

PHYSICS AND SOCIETY

Volume 18, Number 2

April 1989

- Letters**
- 2 Toward a Broader Forum: *B. G. Levi*
 - 2 Light Bulbs Have Global Reach: *Rocky Mountain Institute*
 - 2 A New International Journal: *F. von Hippel*
 - 3 Environmental Topics in Physics Courses: *L. Hodges*
- Articles**
- 3 The University of California, National Weapons Labs, and Arms Control
 - 3 I. Faculty Concerns: *J. Fulco*
 - 5 II. Public Perspectives: *D. Blum*
 - 6 III. Improving the Role of the Labs in Arms Control: *G. T. Seaborg*
 - 8 IV. The Importance of the UC/Weapons Labs Relationship: *P. S. Brown*
 - 11 V. UC's Management of the Weapons Labs: *J. S. Kane*
- Reviews**
- 12 The Future of Land-Based Missiles
 - 13 Toward a Comprehensive Test Ban, by S. Fetter: *D. Hafemeister*
- News**
- 14 Election Results • 1988-89 Officers • Exec Comm Minutes • ByLaw Changes • APS Council Meeting • Baltimore Meeting: Awards, Invited and Contributed Sessions • St. Louis Meeting • Two Forum Books: Nuclear Arms Technologies, Missile Study • Student Pugwash • New Dialogue With Nature • Join the Forum!
- Comment**
- 18 Ethical Values Should Limit Scientific Research: *L. Cavalieri*
 - 20 Editorial: Reflections on the Forum's Missile Study

The American Physical Society
335 East 45th Street
New York, New York 10017

Non-Profit Org.
U.S. POSTAGE
PAID
Hicksville, N.Y.
Permit No. 294

Physics and Society is the quarterly newsletter of the Forum on Physics and Society, a division of the American Physical Society. It is distributed free to members of the Forum and to physics libraries upon request. Nonmembers may receive the newsletter free upon request by writing to the editor; voluntary contributions of \$10 per year are welcome. Make checks payable to APS/Forum. *Physics and Society* presents letters and reviewed articles on the relations of physics and the physics community to government and society. It presents news of the Forum and provides a medium for Forum members to exchange ideas. Opinions expressed are those of the author only and do not necessarily reflect the views of the APS or of the Forum. Contributed articles, letters, etc., should be sent to the editor: Art Hobson, Physics Department, University of Arkansas, Fayetteville, AR 72701, (501) 575-5918. Editorial Assistant: Leonora Hermann.

LETTERS

Toward a Broader Forum

I thank Elton Kaufmann for his interest in the Forum programs. In his letter (January 1989), Kaufmann encouraged Forum officers to broaden the content of the newsletter and of Forum symposia. I believe we are all consciously working in that direction. Over the past few years, perhaps 60% of our programs have dealt with arms control issues, but we have done better lately: Of the eight Forum-sponsored invited-paper sessions held at APS meetings in 1988, four dealt with education, energy and the environment and the fifth — on the safety of U.S. nuclear production reactors — was only peripherally concerned with nuclear defense. Over the past four years, one of the two Forum awards given annually honored work *not* related to nuclear defense. The newsletter has attempted to attract articles on a variety of subjects, and its editor has authored a number of editorials designed to elicit interest in some of these other issues. True, the past two study groups — on civil defense and land-based missiles — have dealt with nuclear defense, but a third study group is actively assessing the current US energy picture. The short course last April was on nuclear arms control issues but its predecessor concerned energy conservation and renewables.

In all these activities we are, however, strongly dependent on the willing participation of our members. We need high-quality contributions to the newsletter on such topics as carbon dioxide, waste disposal, science education. We need imaginative suggestions for invited paper sessions and volunteers to organize them. We need dedicated workers for our study groups. Let us hear from you.

The Forum is ready to entertain suggestions for a new study and I for one invite proposals on a topic that does *not* deal with nuclear defense. In fact I will make this letter serve as a call for proposals of study group topics. If you wish to make such a proposal, write down your thoughts on why the topic is an appropriate one for the Forum at this time and include a detailed outline, and mail it to me.

Barbara G. Levi
20 North Point Drive
Colts Neck, NJ 07722

Light Bulbs Have Global Reach

Replacing an incandescent light bulb with a compact fluorescent bulb seems like a simple act, but the consequences go far beyond saving a few dollars on your energy bill. That compact fluorescent light bulb is a powerful weapon in the battle to protect the global environment. A single 18-watt compact fluorescent bulb produces the same light as a 75-watt incandescent bulb and lasts about 13 times as long.

Over its lifetime, the new light bulb will slow global warming and reduce acid rain by avoiding emissions from a typical US coal plant of one ton of carbon dioxide and about 20 pounds of sulfur dioxide. Or, if it instead saves nuclear electricity, it will avoid the production of half a curie of strontium-90 and cesium-137 (two high-level waste components) and about 25 milligrams of plutonium -- about equivalent in explosive power to 850 pounds of TNT, or in radiotoxicity, if uniformly distributed into lungs, to about 2000 cancer-causing doses. The same fluorescent bulb will also save the cost of buying and installing a dozen ordinary bulbs (about \$20); the cost of generating 570 kW-h of electricity (about \$20+ worth of fuel); and, during its lifetime, approximately \$200-300 worth of generating capacity.

Not bad for a light bulb, costing about \$15-18, that you can install yourself.

Reprinted from:
Rocky Mountain Institute Newsletter
1739 Snowmass Creek Road
Old Snowmass, CO 81654-9199

A New International Journal

I write to draw your attention to a new international journal, *Science and Global Security*, that will publishing scientific analyses relating to arms control and global environmental policy options. The journal will be published in both English and Russian starting this summer.

Harold Feiveson is the editor and Roald Sagdeev of the Soviet Space Research Institute and I co-chair the editorial board. Other US members of the editorial board are: Herbert Abrams, M.D., Stanford; John Holdren, Berkeley; Tom Johnson, West Point; Frank Long, Irvine; Milo Nordyke, Lawrence Livermore; Ted Postal, Stanford; and George Rathjens, MIT. Other Soviet members are Vitali Goldanskii, Institute of Chemical Physics; Sergei Kapitza,

Vavilov Institute of Physics; Andrei Kokoshin, Institute for the Study of the US and Canada; Stan Rodionov, Space Research Institute; and Evgenii Velikhov, Kurchatov Institute of Nuclear Energy.

The first issues of the journal are expected to include articles on:

- verification of the dismantlement of nuclear warheads,
- feasibility and verifiability of a ban on nuclear reactors in earth orbit,
- verification of limits on nuclear SLCMs,
- techniques for detecting nuclear warheads,
- scientific results of the NRDC-Soviet Academy in-country seismic-monitoring project
- accuracy of the CORRTX method for estimating the yields of underground nuclear explosions, and
- the possibility of imposing performance limitations on some BMD-relevant technologies.

If you are potentially interested in submitting an article to the journal, write to Harold Feiveson at the Center for Energy and Environmental Studies, Princeton University, Princeton, NJ 08544, or call him at 609-452-4676.

For a complimentary first issue and subscription information, write Gordon and Breach Science Publishers, Marketing Department, P.O. Box 786 Cooper Station, New York, NY 10276.

Frank von Hippel
Center for Energy and Environmental Studies
Princeton University
Princeton, NJ 08544

Environmental Topics in Physics Courses

An editorial (October 1988) inquired as to whether any physicists had been teaching topics such as the greenhouse effect in their physics courses. I have been doing so in many of my courses, particularly introductory calculus and non-calculus courses, since 1970. See my article, "Environmental topics for introductory physics courses" in the April 1974 issues of *The Physics Teacher*.

Incidentally, the possible climatic role of carbon dioxide was pointed out by physicist John Tyndall in his Bakerian Lecture "On the absorption and radiation of heat by gases and vapours," published in the 1961 *Philosophical Magazine*, when he wrote "It is exceedingly probable that the absorption of the solar rays by the atmosphere...is mainly due to the watery vapor in the air. Every variation of this constituent must produce a change of climate. Similar remarks would apply to the carbonic acid diffused through the air." In an 1896 *Philosophical Magazine* article "On the influence of carbonic acid in the air upon the temperature of the ground," chemist Svante Arrhenius estimated that a doubling of atmospheric CO₂ would increase the surface temperature by 5 to 6 Celsius degrees, with different warmings at different latitudes.

Verily, there is nothing new under the sun!

Laurent Hodges
Professor of Physics
Iowa State University
Ames, Iowa 50011

ARTICLES

Symposium: The University of California, The National Weapons Laboratories, and Arms Control

With this issue, *Physics and Society* begins a policy of publishing sets of papers based on recent Forum-organized invited sessions at meetings of the American Physical Society. The five papers printed below are based on a session held on the evening of 16 January 1989 at the San Francisco APS/AAPT/AAAS meeting. The session was organized and presided over by Paul Craig, Professor, Department of Applied Science, University of California, Davis, CA. The papers presented here differ somewhat from the program for the session. One listed speaker, John Nuckolls, Director of the Lawrence Livermore National Laboratory, was unable to attend the session. Thus, at the last minute, University of California Vice-President William Frazer, who happened to be in attendance, graciously agreed to extemporaneously present some University and lab views. Also, another of the session participants wasn't able to submit a paper for publication. The five papers printed here include three (Fulco, Blum, Seaborg) based directly on the session in San Francisco, plus two others that I solicited from the University of California (Kane) and Lawrence Livermore National Laboratory (Brown) in order to reflect the range of views expressed at the session.

Editor

Faculty Concerns

Jose' Fulco

There have been many occasions when the University of California faculty have shown strong concerns about the relationship between UC and the weapons laboratories. These concerns have been based mostly on the question "should the university manage the laboratories or not?" About a year before the university regents decided to continue their managerial role over the weapons laboratories, a group of 48 physics faculty of the eight general

campuses wrote a letter to President Gardner requesting several actions by which the university would reaffirm its direct managerial role. At the same time, a large number of faculty members from other disciplines also expressed similar concerns. All these actions prompted the UC Academic Council to appoint a special committee

The author is Professor of Physics at the University of California, Santa Barbara.

to study the relation between the university and the Department of Energy laboratories. This committee should produce a final report by 1990. Therefore, a second question has been added to the faculty concerns: Given that UC is managing the weapons laboratories, what should be the meaning of this management? Should the university exercise fully the five basic managerial functions: planning, organization, direction, supervision, and control, or should it limit itself to only some of them?

Events of the past two years, for example the director's position on stockpile reliability, lobbying of Congress on nuclear testing, the Woodruff-Batzel-Teller controversy, the 1987 Scientific and Academic Advisory Committee (SAAC) report and the following inaction by SAAC and the administration, and environmental problems at Livermore, have prompted widespread critical faculty reactions, reflected in independent articles and commentaries in the national press. These reactions have recently moved the state legislature to pass a bill advising the university to introduce certain changes directed at strengthening its management of the labs. I believe that these events clearly indicate that the present relationship between UC and the weapons laboratories fails in the five managerial functions and therefore cannot be accepted as a direct management relationship.

Therefore, we are back to 1978 when the Gerberding report, which was considered to reflect the views of the faculty, stated: "We also unanimously and strongly recommend significant changes. The majority of our committee endorses continuation *only* if these changes are made."

These changes are embodied in what I consider to be the most important statement of the Gerberding report: "It should continually survey all aspects of the laboratories' programs and policies so as to discharge the university's obligations to itself and to the public by ensuring that the laboratories' participation in the formulation and conduct of their programs be of the highest quality and the greatest objectivity, and that the laboratories not be isolated from the larger world of thought and action." And, further on: "During its deliberations, our committee found the accumulated total of these aspects" (technical and scientific competence, relative proportion of basic and applied research, freedom of expression, secrecy, scrutiny and control of programs, sense of accountability and awareness of the consequences of weapons research) "increasingly important, and now believes that it is by influencing the whole that the university can make its management of the laboratories morally and intellectually responsible."

The above statements define the basis for UC to justify its managerial role as a public service function, a function which is to provide the equivalent to the principle of civilian control of the military with respect to the weapons laboratories. Forty-five years of history tells us how important the weapons laboratories are in defining public nuclear weapons policy and how influential laboratory scientists have become. But laboratory scientists and their administrations are driven by several forces: (a) Their mission, which is to provide technically superior weapons and systems for national security. (b) Their interpretation of what is the best policy in the use of new weapons. (c) Their scientific interest, which moves them in the direction of more interesting and sophisticated systems. (d) The survival of their laboratories, which lead them to fight for continuation and amplification of their original mission.

All of these forces must be controlled, nurtured, and restrained at the appropriate time and in the appropriate circumstances. A society of laboratory scientists without external interactions readily becomes a closed society shrouded in secrecy in which there is a narrowly defined norm to which the members of the society must adapt, or else they must leave. This closed society is a cohesive

force which could shape policies even while representing a small part of the overall society in which it is imbedded. To prevent the weapons laboratories becoming a closed society the university must provide the interactions and the balances, must nurture a diversification of opinions and behavior, must destroy the norms and create the ability to see other choices and to embrace them.

The Gerberding report expresses this in a most concise manner: "We do think it possible — for the university indirectly to affect national policy regarding both nuclear weapons and energy by influencing the character to the laboratories, more fully exercising the managerial functions which are open to it, encouraging openness and facilitating collaboration between the university campuses and the laboratories. Influence of this kind could be important because it would be exerted in areas in which laboratory personnel have a share of the policy making."

Therefore, to justify its management of the weapons laboratories as a public service function, the university must be prepared to indirectly influence national policy and to fully bear the responsibilities for its actions.

Unfortunately this is not the administration's interpretation of it. For the UC Administration, the management of the weapons laboratories implies the appointment of the laboratory directors, some measure of control on the quality of scientific and technical work at the laboratories, and little else.

The often repeated statement that the main UC management role is to assure the easy expression of dissenting views and the maintenance of some measure of academic freedom compatible with the mission of the labs, while true in principle, does not seem to produce the desired results. We know of only a handful of strong dissenters out of over two thousand technical and scientific personnel. The Woodruff-Batzel-Teller controversy was made public not by the labs or UC but by an outside organization and certainly neither Director Batzel's reaction nor the university's inaction were supportive of freedom of dissent. Finally, I have always been surprised by the lack of public criticism of SDI from laboratories scientists while a large majority of the scientific community interested in national security issues have been so strongly opposed to every aspect of it.

Let me use the rest of my time to talk about the future. I believe that notwithstanding the changes made since the Zinner report (1972), the management style of the university has not changed much. In 1978, the Gerberding report stated: "Besides the significant task of selecting each of the directors and the somewhat less significant fact that university personnel policies apply to laboratory personnel, the university's involvement in the life of the laboratories is barely discernible."

We have two years before a new evaluation of the relationship between the university and the laboratories in preparation for another five year renewal of the contract. I believe that these two years are crucial for the future of the relationship. If at the end of this period, the basic premises of the Gerberding report are not satisfied then the university should not continue its management of the laboratories.

Let me list, then, a minimal set of changes that I believe many UC faculty members consider to be indispensable:

1. Replace the Regents oversight committee for the weapons laboratories with a board of directors composed of regents, university faculty, laboratory scientists, and recognized national security experts from outside the university. This board of directors should provide the structure necessary for the university to exercise fully the basic management functions and to provide the direction, emphasis, trends, and adequacy of the total program. In particular, it must create, maintain, and nurture the conditions for a stronger relationship between the UC faculty and the scientific and technical

personnel of the laboratories.

This proposal has been explicitly made by the Gerberding report: "Our committee recommends the appointment of a board of overseers" that should review all aspects of laboratory programs, insure that the programs are subjected to and based on critical analysis of their impact, participate in the contract negotiations between UC and DOE, encourage a two way flow of inquiry, and foster additional contact between the laboratories and the campuses.

It is interesting to note that this recommendation of the Gerberding report was fought immediately by the Department of Energy. Assistant Secretary for Defense Programs Dwane C. Sewell (a former laboratory employee) states in a letter: "The changing atmosphere at UC has raised the question whether the requirements of two very large and dissimilar endeavors as the nuclear weapons labs and the university can continue to be met as their respective missions require under the administrative arrangement which has worked so well in the past. The question has been also raised by some concerned people in Washington." The message was very clear: Serious attempts to alter a managerial relationship existing at present, i.e. increasing the oversight activities of the university, will result in the termination of the contract by DOE. Apparently, the university decided not to implement the Gerberding proposal. Therefore the new contract is "nearly silent" about the university's oversight role.

2. Choose directors of the laboratories from among the faculty of UC. A similar procedure is followed by AT&T Bell Laboratories in its management of Sandia.

3. Create an independent center or institute for the study of national security and strategic issues, possibly under the Institute on Global Conflict and Cooperation. This center will be dedicated to the study of policies which are or may be influenced by work at the laboratories. It will involve UC faculty, laboratory personnel, and visiting scientists, and could be patterned after the NSF Institute for Theoretical Physics at UC at Santa Barbara. The Center for National Security Studies at Los Alamos may act as a satellite for work involving classified material but it should be integrated into the main UC center. Salary support for extended work periods should be provided from the UC management fee. The laboratories must encourage staff participation in this project, which will require mutual education of all participants. Those UC faculty concerned with the university management role and the future stability of the nuclear world should welcome the creation of a suitable format for their participation in the study of these problems.

It is interesting to notice that the agenda for the Regents meeting of 19 September 1985 contains the following item for action: "Clearly, there are opportunities for further expansion of collabora-

tive education and research. The university administration intends to explore with DOE the initiation of a major program of enhanced laboratory-campus collaboration. Second, the university administration intends to press for a deeper and more broadly-based study of the issues and factors related to arms control, disarmament, and peace in order to bring together persons in the laboratories, on the campuses, and elsewhere who, through collaborative efforts in teaching and research, have a real contribution to make in this area of universal concern".

An important mission of this institute will be to create a new group of independent national security experts, a group being rapidly depleted by the retirement of the original Manhattan Project workers. Since then, essentially only the weapons laboratories have been preparing nuclear weapons national security experts, and these experts have been covering positions in the executive and legislative branches of government, in many think tanks, and in independent institutions. Even the UC liaison officer, Jim Kane, is a former laboratory employee. The past and present chairmen of SAAC, Raines and York, have worked in the labs.

We believe that this is a responsibility that the University of California must carry on to fully satisfy its obligations as a public servant.

4. Each laboratory should create some kind of organization somewhat equivalent to the Academic Senate divisions on each campus. These organizations will have responsibilities for the general control of scientific program quality, for proposing independent scientific initiatives, and for the maintenance of academic freedom of laboratory employees. It is interesting to note that the President of the Society of Professional Scientists and Engineers (not an exclusive bargaining representative) mentioned, in his presentation to the Academic Senate committee on the university's relation with the DOE laboratories, that they would like a formal review mechanism for resolving technical disputes, perhaps including peer review, and more oversight of the fraction of the Livermore budget devoted to basic and long-term applied research.

I believe there is a large measure of untapped intellectual power and expertise in the UC faculty and in the weapons laboratories to generate many new ideas for improving the relationship between the University of California and the laboratories. This power must be tapped. I have personally favored a strong relationship between the University of California and the weapons laboratories. I still think that the university's management of Livermore and Los Alamos could be for the benefit of mankind. However, if the failures of these last two years continue, I believe that a large fraction of the faculty will request that the implicit recommendation of the Gerberding report, i.e. to terminate the relationship, be implemented.

Public Perspectives

Deborah Blum

I have been asked to talk about the public's point of view concerning the University of California and the two nuclear weapons laboratories, Livermore and Los Alamos. Of course, my perspective is that of a journalist, which some would argue is not exactly that of an untainted member of the public. I don't know why. So, what I hope to do is discuss briefly what the journalist's viewpoint is, and then apply it to a specific case study concerning the university and the laboratories.

I'll admit that newspapers aren't always easy to live with. We hold people and institutions to very high standards — decency,

honesty, integrity. Some say we hold others to a higher standard than we do ourselves, which may sometimes be true. A favorite way of putting it in our business is that we are here to "afflict the comfortable and comfort the afflicted." Certainly, we feel a certain responsibility to the public to assure that a public trust is literally that, a trust.

Given that, I'd like to talk about one specific case at Lawrence

The author is a science writer for the Sacramento Bee newspaper, P.O. Box 15779, Sacramento, CA 95852