical Zany Physics Department: Two labs merge when the principal investigators collaborate. Each brings along half a dozen students and

suddenly the lab is overcrowded. All the students are naive and lovable. Half of them are accompanied by their pet dogs or iguanas. Everyone is wisecracking like crazy. It makes you realize what a great bunch we are.

Tv Game Show or How to Hold Student Attention: WHEEL OF JEOPARDY

It changes on impulse. What is  o  e  u  ?

According to Woody Allen it is 85% of life. What is  o  i  u  ?  
(Students do this whenever they attend class. The answer is not "growing up" since that would not apply to Woody Allen.)

The greatest woman in French history. Who was  o  i  ?  
(You write this one when you are doing nuclear physics. The students know whom you mean but they still can't answer H.) No, Joan of Arc was not, but yes, Maria Skladowska was.

(The next one is not physics but it is such a kick.)

olivia Newton-John sings for accountants. What is  e  '  e  i  a  ?

A closer and closer approximation to the truth. What is  i e  e ?

Things you learn that you are not responsible for on an exam. What is  u  u  e ?  
(Richard Feynman's definition.)

Magic explained. What is  y  i  ?

To Physics 101 students, a four letter word. What is  a  ?

Reset

The Olympics or Physics Discovers Paid Endorsements: The official theoretical and experimental science of the 1996 Olympics. It's in the heavens as it is on earth. Newton showed that very thing several centuries ago. So is H any surprise that physics is welcomed around the world? And don't bother to bring your American Express card. Physics, it's everywhere you want to be.

The Superbowl or Physics Discovers Media Hype: Well, Larry, it's countdown to the Nobel Prize in Physics. That's right, Moe, and while we can't mention names, I think we can make some predictions. First of all, there's the discovery of the God Particle. I know that God is taking a bow right now. And what about the offer no one can refuse? I mean the Godfather Particle. And most of all, the one we've been waiting for but we see only its precursor: the Godot Particle. Curly is in the locker room checking on the latest injury, broken symmetry. Come in Curly.

Sex or Physics Discovers The Joy Of: Quite a surprise, the JOY of sex. Who would have expected it? Imagine you are in your teens and H will take another dozen years of intense study to master sex. The years are filled with uncertainty. Sex is damn hard. It's not for everyone. You have to work long hours at H and neglect other things. Will you quality? And then what? Sure, you're good at it but will you get a job doing sex? Come on, gang, be realistic. What we need is The Joy of Physics. Lavishly illustrated, it will show all the positions by which you c~an go blind squinting at spectra.

The Movies or Physics Discovers Hollywood: (Not films because films are art and probably dull. No, we want movies.) Famous physicists should be as exciting as Indiana Jones or Bobby Knight. Let's take the Curies as done by the team of Merchant and Ivory. Since casting is one of their surprising strong points, as evidenced by North Dallas Forty playing Thomas Jefferson, I propose Kevin Costner and Whitney Houston as offbeat Pierre and Marie. Then she can sing the new hits "Polish and Proud", "I Love Paris in an Airless Windowless Lab" and "How Many Nobel Prizes Does It Take for a Woman to Enter the French Academy of Sciences?" Jody Foster and Winona Ryder portray the brilliant and beautiful daughter, respectively. Not to your liking? Vintage flicks are your passion? AMC will show Rock Hudson and Doris Day in LAB PARTNERS. His equipment fails and only hers can save the day. She reprises "Secret Love" while he mouths the words.

Speaking seriously, I do feel that the life of Richard Feynman would make a wonderful movie and that there are many actors who would play him at youthful and older stages of his life in a dynamic and touching way. My own choices include Matthew Broderick, Tom Hanks, Richard Dreyfuss, and with the most daring, Robin Williams. From Brighton Beach to the Big Bomb, from the Brilliant Brain to the ingeneous researcher and the unorthodox teacher, the Challenger disaster and its aftermath, I think Feynman is an unknown American hero who should be made known. I will write the screenplay with a prominent American playwright. Danny DeVito as GellMann. Score by Bruce Springsteen. It can't miss.

Musical Offerings or Physics Discovers Pop-Rock-Blues:

Woke up this morning and my vacuum sprung a leak.  
Yes I woke up this morning and my vacuum sprung a leak.  
Ain't no two ways about it, gonna lose another week.

And now the Republican Folksinger at only a thousand dollars a plate:

Got a situation here was never mine to choose.  
Those Democrats just haven't got the clues.  
So what if mama's sick and baby's lacking shoes.  
I got the everlovin frustrating unbalanced budget blu-u-ues.

Major Professional Athletic Tournaments or Physics Learns What's in a Name: Golf, tennis, and most other games (it's not a sport unless fans can yell while play is going on)

have events named for companies that produce Japanese cameras and Swedish cars. Same with football Bowls. My personal favorite is M & M's. Mmmm I'm willing to call my lab M & M. Face it, I'm willing to call myself M & M. There must be money in it and it won't melt in your hand.

Astrology or Physics Encounters the Daily Newspaper: (Can you believe the Hartford Courant?) If today is your birthday and you are reading this column, you're out of your mind. What are you doing? Get out, get a life, study physics. (Getting control over my word processor.) Energy will be conserved. Use it well. Entropy will be created. Try not to worry. Discoveries will be made. By someone. (This shows the strong resemblance between astrological divination and Chinese cookie fortunes.)

Famous Men or Physics Adopts Endorsements: Enrico Fermi models the new oversize lab coat. He looks like the don in PRIZI'S HONOR. The coat is called Air Fermi and it lets him hang glide and land safely. Next pointless skit Chairman trades banter with Fermi. "Rico, do you do research or teaching?" "Both." "Both?" "Both." (For this Fermi has to learn how to smirk.) "Rico, do you do theory or experiment?" "Both." "Both?" "Both." "Rico, do you do nuclear or condensed matter physics?" "Both." "Both?" "Both." "Rico, do we pay you 25,000 or 50,000 dollars per year?" "Both." (That's a wow.)

Geraldo or Physics Discovers Shock TV: Next on Oprah, kids who do their homework without hassling Mom and Dad. (Truly shocking.)

Grade B or Physics Discovers the Horror Movie: No one is scared of Friday the Thirteenth or a fun time like Hallowe'en. Imagine that Freddy and Jason come back to FINAL EXAMS. Nightmares guaranteed.

Lethal Weapons or Physics Discovers Violence: TERMINAL VELOCITY! 'Nuff said?

The Stock Market or Physics Adjusts to Adjustments: Your value has dropped. Not your worth, which is an intrinsic quality of your work. Your value is what an employer is willing to pay. A hitman has great value while on a job. No job? No value. When your value drops, that's a market disaster. When your colleague's value drops, that's a market correction. It's like the distinction between a dePression and a recession.

PDQ

### **REFERENDUM FOR MEMBERS**

The last page of this Newsletter contains a ballot which you may tear out and use if you wish to vote. The situation is this. Our Section by-laws prescribe a specific sequence of offices for the chief executive. The omces are Chair, then Pastchair, then Council Observer (aka Section Advisor), each for one year. The Observer represents the Section at the APS Council. It is a non-voting office. The Executive Committee of your Section feels strongly that a new method of election and a new duration for the Observer will

benefit the Section and will be fairer to members who would be happy to run for the office of Chair but are reluctant to commit themselves to the future office of Observer. The benefit to the Section is that a longer duration acting as Observer will place our representative in a stronger and closer position to the influence and importance that the Council has. Your Executive Committee would like this post to be served for a three year duration and that the seeker of this office be elected separately from the Chair and Vice-Chair. Any member of the Section is invited to vote by mail on this issue. The ballot is on the back page. Please do the following. Tear out your ballot and fill it out. Address your envelope to our Secretary, Laurence Gould, named on the list of the Executive Committee Membership in this Newsletter. Sign your envelope and include your address or institution as our check of your name on our membership list. We will dispose of the envelope before we tally votes.

As a separate request, whether you decide to vote, we seek suggestions and volunteers to run for office in the Section. We have had dedicated members for years who have worked for the good of the Section and the APS. We probably don't know most of our members who would do a fine job. Kindly inform any officer of your desire to serve.

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Space for your name  
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### **PHYSICS, MUSIC, AND OTHER LANGUAGES**

In "The Joy of Music" Leonard Bernstein wrote that Beethoven's symphonies have the quality of inevitability. By that he meant that the opening themes required the rest of the piece to fall into place. No note could be changed without harm to the whole. The same condition holds for a valid physical theory. Students in elementary physics fail to appreciate that the kinetic energy of a body is inevitably quadratic in speed. It could not have come out otherwise. (There are no accidents in physics. Accidental degeneracies? A misnomer.) Work-energy principles are the Beethoven symphonies of mechanics.

Legend has it, and Shaffer's play "Amadeus" suggests as much, that Mozart had an entire opera in his head before he wrote down a note. (Poor Salieri.) A legend has grown up around Feynman. Mark Kac is supposed to have said that Bethe was an ordinary genius, simply very much smarter than other physicists. You can imagine thinking of his ideas. But Feynman was not simply smarter than others. You cannot imagine the pathway to lead to his ideas. Possibly Feynman had all of path integral quantum mechanics in his mind before he wrote down a symbol. Call him the Mozart of physics. (Comedians declare that Robin Williams is on a plane above all others in their field. Perhaps they have the same reason in mind.) See "No Ordinary Genius" by Christopher Sykes, Norton Pub., 1995. It is likely that Stephen Hawking, partly out of necessity, is no ordinary genius.

Students in a basic physics course often express the belief that a fair test is one that has no problems they have not seen before. To try to dispel that notion, to which I do not subscribe, I inform them of Chomsky's finding that humans have the capability to utter statements they have not heard or read before. We invent what we say, except for parrots. See "Language and Mind" or "Syntactic Structures." It is a sizable step, but justified I believe, to assert that a problem a student has not seen is still fair if the student can use what has been seen to do it. Chomsky goes further with his idea that the human brain is wired for language. Is the human brain wired for math? On the subject, Chomsky has

identified in all natural languages studied a surface structure, essentially the meaning, and a deep structure, the syntax. "I eat food" means what it says, but the word relationships have a universal pattern. In physics an observation is at the surface. All observations are related in patterns called The Laws, the deep structure of physics.

Finally, a little wordplay. More and more, our language is inventing the retronym, which is a new name for an old object, necessitated by a new distinct instance of the object. The standard example comes from music. Formerly a guitar was called a guitar. Then came the electric guitar so the old instrument became an acoustic guitar. Physics is full of retronyms. What is classical physics other than a contrast with modern physics? The contrast with quantum is also classical. A normal fluid is not a superfluid. The normal Zeeman effect is not the anomalous kind. A superconductor could not be called type I until there was a type II. An interaction known as direct waited for one to be known as exchange. Did Newton know he was a classical physicist? Image Mozart saying he composed classical music.

*DM*

### CONNECTICUT

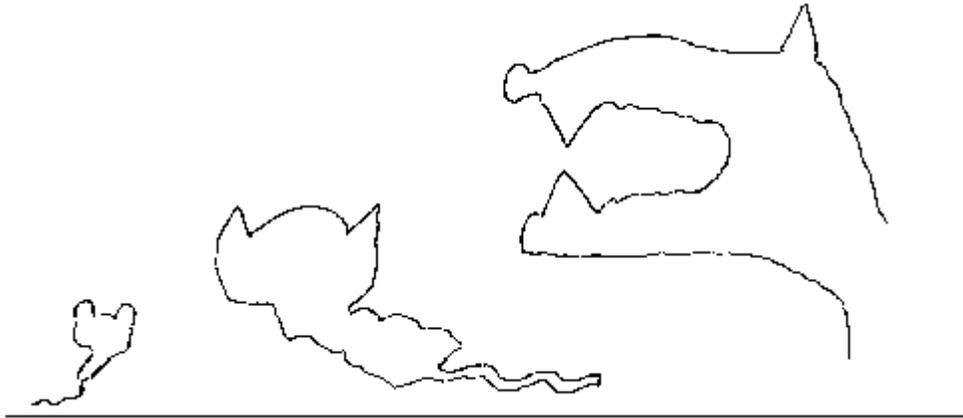
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### THERE'S ALWAYS TOMORROW EXCEPT ONCE

Schrodinger's cat was reading a book when I decided to have a look. The book was entitled "Tame Your Dog." It by and by gave my mind a jog. Wait a minute. Could it mean me? I wasn't about to wait and see. I chewed upon his left front leg, which soon swelled like an ostrich egg. The following day I gave a bite to the foreleg formerly on the right. Twenty-four hours later, oh dear, I clamped my jaws on a leg to the rear. The very next day right after that, I finished the job on the legs of the cat. Four days, four legs, and no more jumping. Still his heart kept up its pumping. The fifth and sixth his ears I chomped, the seventh day his tail I stomped. The eighth his nose I pulled apart, which didn't stop his telltale heart. Eight measurements for me to arrive at knowledge that he remained alive. The ninth was to be the one of note, the one where my teeth met with his throat. Nine lives is the most you get before your heart goes into debt. Starting with the day he died, I measured the state he occupied. Each time I questioned his heart, it said the state of the system was: It's dead. While you live, you have the ability to die with a certain probability. But we must have missed the rehearsal that showed us how to perform a reversal. I'm disillusioned with the laws that suffer from such basic flaws. How can there be no transition once your spiritus has gone fishin? I waited three days, then many more. Recording instruments kept the score. The world as it is could use a hero. So far, it's Death: one, and Long Life: zero.

## THE CAT RESPONDS:

My opponent is in for disillusionment. He overstated what my contusion meant. Yes, I was hurt. I won't deny it. Yet cats bounce back if they but try it. He did not take me all apart. Not everyone's a bleeding heart. My body processes I unwound until I had neither sight nor sound. This is a trick I learned in the East from a Yoga who knew how to tame the beast. If pooch had better eyes, I bet him that "Name Your Dog" would not upset him. Regret I'll save for another day. For now I'll just stay out of his way. Now I have premises so deep and lives to live before I sleep, Yes, many lives before I sleep.



PDQ

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## THE LAST BANG

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### HOMAGE TO THE CITY

**Distinguished University Massively Mismatched, whY?**

It's been one bang after another.  
You may wonder why the bother.  
Wintry discontents still stalk  
The son and daughter of New York.  
The president lives very well while ruling at his own insistence.  
Vice presidents have assistants to the assistants to their assistants.  
The greatest offenses cropping up on the campus stem  
From the illusion the world will miss physics less than the world will miss them.  
Regarding aforesaid son and daughter,  
Hasn't the almighty fixed his or her canon against such slaughter?  
And by the way, don't forget to read the signs  
That the other 15% of life is to park within the white lines.  
Now you know it all.

*DM*

