Physics & Society

THE NEWSLETTER OF THE FORUM ON PHYSICS AND SOCIETY, PUBLISHED BY
THE AMERICAN PHYSICAL SOCIETY, 335 EAST 45th ST., NEW YORK, NY 10017
PRINTED BY THE PENNY-SAVER, MANSFIELD, PA 16933

Volume 14, Number 2 **April 1985**

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PHYSICS AND SOCIETY is a quarterly newsletter of the Forum on Physics and Society, a division of the American Physical Society. The newsletter is distributed free to members of the Forum and also to physics libraries upon request. It presents news of the Forum and of the American Physical Society and provides a medium for Forum members to exchange ideas. PHYSICS AND SOCIETY also presents articles and letters on the scientific and economic health of the physics community; on the relations of physics and the physics community to government and to society, and the social responsibilities of scientists. Contributions should be sent to the Editor: John Dowling, Physics Department, Mansfield University of Pennsylvania, Mansfield, PA 16933, 717-662-4275.

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ENERGY SHORT COURSE (see page 8)

JOIN THE FORUM
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Membership free to APS members
Please write Peter Zimmerman at the above indicated address.

The Tenure Process for Female and Male Physicists

This is a summary of a longer article by Irene Hanson Frieze, Julia Thompson, and Elizabeth Baranger, Physics Department, U. of Pittsburgh, Pittsburgh, PA 15260. The longer article has been submitted for publication, the following summary appeared in the September, 1984 issue of the "Newsletter of the Committee on the Status of Women in Physics." For more information contact the authors at the above address.

Introduction

Women who are interested in science face many barriers to establishing a successful career as a scientist. They may not even take necessary mathematics and science courses in high school and college. Attitudes of other students and faculty further discourage those women who do enroll in such classes. Those who overcome these barriers may then face further difficulty in graduate school and in finding jobs after receiving their doctorates.

Recently there has been an increase of women who pursue doctoral degrees in the sciences, but equal early preparation and qualification still does not seem to guarantee equal later advancement. A conference dedicated to this question (Science **221**, 4618) concluded that salary, promotion, and tenure still lag for women and postulated that more limited opportunities to form mentorships and engage in collaborative work may account for some part of the apparent difference in productivity. In a 1981 survey of 1970–74 doctoral recipients, 68% of the men but only 47% of the women had reached tenured positions, while only 17% of the men but 32% of the women were still assistant professors.

The preceding remarks apply across all fields of science, but some comparable figures are known for women in physics. From a description by Roman and Czuiko on American Physical Society members in *Physics Today*, February 1983, and various American Institute of Physics statistical compilations, we note that only 1.5% of senior physics faculty are women. The salary differential between men and women at the full professor level is $1000, or 3% of the average salary. The median age of full professors is four years older for women than for men.

Because the "tenure gap" or increased time to tenure for women seems to reappear often, even for scientists of comparable scientific productivity and visibility late in their careers, this investigation has focused on career patterns of a matched sample of men and women: scientists who are in tenure-stream appointments or have received tenure in research universities. Because tenure is a crude selector for quality, and the men and women are matched by position at the same institutions, our samples of men and women are roughly equivalent in quality. We have not tried to fine tune this quality indicator but have instead studied career patterns, including breaks for child-rearing and moves to accommodate mutual careers in two-career families. Opportunity was given for open-ended comment to expand upon, explain, or take exception to the objective questions and answers which formed the bulk of the study.

Comparison of Tenured Males and Females

There were 46 tenured women and 127 tenured men in the final sample. All of the tenured physicists in the sample had Ph.D. degrees except two of the women. Seventy per cent of both groups were full professors. Ten per cent of the men and 2% of the women were department chairs or directors. Equal percentages of the women and men were in experiment and in theory. Relatively more women were in elementary particle and in teaching, while fewer were in nuclear. Solid state, high energy particle physics, and nuclear physics were the most common specialities overall. High involvement in teaching was cited by some as a necessary accompaniment of career breaks or changes for personal reasons. Only 23% of the sample were no longer working in the field in which they received their degree. Men were slightly less likely to change than women but the difference was not statistically significant.

For both men and women, about 40% of work time was spent on research activities, 44% on teaching, 5% on grant administration, and 10% on other activities. About one fourth reported that this time allocation had changed. The women reported changing to being involved full time in research and getting more involved in administration. More involvement in administration was the primary type of change for the men (46%). Previous findings of women being more interested in teaching were not confirmed in the sample.

One man and five women reported a break in full-time work of more than a year. Two women (and no men) reported working unpaid for some years. Over half the women and 30% of the men reported accepting jobs for personal reasons. The women were most likely to have accepted jobs to be in the same location as their husbands or for other family considerations and more likely to have accepted jobs not beneficial to their careers.

Achieving Tenure

There was a significant difference in the time it took women to achieve tenure as compared to the men. While men took an average of 8.3 years from the time of receiving their Ph.D. degrees, women took an average of 10.9 years. The variance in time for women was also greater, indicating that some women got tenure as quickly as any of the men while others took a good deal of time. Six of the women took over 20 years to achieve tenure while all the men had tenure by 19 years after receiving their degrees.

Men (86%) were more likely to be married than women (65%). Only one man but eight women were single (1% vs 17%). Eleven percent of the women were divorced while 6% of the men were. It appears that not being married is a consequence of high career involvement for many tenured women. The women had fewer children (1.5 vs 2.5) than the men on the average. The women reported assuming 70% (and men 26%) of the care for their children. Thus, child care responsibilities may be contributing to the longer length of time women take to acquire tenure. Changing jobs for personal reasons might also contribute to length of time to tenure.

When a comparison of tenured faculty who had not changed jobs for personal reasons and who had worked full time since receiving their degrees was made, 17 (out of the original 46) tenured women and 87 (of the original 127) men remained in the sample. In this group, there was no difference in the time it took for men and women to attain tenure. Both averaged 8.2 years. Even in this highly selected sample, however, the men had more children than the women, and those women who did have children spent more time in caring for them than the men. The women also attained their Ph.D. degrees from somewhat more prestigious institutions.

Forty-six percent of the tenured women believed that they had experienced sex discrimination in their careers. Examples of such discrimination given by the women in the study included not being given full credit for publications co-authored with their husbands, not being given a regular position or promoted because their husband was (or was not) on the tenured faculty, not being given as much mentoring or other support by senior faculty, and being told that tenure was not appropriate for a woman. The women also cited numerous difficulties in achieving tenure related to the fact that they had taken nontenure stream positions earlier in their careers, in accommodating to family constraints. Interestingly, only 28% of the untenured women felt that sex discrimination had affected their careers. Either things are changing, or the untenured women have not yet confronted continuing forms of discrimination.

Untenured Physicists

There were also sex differences among the untenured faculty. The women more often were affected negatively by career changes and more of them were working part time. There were no differences in the amount of time spent on research or teaching, but men spent more time on grant administration. The untenured men got their degrees from more prestigious institutions than the women. There were no other statistically significant differences in the untenured males and females.

Conclusions

The results of this study replicate earlier studies in that academic women were found to take longer to achieve tenure than men. However, the fact that women take longer to gain tenure appears to be related to their working part time and making career and job changes for family reasons. When women who followed the "traditional" pattern of working full time after receiving their degrees and not making career changes for personal reasons were compared with similar men, there were no differences in the time to acquire tenure.

Wood Energy - A Physics Blindspot by Lawrence Cranberg, 1205 Constant Spring Dr., Austin, TX 78746

A review article in **Physics Today** for Dec., 1975, on the physics of cambustion includes a chart illustrating flow patterns of energy in the United States for 1973. It shows the various sources of energy, including, for example, Geothermal energy, which accounts for 0.08 quads, but it omits entirely the role of wood energy, which contributes at least ten times as much to the national energy budget, and is of the same order of magnitude as nuclear or hyroelectric energy.

The complete neglect of wood energy is particularly remarkable since in the use of wood-fuel for domestic heating there is vastly greater personal involvement of the consumer in the actual mechanics of use than is the case with any other energy source. We are observing a classic case of overlooking something of great importance because of its very familiarity. The situation with wood energy today is perhaps comparable to the case of gravity in Newton's day. The phenomena were so familiar and ubiquitous as to escape notice. Another likely factor in the wood-energy situation may be an assumption that waod-energy offers no problems of scientific interest. Or there may be an intimidating undercurrent of concern that waod, being a naturally occurring material of great complexity and variability, cannot be studied as a fuel with any hope of achieving deep scientific understandings or useful technological improvements. And one cannot put aside the surmise that wood-energy suffers from falling into an interdisciplinary niche between physics and chemistry, and may be regarded by physicists with a condescension bred not only of familiarity, but of being outside the agenda of any of the accepted sub-fields of physics.

Whatever the reasons that wood-energy has suffered neglect at the hands of the physics community, the fact that it has suffered neglect has had some rather startling consequences. In particular, wood energy is a topic which may well be the richest source of papular misunderstanding and veritable hoaxes in recent scientific history. Surely the most remarkable example of popular misunderstanding in our own or any other time is the belief that the domestic fireplace is not a heat source on balance, but is effectively a refrigerator of the space which it is ostensibly intended to heat. The January, 1981, number of the widely read magazine **Consumer Reports**, alleged that on the basis of tests in a calorimeter room the net heat gain fram a fire in a conventional grate was a **negative** 5000 BTU per hour. This figure was inferred from measurements of a gain due to radiant energy from the fire of 2,500 BTU per hour, and a loss of 7500 BTU per hour due to the venting up a fireplace flue of air from the calorimeter room at a rate of 10,000 cubic feet per hour, and assumed difference of 40 degrees F between the outside and inside air temperatures.

It is self-evident that the results af **Consumer Reports** cannot be reconciled with the universal experience of mankind over thousands af years that firemaking under the circumstances which prevail in domestic interiors provides a net warming effect and not a net refrigerating effect. Details of the errors perpetrated in arriving at such a patently absurd result have been fully exposed in the course of ongoing litigation between Consumers Union and the undersigned and need not be reviewed here. What is of general and useful significance from the point of the scientific community, and more specifically af the physics community, is that the patently absured finding of **Consumer Reports** was not greeted by the general incredulity which it deserved.

The failure of the scientific community to react to the fireplace-refrigerator absurdity has had far-reaching consequences. That absurdity was a key point in the campaign of the wood-stove industry, which in the last decade has sold millions of units, claiming that the fireplace is a "dismal failure" as a heat source, and touting the superior efficiency of the "air-tight" wood stove. The October, 1981, number of **Consumer Reports** followed its defamatory report on fireplaces with a glowing account of the wood stove: a report which completely ignored its many limitations, drawbacks and disadvantages. The "staggering hike" noted by the U. S. Consumer Products Safety Commission in wood-stove related fires, and the spreading concern about environmental pollution caused by the carcinogens abundantly produced by wood burned under air-starved conditions are twa major issues whose neglect is particularly remarkable in the face of the enormous attention given to safety and pollution in connection with the use of nuclear energy and energy sources generally.

It is a badge of pride in the physics community that it has responded with such acute concern to the safety and pollution problems of the nuclear industry and of the burning of fossils fuels. But by the same token, it has been remarkably derelict in its corresponding duty with respect to wood energy, where the safety problems have taken a heavy toll in life and property, and the pollution in some areas has reached health- and comfort-threatening levels, and is prompting legislative action in a number of states.

Thus far the physics community has responded through its Panel on Public Affairs by refusing even to consider appropriate investigative studies, and the Chairman of our Applied Physics Committee has ignored pleas for a symposium on the problems of wood energy. Most recently a paper which carefully critiqued the findings of **Consumer Reports** noted above was rejected not on the grounds that it was erroneous, but because it was allegedly favorable to my "industrial" interests, and because it dealt with matters in litigation.

The notion that what is under litigation is beyond the purview of science is one which raises some very serious issues of fundamental principle. It bestows a prior importance on the courts, and implies subordination of science to their processes and conclusions. Such a posture is not only invidious to science, but it promises to do a serious disservice to our judicial system. The latter is staffed by men and women who for the most part have little or no scientific training, and if the science community takes a hands-off attitude where scientific matters are concerned, we have abandoned a vital arena of decision-making where in fact we are desperately needed. The proposals of Arthur Kantrowitz for "Science Courts" underscores the grave shortcomings of our present court system for the resolution of questions which have an important science component. And the recent re-structuring of the federal courts of appeal for dealing with patent litigation is further indication of the problems which today face our courts in dealing with scientific and technical matters.

We have recently observed the 20th anniversary of a landmark decision by the U. S. Supreme Court which bears vitally on the questions we have just been discussing with respect to the relationship between science and the courts: the decision of the Warren Court in The New York Times V. Sullivan. That

decision rodicolly oltered the posture of the courts in relotion to error os olleged in suits for libel or product defomotion. It clooked error in the protections of the First Amendment guarantees of free speech and free press, and thereby reversed two centuries of law which had mode men accountable to the courts for defamatory error.

Before we turn over to the courts our traditional responsibility for ascertaining scientific truth, we would be well-advised to understand fully the significance of the decision in The New York Times V. Sullivan. The victory in that case went not to the side which had truth, but to the side that was able to evade responsibility for gross error because the court creoted a new principle which demanded proof of "actual malice" - a proof which goes to the stote of mind of the perpetrator of error.

If the scientific community is going to subordinate its publications to the prior verdicts of our courts, let us at least be informed about what a victory or a loss means in the courts under present circumstances.

The fact is that this is no time for us to be shirking our responsiblities and passing the buck to the courts or anyone else. We have been sadly remiss in our responsibilities to the public with respect to the problems of wood energy, and the sooner we address those problems the better.

Forum Sessions at Washington APS Meeting (Crystal City, VA, 24-27 April 1985)

ACID RAIN: HOW SERIOUS AND WHAT TO DO

Chairperson: Prof. David Hafemeister, Physics Department, California Polytechnic University, San Luis Obispo, CA 93407

Recent Results on Acid Rain at the National Research Council
Dr. Myron Uman, Staff Director, Environmental Studies Board, National Reserach Council, 2101 Constitution Avenue, NW, Washington, DC 20418

Why Research on Acid Rain Is Necessary
Dr. George Hidy, President, Desert Research Institute, University of Nevada, PO Box 60220, Reno, NV 89506

Acid Rain: What Science Tells Us
Dr. Michael Oppenheimer, Senior Scientist, Environmental Defense Fund, 444 Park Avenue South, New York, NY 10016

Present and Proposed Laws on Acid Rain
Dr. Len Weiss, Minority Staff Director, Subcom. on Energy, Nonproliferation and Gavernment Processes, Committee on Governmental Affairs, US Senate, Washington, DC 20510

The Forum Awards Session will precede the Wednesday evening sessian on Nuclear Winter. There is no Forum Award this year. The Szilard Award goes to two groups who have pioneered studies on nuclear winter. The first is P. J. Crutzen and J. W. Birks whose **Ambio** paper first called attention to the importance of smoke as a contributor to atmospheric problems after a nuclear war. The second is the TTAPS group: R. P. Turco, O. B. Toon, t. P. Ackermon, J. B. Pollack, and Carl Sagan for their **Science** article "Nuclear Winter: Globol Consequences of Multiple Nuclear Explosions."

Invited Paper Session on Nuclear Winter Wednesday, April 24, 8:15 p.m.

"Nuclear Winter" describes the climate that might ensue after a nuclear war if the groundbursts generate enough dust and if the thermal radiation ignites enough fires to block the sunlight from the earth for long periods of time. Since that possibility was first predicted, the subject has stimulated intense debate. As underscored by a National Academy of Sciences study released last December, uncertainties surround nearly all the parameters entering the calculation. Key areas include the forgeting scenaria, the size and number of smoke and dust particles, their height of injectian into the atmosphere and their rate of removal. Additional uncertainties prevail in the predicted impact of these atmospheric particulates on the climate. This program will allow several active participants in the debate to present their views, and discuss these views with one another. For the panel discussion, the three speakers below will be joined by John Birks and Richard Turco, who already have spoken in the Forum Awards Session.

Session Organizer: Barbara G. Levi

Session Chairperson: Stephen Fels
Geophysical Fluid Dynamics Lab
Princeton University

Michael McCracken
Lawrence Livermore Laboratory
"Nuclear Winter: Recent Results from Climate Models"

George Rathjens
Department of Political Science
Massachusetts Institute of Technology
"Nuclear Winter: A Critical Review"

George Carrier
Department of Applied Science
Harvard University
"Nuclear Winter: Current Understanding"

NEWS OF THE FORUM

ENERGY SHORT COURSE
(see page 8)

Executive Committee Meeting at Washington APS Meeting: Meeting will be in Room 217 of the Mariott Crystal City Hotel on Thursday 25 April at 11:30 am. The meeting is open to all Forum members.

FORUM APS FELLOWS

The following three individuals have been owarded fellowship in the APS from the Forum:

Thomas B. Cochran
Citation: "For his original analyses of the technology of nuclear weapons, breeder reactor technology and their relationship to nuclear proliferation."

Kosta Tsipis
Citation: "For his perceptive use of physics and physical principles in the anolysis of proposed weapons systems and for the influential papers which resulted from his work."

M. Carl Walske
Citation: "For his tireless advocacy of a sensible exploitation of nuclear energy combined with rational safeguards against proliferatian and for his participation in test ban negotiations in their earliest days."

Previous APS fellows from the Forum are: Harold Davis, Robert Socolow, Ted Taylor, James S. Trefilm and Frank von Hippel. Congratulations to all these fine fellows.

Footnote from the Forum's Secretary/Treasurer:

A favor to ask you the next time we have a mail ballot: let's specify that ballots must be sealed with one piece of tape at a specified point. This business of staples is driving my automatic opening machinery (ages 8 to 12) nuts; furthermore, we're getting lots of staples which fall out of the paper and lodge in the carpet on the office floor. Would you believe, someone found it necessary to seal his/her ballot with eight staples! I'm not sure I understand what the object of such measures to ensure privacy are. To keep the Secretary from reading the ballot, the mailman? The mail is ferocious, but not one single taped ballot has arrived open or ripped. On the contrary, some of the staples have become snagged and pulled out of the paper.

Fifth International Sakharov Hearing

This hearing will be held in London at the London Press Center, 76 Shoe Lane, EC4 on 10-11 April 1985. The principle purpose of the Hearing is to document, by means of expert testimony, the state of compliance by the Soviet Union with its Human Rights commitments under the Helsinki Final Act. For more information contact Allan Wynn, 1 Doyley St., London SW1X 9AQ, England.

LIMITS OF FREEDOM

Following are the results from a poll on "The Limits of Freedom" from **Photonics.** Photonics is a trade journal for the optics industry distributed free to those working in the optics lasers spectra areas. This poll is from the August, 1984 issue and the results were published in the Nov., 1984 issue, pp 98-99.

Do you believe that the Defense Department should have the right to forbid publication of the results of research it has funded, even when the research is unclassified? 48% Yes; 50% No; 2% No answer.

Two years ago this month, a major confrontation on this issued occurred when the Defense Department barred the delivery of some 100 technical papers at SPIE's annual international symposium. In what direction do you feel relations between the science community and the DOD have moved since then? 12% Improved; 26% Become worse; 53% About the same; 9% No answer.

In recent years the number of scientific exchanges between the US and Russia has been drastically curtailed. Would you like to see exchange programs increased, cut even further or kept at their present level? 40% Increased; 35% Cut; 22% Kept at present level; 3% No Answer.

Defense officials have claimed that international scientific meetings enable Communist participants to obtain information of major potential military value. Do you feel this is a serious problem, a small problem or a false alarm? 46% Serious problem; 38% Small problem; 15% False alarm; 1% No answer.

Most US universities today refuse on principle to do classified research for the military. Do you consider this policy right? 55% Yes; 41% No; 4% No answer.

From what you know about present US controls over the export of nonmilitary technology to the Communist bloc, would you assess them as too restrictive, too lenient or about right? 23% Too restrictive; 44% Too lenient; 26% About right; 7% No answer.

ENERGY SHORT COURSE (see page 8)

HIGHLIGHTS OF THE FY 1986 SCIENCE BUDGET

This is extracted from **Science 277**, 726-728 (1985). This article, headlined "The Science Budget: A Dose of Austerity," points out that military R&D would get large increases; the physical sciences would fare relatively well; and belt-tightening is in store elsewhere.

Figure 1 gives the breakdown of R&D by the primary agencies, Figure 2 shows the militarization of R&D, and Figure 3 details the conduct of basic research by major agencies.

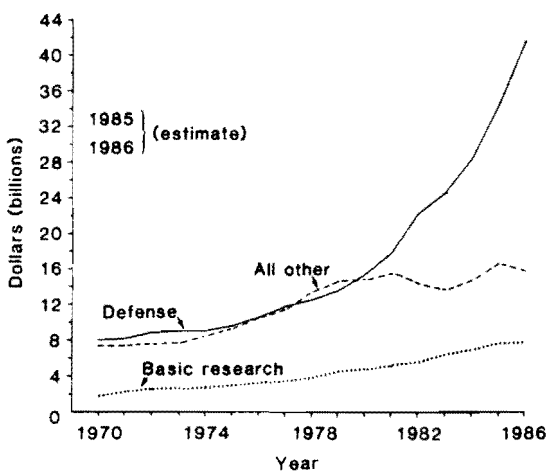
Figure 1. Conduct of Research and Development by Major Departments and Agencies

(In millions of dollars)

Department or agency	Obligations			Outlays		
	1984 actual	1985 estimate	1986 estimate	1984 actual	1985 estimate	1986 estimate
Defense-Military functions	26,408	32,318	39,426	23,583	28,539	34,860
Health and Human Services	4,836	5,472	5,159	4,449	4,995	5,239
(National Institutes of Health)	(4,252)	(4,835)	(4,561)	(3,960)	(4,408)	(4,654)
Energy	4,642	4,805	4,712	4,702	4,826	4,714
National Aeronautics and Space Administration	2,877	3,506	3,730	3,539	3,260	3,564
National Science Foundation	1,203	1,354	1,447	1,108	1,313	1,403
Agriculture	868	940	882	867	901	882
Transportation	446	480	362	342	481	377
Interior	362	378	335	393	371	339
Environmental Protection Agency	261	312	327	266	282	317
Commerce	361	384	271	330	368	291
Agency for International Development	192	217	225	139	225	239
Veterans Administration	190	227	190	186	224	187
Nuclear Regulatory Commission	191	150	138	196	152	141
All other [1]	363	417	396	418	396	407
Total	**43,199**	**50,958**	**57,598**	**40,518**	**46,331**	**52,958**

[1] Includes the Departments of Education, Justice, Labor, Housing and Urban Development and Treasury, the Tennessee Valley Authority, the Smithsonian Institution, the Corps of Engineers, and the Federal Emergency Management Agency

Figure 2. The Militarization of R&D



The militarization of R&D

Out of every dollar the federal government spends on R&D, 72 cents now goes to defense programs. [Basic research is included in the totals for defense and nondefense spending.]

Figure 3.
Conduct of Basic Research by Major Departments and Agencies

(In millions of dollars)

Department or agency	Obligations			Outlays		
	1984 actual	1985 estimate	1986 estimate	1984 actual	1985 estimate	1986 estimate
Agencies supporting primarily physical sciences and engineering:						
National Science Foundation	1,132	1,273	1,366	1,042	1,235	1,325
Defense—Military functions	847	829	962	720	768	852
Energy	827	912	934	820	904	937
National Aeronautics and Space Administration	713	801	834	729	825	818
Interior	120	130	119	133	128	120
Commerce	21	22	18	21	21	18
Other Agencies	9	9	10	8	9	10
Subtotal	3,668	3,976	4,241	3,473	3,891	4,078
Agencies supporting primarily life and other sciences:						
Health and Human Services	2,812	3,225	3,049	2,587	2,938	3,087
(National Institutes of Health)	(2,625)	(3,022)	(2,847)	(2,441)	(2,753)	(2,896)
Agriculture	393	440	418	394	410	407
Smithsonian Institution	61	65	64	56	63	66
Environmental Protection Agency	30	37	40	26	24	28
Veterans Administration	16	15	16	16	16	16
Education	10	12	12	28	9	11
Other Agencies	16	17	22	14	17	19
Subtotal	3,337	3,810	3,621	3,120	3,476	3,633
Total	7,005	7,786	7,862	6,593	7,367	7,712

Letter from the Editor:

The disappointing low return of ballots for the **Forum** elections (less than 10%) prompts me to survey **Forum** members about several aspects of the **Forum** newsletter, **Physics and Society.** Please complete the following questionaire and return it to

John Dowling
Physics Department
Mansfield University
Mansfield, PA 16933

Areas of Interest to **Forum** members. How do you rate newsletter coverage of these areas:

	Do more	Ok as is	Do less	Don't bother
Arms Control	☐	☐	☐	☐
Energy	☐	☐	☐	☐
Special needs of				
Women Physicists	☐	☐	☐	☐
Minority Physicists	☐	☐	☐	☐
Disadvantaged Physicists	☐	☐	☐	☐
Employment for physicists	☐	☐	☐	☐
Environmental problems	☐	☐	☐	☐
Economic issues	☐	☐	☐	☐
Public Education related to physics	☐	☐	☐	☐

Other (Whot else should the newsletter discuss)

_____

_____

_____

Rate **Physics and Society**, How does the newsletter do in the following areas:

	very good	ok	poor
News of Forum	☐	☐	☐
News of APS	☐	☐	☐
Overall content	☐	☐	☐
Format	☐	☐	☐

Rating the Editor's performonce:

The newsletter is
_____extremely _____somewhat _____not at all biased
Overall the Editor's performonce is a ____(10 is high, 0 is poor).

I usually _____read all _____read things of interest_____skim_____throw away the newsletter.

The newsletter should

_____continue to be a quarterly

_____issues per year would be ideal

One final note: It is like pulling teeth to get people to submit items to **Physics and Society.** If you have anything to say about any of the above issues, please submit your contribution for publication.

WHERE THE DOLLARS GO by Evans M. Harrell, School of Mathematics, Georgia Tech, Atlanta, GA 30332-0160

The following is a table of various budgetary figures, including items related to scientific research and military activities. They have been compiled from sources such as the **World Almanac**, **Physics Today**, **Science**, and major newspapers. All figures are shown in dollars per capita.

Arms Control and Disarmament Agency	0.07
NOAA (1986 proposed)	0.73
Corporation for Public Broadcasting (1982)	0.73
Federal nuclear war civil defense (1984)	0.75
Federal solor energy research (1982)	0.77
Smithsonian Institution (1982)	0.81
5 hrs. of proposed DOD budget 1985-89	0.92
Military controcts of 75th largest defense firm	0.96
Military reseorch at M.I.T	1.05
Legal Services Corporation (1982)	1.10
Environmental Protection Agency (1985)	1.35
Magentic fusion reserach (1985)	1.90
High energy physics operoting funds (1985)	2.35
Annual sales of Trivial Pursuit (1984)	2.85
Space Telesope	5.15
NSF (1985)	6.45
Kings Bay submarine base construction	7.75
1 Trident submarine	8.60
Estimate of superconducting supercollider	12.90
Star Wars research (1986 proposed)	15.90
Military contracts of General Dynamics (1983)	29.00
NASA (1985)	32.00
Department of Energy (1985)	33.00
1 yr Swiss civil defense	33.00
Shoplifting losses (1984)	43.00
U.S. orders of nuclear arms and systems (1983)	130.00
Total Federal military R&D (1986 proposed)	179.00
Total Federal R&D (1985)	219.00
U.S. balance of trade deficit (1984)	430.00
National blast shelter program (estimate)	500.00
Social Security (1982)	757.00
Federal deficit (1985)	946.00
Federal income taxes (1982)	1280.00
Annual constuction rate (1984)	1380.00
1 year of proposed DOD budget 1985-89	1630.00
Estimates of Strategic Defense Initiative (Star Wars)	860.00 to 4300.00
National debt (1982)	4909.00

SHORT COURSE
ENERGY SOURCES:
CONSERVATION AND RENEWABLES
(Saturday/Sunday, April 27-28, 1985, OTA Conference Room after APS/DC Meeting)

A decade has passed since the oil embargo of 1973-4. The use of energy will continue to affect world security, economics ond the environment. In 1974 the American Physical Society conducted a study on EFFICIENT USES OF ENERGY (AIP Conference Series 25, the most popular AIP book sold) which indicated useful ways to apply physics and technology to reduce the energy problem. The faculty for the Short Course are nationally-renowned "experts" in their fields of study. They will discuss the progress and possible future directions in conservation (enhanced end-use efficiency) and in renewable resources. The workshop is intended for a physics-based audience in that we will emphasize equations and data bases. The proceedings (about 500 pages) will be included in the cost of $40. The workshop is being organized by Dovid Hafemeister (Cal Poly U), Henry Kelly (Office of Technology Assessment), and Barbara Levi (Princeton), and it is sponsored by the Forum of the APS and the American Association of Physics Teachers.

LIST OF TOPICS

1. Reflections on 10 Years of Energy Policy; John Gibbons (OTA)
2. Responses and Planning a Decade after the Oil Embargo of 1973; Robb Socolow (Princeton)
3. Energy Efficiency in Buildings: Progress Since 1973 and Future Potential; Art Rosenfeld (LBL)
4. The Response of the Congress: New Laws; Ben Cooper (U.S. Senate)
5. Engineering/Economic End-Use Energy Models: Daniel Hamblin and Teresa Vineyard (ORNL)
6. Finding, and Fixing Heat Losses in Houses; Gautam Dutt (Princeton)
7. Heating, Ventilation, and Thermal Flows and Storage in Large Buildings; Art Rosenfeld/Bruce Birdsall (LBL)
8. Passive Solar; David Cloridge (U. Colorado)
9. Indoor Air Pollution: Dependence on Sources, Ventilation Rates and Other Factors; Tony Nero/Richard Sextro (LBL)
10. Window Technologies; Steve Selkowitz (LBL)
11. Lighting Technologies; Sam Berman (LBL)
12. Appliances: Howard Geller (ACEEE)
13. Industrial Energy Conservation; Marc Ross (U. Michigan)
14. Potential for Energy Savings in Old and New Auto Engines: John Reitz (Ford)
15. Managing Electricity Demand Through Dynamic Pricing; Robert Peeddie (Elect. Dist Board)/Douglas Bulleit (ICS)
16. Cogeneration and Economics of Energy Conservation; Bob Williams (Princeton)
17. Photovoltaics: Paul Moycock (Photovoltaic Energy Systems)
18. Production of Liquids and Gases from Biological Feedstocks; Tom Bull (OTA)
19. Rural Electrification Using Small Hydro Installations: Pete Smith (Energenics Systems)
20. Wind Energy Systems; Lou Divone (DOE)
21. Ice Ponds; Ted Taylor (Nova)
22. Heat Pumps and ACES House; Ann Baxter (ORNL)
23. Technical Appendices

REGISTRATION FOR THE SHORT COURSE

The cost of $40 will include a 500 page AIP book as well as a ticket to the conference. DON'T PROCRASTINATE AS ATTENDANCE WILL BE LIMITED TO ABOUT 100. Send your nome, address, phone number, and a check for $40 (made out to the American Physical Society) to David Hafemeister, 553 Serrano, San Luis Obispo, CA 93401; (805-544-5096).