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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)

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on physics and society of the American Physical Society
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 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 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.

**Uncontinued Physicists**

There were also sex differences among the untenured faculty. The number of the widely read magazine *Consumer Reports*, alleged that on the basis of tests in a calorimeter room the net heat gain from 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 of *Consumer Reports* cannot be reconciled with the universal experience of mankind over thousands of 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.

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 wood-energy offers no problems of scientific interest. Or there may be an intimidating undercurrent of concern that wood, 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 surprise that wood-energy suffers from falling into an interdisciplinary niche between physics and chemistry, and may be regarded by physicists with a condescending breed 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 popular 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 ostensibly intended to heat. The January, 1981, issue of the widely read magazine *Consumer Reports* has noted that it has responded with such acute concern to the safety and pollution problems of the nuclear industry and of the burning of fossil 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.

**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.

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 fossil 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 for 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.
decision radically altered the posture of the courts in relation to error as alleged in suits for libel or product defamation. It cloaked error in the protections of the First Amendment guarantees of free speech and free press, and thereby reversed two centuries of law which had made 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 to the side which had truth, but to the side that was able to evade responsibility for gross error because the court created a new principle which demanded proof of "actual malice" - a proof which goes to the state 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 responsibilities 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.

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

ACID RAIN: HOW SERIOUS AND WHAT TO DO
Chairperson: Prof. David Hofemeister, 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 Research Council, 210 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 Government Processes, Committee on Governmental Affairs, US Senate, Washington, DC 20510

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The Forum Awards Session will precede the Wednesday evening session 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. Ackerman, J. B. Pollock, and Carl Sagan for their Science article "Nuclear Winter: Global Consequences of Multiple Nuclear Explosions."

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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 targeting scenarios, the size and number of smoke and dust particles, their height of injection 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"

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NEWS OF THE FORUM

ENERGY SHORT COURSE
(see page 8)

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FORUM APS FELLOWS

The following three individuals have been awarded 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 analysis 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 proliferation and for his participation in test ban negotiations in their earliest days."

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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 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 is to ensure privacy. 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.

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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 Helsinki Final Act. For more information contact Allan Wynn, 1 Dayley 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, and 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 issue 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; 2% 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.

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

<table>
<thead>
<tr>
<th>Department or agency</th>
<th>Obligations actual</th>
<th>Obligations estimate</th>
<th>Dollars actual</th>
<th>Dollars estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defense-Military functions</td>
<td>26,408</td>
<td>32,318</td>
<td>39,426</td>
<td>23,583</td>
</tr>
<tr>
<td>Health and Human Services</td>
<td>4,836</td>
<td>5,472</td>
<td>5,159</td>
<td>4,449</td>
</tr>
<tr>
<td>Energy</td>
<td>4,642</td>
<td>4,805</td>
<td>4,712</td>
<td>4,702</td>
</tr>
<tr>
<td>National Aeronautics and Space Administration</td>
<td>2,877</td>
<td>3,506</td>
<td>3,710</td>
<td>3,539</td>
</tr>
<tr>
<td>National Science Foundation</td>
<td>1,203</td>
<td>1,354</td>
<td>1,447</td>
<td>1,108</td>
</tr>
<tr>
<td>Agriculture</td>
<td>868</td>
<td>940</td>
<td>882</td>
<td>867</td>
</tr>
<tr>
<td>Transportation</td>
<td>446</td>
<td>480</td>
<td>362</td>
<td>342</td>
</tr>
<tr>
<td>Interior</td>
<td>362</td>
<td>378</td>
<td>335</td>
<td>393</td>
</tr>
<tr>
<td>Environmental Protection Agency</td>
<td>261</td>
<td>312</td>
<td>327</td>
<td>266</td>
</tr>
<tr>
<td>Commerce</td>
<td>361</td>
<td>384</td>
<td>271</td>
<td>330</td>
</tr>
<tr>
<td>Agency for International Development</td>
<td>192</td>
<td>217</td>
<td>225</td>
<td>139</td>
</tr>
<tr>
<td>Veterans Administration</td>
<td>190</td>
<td>227</td>
<td>190</td>
<td>186</td>
</tr>
<tr>
<td>Nuclear Regulatory Commission</td>
<td>191</td>
<td>150</td>
<td>138</td>
<td>196</td>
</tr>
<tr>
<td>All other</td>
<td>363</td>
<td>417</td>
<td>396</td>
<td>418</td>
</tr>
<tr>
<td>Total</td>
<td>43,199</td>
<td>50,958</td>
<td>57,591</td>
<td>40,518</td>
</tr>
</tbody>
</table>

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.]
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 questionnaire 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:

<table>
<thead>
<tr>
<th>Arms Control</th>
<th>Energy</th>
<th>Special needs of</th>
<th>Women Physicists</th>
<th>Minority Physicists</th>
<th>disadvantaged Physicists</th>
<th>Employment for physicists</th>
<th>Environmental problems</th>
<th>Economic issues</th>
<th>Public Education related to physics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do more</td>
<td>Ok as is</td>
<td>Do less</td>
<td>Don't bother</td>
<td>Do more</td>
<td>Ok as is</td>
<td>Do less</td>
<td>Don't bother</td>
<td>Do more</td>
<td>Ok as is</td>
</tr>
</tbody>
</table>

1. Do you rate Physics and Society as very good, ok, or poor?
2. How good is the coverage of the following areas in the newsletter:
   - News of Forum
   - News of APS
   - Overall content
   - Format

Rating the Editor's performance: The newsletter is ___________________________ extremely biased, ___________________________ somewhat biased, ___________________________ not at all biased. Overall the Editor's performance is a __________ (10 is high, 0 is poor).

I usually ___________________________ read all items of interest, ___________________________ skim all things of interest, ___________________________ throw away the newsletter.

The newsletter should ___________________________ continue to be a quarterly, ___________________________ have more 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

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.

<table>
<thead>
<tr>
<th>Spending Category</th>
<th>Cost per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arms Control and Disarmament Agency</td>
<td>0.07</td>
</tr>
<tr>
<td>NOAA (1986 proposed)</td>
<td>0.73</td>
</tr>
<tr>
<td>Corporation for Public Broadcasting (1982)</td>
<td>0.73</td>
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<tr>
<td>Federal nuclear war civil defense (1984)</td>
<td>0.75</td>
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<td>Federal solar energy research (1982)</td>
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<tr>
<td>Smithsonian Institution (1982)</td>
<td>0.81</td>
</tr>
<tr>
<td>5 hrs. of proposed DOD budget 1985-89</td>
<td>0.92</td>
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<tr>
<td>Military contracts of 75th largest defense firm</td>
<td>0.96</td>
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<td>Military research at M.I.T</td>
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<td>Legal Services Corporation (1982)</td>
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<td>Space Telescope</td>
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<td>NSF (1985)</td>
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<td>Kings Bay submarine base construction</td>
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<tr>
<td>1 Trident submarine</td>
<td>8.60</td>
</tr>
<tr>
<td>Estimate of superconducting supercollider</td>
<td>12.90</td>
</tr>
<tr>
<td>Star Wars research (1986 proposed)</td>
<td>15.90</td>
</tr>
<tr>
<td>Military contracts of General Dynamics (1983)</td>
<td>29.00</td>
</tr>
<tr>
<td>NASA (1985)</td>
<td>32.00</td>
</tr>
<tr>
<td>Department of Energy (1985)</td>
<td>33.00</td>
</tr>
<tr>
<td>1 yr Swiss civil defense</td>
<td>33.00</td>
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<tr>
<td>Shoplifting losses (1984)</td>
<td>43.00</td>
</tr>
<tr>
<td>U.S. orders of nuclear arms and systems (1983)</td>
<td>130.00</td>
</tr>
<tr>
<td>Total Federal military R&amp;D (1986 proposed)</td>
<td>179.00</td>
</tr>
<tr>
<td>Total Federal R&amp;D (1985)</td>
<td>219.00</td>
</tr>
<tr>
<td>U.S. balance of trade deficit (1984)</td>
<td>430.00</td>
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<tr>
<td>National blast shelter program (1984)</td>
<td>500.00</td>
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<tr>
<td>Social Security (1982)</td>
<td>757.00</td>
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<tr>
<td>Federal deficit (1985)</td>
<td>946.00</td>
</tr>
<tr>
<td>Federal income taxes (1982)</td>
<td>1280.00</td>
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<tr>
<td>Annual construction rate (1984)</td>
<td>1380.00</td>
</tr>
<tr>
<td>1 year of proposed DOD budget 1985-89</td>
<td>1630.00</td>
</tr>
<tr>
<td>Estimates of Strategic Defense Initiative (Star Wars)</td>
<td>860.00</td>
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<tr>
<td>National debt (1982)</td>
<td>to 4300.00</td>
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</tbody>
</table>

### 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 and 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 David Hafemeister (Cal Poly U), Henry Kelly (Office of Technology Assessment), and Barbara Levi (Princeton), and 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 Flaws and Storage in Large Buildings; Art Rosenfeld/Bruce Birdsell (LBL)
8. Passive Solar; David Claridge (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 Peedie (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 (Novo)
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 name, 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).