CSWP GAZETTE

A Newsletter of the Committee on the Status of Women
in Physics of the American Physical Society

October-November 1986 Volume 6, Issue 3

NOTE TO OUR READERS

The questionnaire to be used for data intended for the Roster of Women in Physics is enclosed with this issue, as it was inadvertently left out of most copies of the July issue of the *Gazette*. If you are updating information for an existing Roster entry, please supply your Roster number; this may be found in the upper right corner of the mailing label on the *Gazette*. The "Foreword" in the July *Gazette* issue contains additional material concerning the utilization of the Roster. Information on each questionnaire, or each Roster entry, is kept confidential.

Please send your Roster information and any other requests, letters, or suggestions to Dr. Miriam Forman, APS, 335 East 45th Street, New York, NY 10017. The information will then be forwarded to the appropriate CSWP member.

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FOREWORD

With the encouragement of colleagues on the APS Committee on the Status of Women in Physics, your editor presents in this issue of the *Gazette* an editorial (slightly cut) that she wrote for *The Cornell Engineer* in 1952, while an undergraduate in Cornell's five-year Engineering Physics program. For comparison, there follow some selected portions of news items, provided by CSWP-member Dr. Evelyn Hu, that appeared in a recent issue of the IEEE publication, "The Institute." Comparison of these 1952 and 1986 articles shows the enormous improvements that have been accomplished by engineering schools in the enrollment of women (and minority) students. We note that the scholastic honorary society for engineers, Tau Beta Pi, did not admit women to full-fledged membership until 1975 (as local chapters "didn't want women at their 'smokers,'" according to one chapter advisor). However, today women students frequently are leaders in Tau Beta Pi chapters; and the Society of Women Engineers has grown from small groups of two or three women at each engineering school to flourishing and highly visible organizations at most universities.

Although any given physics department has much less visibility and less influence than an entire school of engineering, are there lessons physicists might learn from engineers in regards to strategies that could be used to attract more qualified women into the discipline of physics?

Another field closely related to Physics, that of Astronomy, is represented in this *Gazette* by excerpts from an article "Women's Work," written by well-known astronomer Vera Rubin for *SCIENCE 86*, with comments on Dr. Rubin's article found in a recently launched Astronomy Newsletter.

Results from a survey of M.I.T. graduate students, concerning differences between men and women students, have been described by Mildred S. Dresselhaus, former APS president, in a recent issue of *Physics Today*. Dr. Dresselhaus's article is excerpted here. Also presented is a biographical sketch of Dresselhaus that appeared in a University of Chicago publication earlier this year.

An updated list of Colloquium Speakers is included in this *Gazette*.

Janice Button-Shafer
Department of Physics
University of Massachusetts
Amherst, MA 01003

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SPS SCHOLARSHIP RECIPIENT

The Society of Physics Students (SPS) has announced that Tania M. Slawecki, a junior physics major at Lycoming College in Williamsport, Pennsylvania, has been selected as the second recipient of the Society of Physics Students Scholarship. She will receive a grant of $1000 to help fund her final year of undergraduate study.

Ms. Slawecki, while maintaining a 3.98 grade-point average out of a possible 4.00, has developed a great interest in gravitation and will take an independent study course on the topic during her senior year. In addition to her class work at Lycoming College she will serve as a laboratory assistant and a planetarium operator for the Department of Astronomy and Physics, a writing tutor for the Department of English, and a violist with the Williamsport Orchestra. The Lycoming College SPS Chapter has flourished during Ms. Slawecki's two terms as chapter president.

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WE HEAR THAT . . .

Dr. Sheila Evans Widnall, president-elect of the American Association for the Advancement of Science, has been appointed to the Abby Rockefeller Mauzé chair at the Massachusetts Institute of Technology. This professorship is reserved for the appointment of distinguished women scholars who will encourage advancement of women in the professions, industry, and the arts. Internationally recognized for her original research in fluid mechanics and aerodynamics, Professor Widnall is a fellow in both the American Physical Society and the American Institute of Aeronautics and Astronautics, and was elected to the National Academy of Engineering in 1985.

The late Dr. Judith A. Resnik, NASA Mission Specialist and a member of the Society of Women Engineers, is being honored by the establishment of a new medal. The Board of Directors of the Society decided in June of 1986 that the medal, the Resnik Challenger Medal, will be awarded to a woman engineer for "visionary contributions to space exploration." The Society is also developing a Resnik Scholarship, with contributions being received from donors around the world (by SWE Headquarters, 345 East 47th St., New York, N.Y. 10017).

Dr. Susan M. Simkin, astronomer in the Department of Physics and Astronomy at Michigan State University, and chair of the American Astronomical Society Committee on the Status of Women in Astronomy, has started "A Newsletter for Women (and Men) in Astronomy." She reports that "the women in mathematics seem to have developed a much better picture (than have astronomers) of their problems and devised viable solutions. The Newsletter of the Association for Women in Mathematics appears to have helped in this."

[Dr. Simkin includes in her first Newsletter a "literary review" of the article "Women's Work—For women in science, a fair shake is still elusive," written by well-known astronomer Vera Rubin, for the July/August issue of *SCIENCE 86*. Portions of her review and of Dr. Rubin's article are presented elsewhere in this issue of the CSWP *Gazette*.]

Dr. Tricia Reeves, of Kansas State University, has won an American Postdoctoral Fellowship in Physics from the American Association of University Women. The few other awards in this category went to scholars in the fields of biology, economics, and literature. Shangyuan Huang of China won an International Fellowship from AAUW to study in the field of Optic Fibers at Stanford University. The American Postdoctoral Fellowship is an award of $15,000; the International Fellowship, an award of $10,000.

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LETTERS

All but the last of the letters presented here were sent in response to the "Feature Article" of the July *Gazette*, written by Mary Beth Ruskai of the

University of Lowell (Department of Mathematics). Dr. Ruskai expressed her concern over "certain negative attitudes toward science and mathematics developing in so-called feminist circles."

Dr. Ruskai, who does mathematical physics, presently heads the New England section of the American Women in Science organization. Her article that appeared in the *Gazette* has also been printed in the newsletter of the Association for Women in Mathematics; responses will appear in the November-December issue of the AWM newsletter.

Dear Dr. Ruskai,

I enjoyed reading your well-written, well-documented piece in the latest CSWP *Gazette*. As others take up the topic and pursue the points you raise, I would hope that an effort could be made to avoid creating divisiveness between "scientists" and "social scientists," since most of the latter consider themselves scientists. It is a good deal less provocative to say that social scientists do not understand what it is like to be a physical or biological scientist than to say that social scientists do not understand what it is like to be a scientist.

I don't think we want to discourage the work of social scientists who explore differences between boys and girls, and between men and women, and address the question of what relevance, if any, these differences have for careers and creative effort. At the same time, your main point is a very important one—that the methods and nature of the social sciences differ so markedly from those of the physical and biological sciences that most social scientists cannot speak with any authority about what it is really like to be a practicing physical or biological scientist.

Your excellent article deserves wide attention.

Sincerely,
Kenneth W. Ford
Consultant for Educational Programs
The American Physical Society

Dear Dr. Ruskai,

I read with interest your letter in the latest CSWP *Gazette* and share your concern. I would like to suggest that the lack of participation by women scientists in "women's issues" results from (1) a lack of time (they're busy *doing* science, not talking about it); (2) a disinclination to generalize and write or speak publicly on any subject without data (Since the gathering of relevant data is not their research area, they have available only the data of social scientists or anecdotal data related to their own experiences or those of friends or acquaintances.); (3) lack of experience with popular or non-scientific writing.

This leaves the social scientists who devote their professional lives to such issues, and who often do rather soft science, as the spokespersons for women scientists.

I don't have any very specific suggestions for changing things, however. Those of us who teach non-science students can try to dispel some of the myths. I will circulate your letter to some of the more outspoken feminists on our campus. Perhaps it should be reformulated as an article with wider distribution.

Sincerely,
Dr. Katheryn Rajnak
Department of Physics
Kalamazoo College
Kalamazoo, MI 49007

Dear Mary Beth,

Thanks for your article in the CSWP *Gazette*; I thought I was alone in disbelieving all the "research" about women's abilities in math and science. What a promotion for science/math anxiety those non-scientific studies are!

A bit of encouraging news . . . I have been teaching "engineering" physics (2-year sequence, calculus based) at this community college for 31 years and I did my graduate and undergrad work at UCLA when there were almost no women in physics. Things *are* changing, despite the social scientists. About 15–20% of my students are now women, albeit a large number are not American born (perhaps the culture shock for Asian and Middle Eastern women is so great they don't know they are not supposed to be good in math/science).

I believe the source of these attitudes has been documented (?) in the math anxiety of female grade school teachers who consciously or otherwise influence girls to fear and dislike math. Many of my female students had to take a lot of makeup work in math before starting college level work; fortunately, the community college is very good at this.

Girls, then, need role models, preferably at a very early age. Grade school teachers need to lose their math anxiety, too. Can we get to them in our communities? Perhaps it is time for a campaign. Many of us would like to help design or carry-out the necessary work.

Incidentally, as you probably know, women science/math students are wonderfully nurturing and feminine in the best possible way. They have made these last 5–10 years of teaching much more rewarding for me; they express appreciation!

I am sure you will receive a great deal of mail from other women. If you send out any general response, please put me on your list.

Sincerely,
Geraldine Karpel
Professor, Physics
El Camino Community College District
Torrance, CA 90506

Dear Dr. Ruskai,

I did find your letter in the CSWP July *Gazette* stimulating enough to want to respond, even if, as "not economically active," I may be outside the group of women scientists you planned to reach.

While the problem of sociologists, who may know little, and understand less, of the mathematical and physical sciences, speaking for women scientists would appear to be real, some sort of register of suitable, willing women scientists might be able to be publicized.

But the underlying problem of real misconceptions of the nature of scientific work affects not only women (and others) who might consider entering these fields. If there was more real knowledge of the nature of work in the physical and mathematical sciences among all non-scientists the problem wouldn't be so serious. The particular version I'd met was that physical sciences were for people who wanted nice, safe, set answers, and didn't want to face the real intellectual challenge of more open-ended fields—a symptom of acute, rampant ignorance. But the image of the intelligent, uncreative, inartistic, greasy grind is pervasive—it runs through the recent "Insiders Guide to Colleges" our son's been reading—and a symposium on Engineering careers left him put off by the vision of a lifetime searching for a "better bolt." All not gender-related, but I think girls are more discouraged by this sort of image.

Unfortunately I was unable to find Dr. Tobias' article to reread at this point. I agree entirely that traditional high standards must be kept in physics courses. But, as I remember the original article, some of the "remedial spoon-feeding" dealt with what could have been described as "science-readiness" that ought to have been acquired before or in primary school. Unfortunately this lack of exposure would appear to be self-perpetuating and it would appear to be connected to the high percentage of college students with a pre-Newtonian understanding of mechanics reported in *Physics Today* several years ago. I agree entirely that improved mathematical preparation at *all* levels would help the situation immensely, but by secondary school it's often too late. I came away from Dr. Tobias' article with the feeling that something at the Sesame Street level was needed.

I was lucky. I came from a technically/scientifically literate family and had uncles who considered such things as explanations of aerodynamics natural when faced with entertaining two-year-old girls. I also was able to go to one of the "seven sisters" colleges before the great coeducation push so that social pressures against doing physics were minimal. But my high school didn't even allow physics for academic girls unless they planned on nursing, and I was told that I couldn't do German as the available space was needed for boys who needed it for "their" science! I expect we've all run into something

on that order— and it's well worth making a fuss about it, if it hasn't stopped yet (as I hope it has). But I'm all too afraid that girls are still steered to biological sciences and away from advanced maths in too many cases.

Sincerely,
Nancy Weatherell
Wylye Head, Kilmington
Warminster
Wiltshire BA12 6RD
England

Dear Editor,

Thank you for the Newsletter of the Committee on the Status of Women in Physics. I always read it with pleasure upon receipt, if possible.

When I first read the September-October 1985 issue, I put it aside on my desk because I thought that I would like to share a poem that I wrote in 1985 on the subject of Nuclear War. It has appeared twice in the *Watchman*, which is the Diocesan newspaper of the Anglican (Episcopal) Diocese of Johannesburg. The second appearance was in order to accompany my recent article on the Chernobyl disaster.

I am at present Radiation Medical Physicist at the Hillbrow Hospital, Johannesburg. The Radiation Therapy Department does about 3600 new patients per year so that we should have nine physicists. I have only one colleague, who has just been registered with the South African Medical and Dental Council. We have three linear accelerators (1:20 Mv and 10 Mv photons and 6, 9, 13, 17, and 20 Mev electrons; 2:6 MV photons; 3:5 Mv photons), two Cobalt treatment units and two X-ray therapy units, 250 KVp and 100 KVp.

I received my Doctorate from The Johns Hopkins University for work on proton-alpha polarization in 1958 (experimental work done at Brookhaven), worked at Atomic Energy Research Establishment, Harwell, England (where I met my British—South African husband) and the University of the Wiwatersrand as a Nuclear Physicist before I became a Radiation Medical Physicist. I have three children and have never stopped working full-time.

I am very involved in the Anglican Church, although I do not have a great deal of time at present. Mostly I write articles for the *Watchman*. I sit on Diocesan Council for the Cathedral. I was the first woman to be Churchwarden of the Cathedral. I have just represented the Cathedral at the Elective assembly at which we elected a successor to Bishop Desmond Tutu, who has just become our ArchBishop of Cape Town.

Yours sincerely,
Mary Jean Scott Silk, PhD
Department of Medical Physics
Hillbrow Hospital
Private Bag 23140
Joubert Park 2044
Johannesburg
South Africa

(**Editor's note**: We regret that lack of space prevents our publishing the poem on Nuclear War that Dr. Silk sent. We hope to present it in a future issue of the *Gazette*.)

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WHERE ARE THE WOMEN?

(a 1952 editorial)

Last year, of some 40,000 engineering degrees granted, only 77 went to women. Yet, in hundreds of colleges throughout the country are analytically minded young women enrolled as math or physics majors or perhaps as students of the humanities or even home economics—many of whom would have become capable engineers if they had been of the opposite sex.

The furor raised during the past year over the drastic shortage of engineers is an old story by now, but the situation is expected to continue for a good many more years. Surveys indicated a shortage of over 40,000 engineers last spring with a probable continued deficiency for the next five to ten years. Instead of looking for jobs as did other graduates, engineering students found their services the object of industrial competition. Most engineering graduates had at least half a dozen offers, with an average starting salary of $350 a month. Large companies were offering to hire entire graduating classes; men about to be drafted were signing promissory contracts for the future.

Not so long ago, it seemed to be generally true that a company preferred to hire an inferior male engineer rather than a good woman engineer, in spite of the fact that women like Edith Clark and Lillian Gilbreth proved themselves capable in this masculine profession. But today, with the draft sapping our manpower and with industry hiring engineers for a wide range of positions (40% of industry's management personnel are engineer-trained), women are being looked to for possible help in meeting the demand.

It is up to each engineering-minded high school girl to decide for herself 1) whether she thinks she has the qualifications which would fit her for an engineering education; and 2) whether she has the interest and determination to go through with that education. However, the high school graduate has to depend to a great extent on the advice of parents, friends, and teachers; in many cases, a girl has not had the chance to find out whether she has more than an infatuation for a particular engineering field and whether she has any real ability because of the discouraging, out-of-date ideas of her elders. Many girls have instead been satisfied with theoretical math and physics courses which, unless supplemented with an unusually large number of technical electives, give little opportunity for acquiring the common-sense, practical knowledge so necessary for industrial research . . . or for learning anything beyond the pure science training useful chiefly for a teaching or pure-research career.

If a woman has the same interests and capabilities as a man, why should she not have the same opportunity to develop these interests? True, a woman has to be able to adjust to the idea of "going it alone" (though she will soon attain the respect of her male classmates and her instructors if she shows real interest), and she may face difficult situations when she enters into a career . . . and finally she perhaps will have the challenging problem of trying to combine marriage and a career. But balanced against these is the satisfaction of acquiring a better understanding of her physical environment and the tools with which to create in that environment as well as the confidence of being able to work alongside her fellowmen and . . . even if she gives up her career for marriage . . . the satisfaction of having an education in a field which holds her chief interest.

It is often said that engineers are too much limited by their rigorous technical education; however, the five-year program such as Cornell offers (particularly the Engineering Physics course, which, with its combination of down-to-earth engineering training and a broad scientific foundation, is excellent technical training for a girl) enables students to take a large number of liberal electives. Along with developing the ability to understand physical phenomena, the engineer, male or female, is encouraged today to develop his interests in the arts and in general participation in college and community life.

Women are generally considered to be of more meticulous nature than men; their approach to problems maybe somewhat different. They may not be able to fit as easily into engineering management positions, but they can and have surpassed men in ability and achievement in many realms of technical work.

The situation today is critical. The women of this country have had to assume no obligations in their country's defense mobilization program, as they have elsewhere. Yet they have equal rights and supposedly equal opportunities in the political, social, and economic structure of this nation . . . and they certainly have ability. So why should they not make use of it?

(from *The Cornell Engineer*, October 1952,
by Janice Button, EP '54)

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IEEE NEWS

The following are excerpts from the August 1986 issue of *The Institute*, a news publication of the Institute of Electrical and Electronics Engineers.

Task Force to Reassess the Roles of Women and Minorities at Work:

"The situation of women and minorities in the engineering workforce must be reassessed," said the chairman of the IEEE's new Women and Minorities Task Force. "We will attempt to do that."

"Women and minorities are in the workforce now, but what is their status?" asked chairman Evelyn Hirt, an electrical engineer at BDM Corp. in Albuquerque, N.M. "What do they still need to become professionals? That is what we need to look at, so that we can make factual, not emotional, statements on the issues."

The task force, which was approved by the IEEE U.S. Activities Board in January, was organized to promote opportunities and achievements involving women and minority IEEE members, and to study the changing problems they face. More specifically, it will address areas such as education, recruitment, hiring, compensation, professional development, and career advancement into management.

The group is the product of a merger between the Committee on Professional Opportunities for Women (Compow), formed in 1971, and the Regional Activities Board–USAB Minorities in Engineering Committee, according to Hirt. "We found that minorities and women faced many of the same problems in the workplace, so for efficiency we just combined the groups."

Laura Rust, past chairman of Compow, said that she had faced "the frustrations" of establishing goals and getting sufficient funding for her committee. However, she was unsure as to how effective the task force might be, saying the IEEE may not be ready to "take on the responsibility of addressing women's and minorities' issues because they make up too small a section of the workforce."

"At this point, a task force is at least better than a committee," Rust said. "But I still think the Society of Women Engineers does a much better job of handling women's issues." She suggested that the task force might organize a liaison with the SWE "to look at what needs to be done" and establish a firm set of goals.

"We've opened the door for women and minorities, but they need to know what hall to go down," Hirt said. "They still need direction and a knowledge of the possible career choices because their backgrounds haven't prepared them for the professional side of the job."

More Women Choose Careers in Engineering:

"I'm more optimistic than I've been in a long time about women in engineering," said Shirley Malcom, head of the science opportunities program at the American Academy for the Advancement of Science. "They [male engineers] need us in the workplace. But I'm still worried about what happens to women until the men realize that they need us."

Malcom said women are attracted to electrical engineering because jobs are easy to find and starting salaries are relatively high.

However, in 1982, according to a report by the American Association of Engineering Societies' Engineering Manpower Commission, women accounted for only 2 percent of the total number of electrical engineers, 6 percent of the chemical engineers, 2 percent of the civil engineers, 4 percent of the industrial engineers, 2 percent of the mechanical engineers, and 26 percent of the computer specialists in the United States.

In the early 1970s there were not many women in engineering, but the numbers increased substantially as the decade progressed. Now they are leveling off, and some people even predict a decline in female enrollment in college courses, Malcom said.

Alan Fechter, executive director of the Office of Scientific and Engineering Personnel at the National Research Council, said a "new kind" of woman is entering the engineering workforce, with attitudes, motivations, and beliefs that differ from those of her predecessors.

"Before, the conventional practice was for women to make their careers subordinate and drop out of the workforce to take care of their families, but now they can either try to have it all or not even have a family," he said.

Women start out 'equal'

Susan K. Whatley, president of the Society of Women Engineers and program manager for geologic repositories at Martin Marietta Energy Systems in Oak Ridge, Tenn., said she has noticed more women working in engineering jobs over the last four years. And upon starting their jobs, new women engineers now tend to face the same problems as new male employees.

"Women at the entry level seem to be pretty much equal with their male coworkers," Whatley said. "Early on, it was assumed women couldn't do the job. I think this has gone away for the most part."

A recent National Science Foundation study, "Women and Minorities in Science and Engineering," appears to support Whatley's observations. It found that in 1984 women accounted for 13 percent of the science and engineering workforce, up from 9 percent in 1976. The report also stated that women now have relatively equal access to science and engineering educations but are still not treated equally in the workplace. [For copies of the report, write to the National Science Foundation Publications Office, 1800 G Street, N.W., Room 232, Washington, D.C. 20550.]

A 1986 survey from the U.S. Department of Education likewise found that women are being awarded more engineering degrees. In 1973 women were awarded 1.2 percent of the bachelor's degrees and 1.7 percent of the master's degrees in engineering, according to the survey. By 1983 those numbers had risen to 12.3 percent and 9.3 percent, respectively.

However, like the NSF study, the Department of Education report found that once women have earned their degrees, they are still more likely than their male colleagues to be unemployed, and if employed are less likely to get jobs in science and engineering.

Whatley has found that many women engineers get lodged in lower-level management positions because they often take time off from their careers to devote to a family.

"When they get into their thirties, many women seriously think twice about devoting their entire lives to their careers," Whatley said. "I think because of this, women will always be a little behind men in their careers. It's something that's never going to go away."

Another problem, according to Whatley, is that although it has become easier for women to assume middle-management positions, "it still may take women longer than men to get there, and it is still virtually impossible for them to get high-level jobs."

On an optimistic note, Whatley asserted that a lot of men's "rough and tough," chauvinistic attitude toward women in engineering have, for the most part, vanished.

Whatley thinks children's science textbooks and high school guidance counselors help perpetuate the view that engineering is strictly men's work. The Society of Women Engineers and Women in Science and Engineering have organized high school career guidance programs in the Oak Ridge area to help combat the problem, she said. As part of the program, high school juniors and seniors are invited each fall to hear speakers like Whatley discuss career opportunities for "young women who should be engineers but are never told so in school."

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WOMEN GRADUATE STUDENTS

(excerpted from an article in the June issue of *Physics Today*, by Mildred S. Dresselhaus, Institute Professor of Electrical Engineering and Physics, Massachusetts Institute of Technology)

Although in 1983 only 2.7% of the PhDs working in physics and astronomy were women, many more women are now majoring in physics, both as undergraduates and as graduate students. As recently as five years ago, the AIP Manpower Statistics Division surveys showed only 10% of those earning bachelor's degrees to be women, whereas the class of 1985 had 14% women. Five years ago 6% of the PhD recipients were women; in the class of 1985, 8% were women.

The upward trend for women physicists is even more favorable in universities with a strong science and engineering focus. For example, in 1984 women undergraduates at MIT were 72% as likely as men to be majoring in physics, compared with 44% just five years before. Though this value has fluctuated from year to year by as much as 20%, the long-term increase is statistically unmistakable, and clearly visible in the classrooms.

To obtain some meaningful data on the academic environment for MIT graduate students, the MIT Committee on Women Students' interests conducted a survey in 20 academic departments. Last year the data were thoroughly analyzed for students in the department of electrical engineering and computer science, where in 1984 there were 642 students, of whom 15.7% were women. This year we analyzed data for graduate students in physics and other departments.

The most striking finding of the survey is the essential similarity between women and men graduate students in physics, a department where women represent 14% of the 297 graduate students. Based on the completed questionnaires of 25 women and 86 men physics graduate students, the differences between women and men were smaller in physics than in any other academic department. Essentially all men and women aspire to complete the PhD degree in physics. They were similarly supported during graduate study (by graduate assistantships, teaching assistantships and fellowship support). Neither women nor men experienced significant difficulty in finding research groups, and both men and women were generally satisfied with the types of research they were doing. Interestingly, the ratings women physics students gave their own research performance showed essentially the same distribution as those of the men; for almost all other academic departments, women graduate students perceived their academic performance to be significantly inferior to that of the men, though quantitative measures such as rates of passing qualifying exams and completing degrees indicated more nearly equal performance. Women physics students were as likely as men to present papers at conferences or to be first authors on publications, and women felt that they had no more problems than men in meeting deadlines, in contrast to patterns in many other academic departments. Perhaps the similar career expectations of men and women physics students and a critical mass of women graduate students has helped to create an approximately egalitarian environment.

Some differences between men and women physics graduate students did, however, appear in the survey. Although men and women spent about the same number of hours per week in academic study, women spent significantly more time (about 10 hours per week more) than men doing research work and less time than men in leisure activities; these findings are consistent with those for the electrical engineering and computer science department. Women found the pace and pressure of graduate physics study more severe than did the men. Women students were more likely than men to feel the pressure imposed by their faculty supervisors or by peers. Women students felt that they got somewhat less help with their research work, both quantitatively and qualitatively, than did the men, and women felt they had slightly more trouble than men in developing research skills. Women students valued the help received from faculty and peers more highly than men did, and especially appreciated the opportunity to participate in group discussions. The "atmosphere" in the research group was more important to women than to men, and women were more apt to feel hindered in their productivity by the lack of availability of equipment or lab space.

With regard to courses, men were more critical than women of below-standard classroom teaching. However, women were more apt to feel that exams did not reflect their true ability than men, consistent with findings in almost all of the academic departments.

In fields where research results can be evaluated quantitatively, women students tend to feel more secure about their performance relative to that of men. I think women who choose careers in physics, a field where they can expect to be significantly outnumbered, are generally more confident than those in other fields. But they nevertheless need reassurance. Big discoveries are usually made by taking risks, and women are less apt than men to go off in unknown, risky directions. Women students like to review their work with their supervisors and seek to please them by doing what is expected of them. I believe that on the average they get less feedback from their male peers and supervisors because men hesitate to criticize women. So if a woman doesn't receive a promotion she expected, she's surprised. These problems suggest the urgent need to train our women students to be even more independent than the men.

It is clear to me that on the average, women students at both the undergraduate and graduate levels perform better when their numbers reach a critical mass, which operationally means when there is another woman student in the classroom or in the same or a neighboring research group. Their mutual support and shared experiences enhance their confidence and their ability to cope with problems in the academic environment. Faculty and administrators should appreciate this point.

Graduate-student networks are very successful in helping women research students cope with the social and interpersonal problems they commonly face. (Minority students likewise find these student networks essential.) Faculty members should be sensitive to these problems and supportive of student networks.

I have noticed, both with my own students and through the student survey discussed above, that women graduate students, on the average, seek more attention, feedback and help than men, though individual students differ greatly in this regard. Though faculty should be careful not to treat students as stereotypes, sensitivity to this point might be constructive. At MIT, a doctoral student makes a presentation to his or her thesis committee each term. Women students take the event and the feedback more seriously than men students. The average performances of men and women on the various doctoral exams are almost exactly the same. But the women tend to be more anxious about exams than the men and to feel they haven't done as well, even when the results later turn out to be equivalent.

Women students have a tendency to be more conscientious and to work longer hours. This characteristic should in the long run be an advantage, though in early graduate-school years it may just be a response to insecurity and the need for more help from peers and faculty. Faculty can be especially helpful in channeling this extra effort into productive areas and in helping a student set better priorities for the use of her time.

After carrying out the survey of graduate students at MIT, we became aware of a similar survey that had been conducted at Stanford University. It is impressive that though the questions and approaches of the two surveys were substantially different, they reached similar conclusions with regard to the overall similarities between women and men graduate students, as well as with regard to differences. I hope that the greater anxieties, pressures and insecurities experienced on the average by today's women graduate students will soon vanish as more women enter and contribute importantly to physics. Though much has been gained in the past decade, there is no doubt that much remains to be done.

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RAMEY, SIMPSON, AND DRESSELHAUS

(portions of an article, "My Daughter, the Scientist," in the *University of Chicago Magazine*, Spring, 1986, by Chris Anne Raymond and Brigitte Carlson)

Estelle Ramey, Joanne Simpson, and Mildred Dresselhaus differ in temperament, in background, and in the nature of their work. But they forged themselves into scientists out of common ability to endure and fight a stereotype that would have had them believe it wasn't possible.

This year all three are celebrated in "My Daughter, the Scientist," an exhibit of a dozen scientists and engineers created at the Museum of Science and Industry in Chicago. Estelle Rubin Ramey, PhD '50, is a professor of physiology and biophysics at Georgetown University School of Medicine in Washington, DC; Joanne Gerould Simpson, SB '43, SM '45, PhD '49, is head of the Severe Storms Branch of the Goddard Space Flight Center, in Greenbelt, MD, part of the National Aeronautics and Space Administration. Mildred Spiewak Dresselhaus, PhD '58, is an Institute Professor at the Massachusetts Institute of Technology in Cambridge, MA.

Ramey has been studying the physiological differences between the sexes for almost fifteen years. Together with Peter Ramwell, also a professor of physiology and biophysics at Georgetown, she has been investigating the relationship between the male sex hormone testosterone and heart disease. Their findings: testosterone appears to intensify a male's response to stress, but estrogen, the female sex hormone, seems to protect against it.

Joanne Simpson, the first woman in the world to get a Ph.D. in meteorology, studies storms at the Goddard Space Flight Center, the first place where she has not felt isolated by her sex. "There are so many women scientists here that I can talk science in the ladies' room," she says. "That's the first time that's ever happened." The group she directs designs instruments to take measurements of the atmosphere, particularly of severe storms, from space and uses existing data from satellites and the space shuttle to predict and understand storms. They also make highly sophisticated computer models of how storms actually operate.

Mildred Dresselhaus is a solid-state physicist whose highly technical research, modifying the properties of electronic materials, has earned her election to both the National Academy of Sciences and the National Academy of Engineering. She is also a former president of the American Physical Society. Most recently she has been studying and modifying the

properties of carbon fibers. Unlike Ramey and Simpson, and a decade younger, she doesn't feel that her career has been hindered by sexism. It was the very fact, she said, that she didn't take herself seriously until twenty years ago that made success come naturally. "I was just trying to do a very small thing," she says. "That I did more is just fantastic."

Mildred Dresselhaus grew up in a seedy Brooklyn neighborhood, the child of immigrant parents. Her mother took in sewing by day and worked in an orphanage by night. As a child, Dresselhaus worked as a tutor, and in factories and sweatshops, anything to bring in money. But often she and her older brother went to bed hungry. She was beaten up on the streets, "but I learned the things one does to be safe," she says. "I survived."

Unlike Ramey and Simpson, she doesn't feel that being a woman hurt her career as a scientist, in spite of the fact that her dissertation supervisor regularly let her know that he was completely opposed to women scientists. "He let me know that every time he saw me," she says. "So I just avoided him, never spoke to him." And she remembers being impressed by the presence of future Nobel laureate Maria Mayer at the University of Chicago, who was never able to get an appointment better than "voluntary associate" because of nepotism "rules."

Dresselhaus recalls that she was surrounded by "a number of really good women students" and she remembers the professional women at the University, whatever their title, being highly respected. "So when I was a graduate student," she says, "I didn't really have the idea that women couldn't do it."

When he did catch her long enough to talk to her, Dresselhaus's thesis supervisor told her that educating women was like poetry. "He felt that women weren't going to contribute, and maybe it was good for the culture of the race, but that was about it," she says. "And so I listened to him and from then on, for about ten years, I did my career as a luxury. You know, 'this is my hobby and I just do it for fun and whatever I do, that's fine. And what I don't do, that's also fine. I'm not competing against anybody because I'm not a serious worker, I'm on the fringes.' It took all the pressure off. I could raise my family."

Dresselhaus says she realized she "really was a professional" when she went to M.I.T. for an interview and was hired as a full professor. (During the interview, she was unaware that she was being considered at that level.) At the time she held a job as a full-time research scientist. "Well, when I became a full professor, you know, things changed because students and colleagues looked up to me. I was put in a different kind of position. The work didn't change. Nothing changed but my perception. I was on the outside fringes and all of a sudden I became a part of the scene."

Dresselhaus is careful to point out that there was an unusual quality to her circumstances, which helped her from the beginning. Her chosen field was solid-state physics, a field so new that when she earned her Ph.D., it wasn't yet named. "I graduated around the time of *Sputnik* and industry was gearing up to make a big investment in semiconductors and things that I knew about. So it was very, very easy to get a good job. The field was wide open. Everything that you tried turned to gold. There were lots of jobs. There was hotshot research because there were a lot of new tools and new ideas floating around, and the industry was looking for people like crazy. They were so anxious to get competent people that they didn't care if they were women."

Dresslhaus's positive outlook may have something to do, as well, with a stubborn perseverance nurtured in childhood. After her older brother enrolled in the Bronx High School of Science, Dresselhaus decided to enroll at Hunter College High School, despite the fact that neither her teachers nor her mother wanted her to. "After I was discouraged I didn't tell anybody what I was doing," she says. "I just went and took the exams and I passed. And that was that." She went on to Hunter College where Rosalyn Yalow, another future Nobel laureate, became her friend, confidant, and mentor. Dresselhaus graduated with a triple major, in math, physics, and chemistry, summa cum laude.

After a Fulbright Fellowship to Cambridge University and a master's degree at Radcliffe College she came to the University of Chicago for her doctoral work and met her future husband, Gene Dresselhaus, who was then a beginning instructor. (He is also a physicist and an engineer.) Dresselhaus feels that it was while she was raising four children that she did her best research. "I was young, and I was only doing research and raising children. I didn't have teaching committee assignments, national committee assignments ... And I was in a laboratory that provided good technical support. My husband had a good job so we could afford a babysitter," she says. "I was just doing two things. Children and work. And it was a good combination because it was different and mutually supportive. But later on, as your career develops it gets much more complex. As I got more so-called successful, I had less time to do the sort of thing I'm good at."

When all three women talk about the prospect for young women scientists today they talk about working out a productive co-existence with men. They talk about having families. And each of them mentions the importance of a supportive spouse. "If it wasn't for that I don't think you'd have the will to go on," says Dresselhaus. "Something would give." But the actuality of childbirth and childcare is still formidable. "Childcare is really the preeminent problem," says Ramey. "I don't know any young women who are concerned whether there's dust under the living room couch. What they're concerned about is what's happening to their children." It is a family issue, she says, that comes from a need to rethink our conceptions and our expectations of both men and women.

But there's nothing to be done about the demands of science, says Simpson. "To make really terrifically creative and important contributions you need to do it sleeping, breathing, and waking up in the middle of the night with an idea," she says. That precludes taking much time off. "If women can't make the sacrifice then they aren't going to make it," she says. "They'll have an interesting job and probably a nice life but they won't make the top-level contributions to the field or get the top-level jobs."

Dresselhaus thinks what is easier for women today is that they are being offered more chances. What is harder is that there is so much more pressure on them to achieve. "The professions are so much more competitive now than they were when I was getting in," she says, "so the pressure is much higher. And women now consider themselves seriously; they consider themselves in competition with men ... that makes it more complex."

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LITERARY REVIEW

[from "A Newsletter for Women (and Men) in Astronomy," edited by Dr. Susan M. Simkin, Dept. of Physics and Astronomy, Michigan State University]

"WOMEN'S WORK—For women in science, a fair shake is still elusive," by Vera Rubin

***SCIENCE 86*, July/August, p. 58.**

All the "astronomy" women I know have read and discussed this article. (It was pointed out to me by my oldest son the day the July copy of *SCIENCE 86* arrived at our house.) The only male (astronomer) who has mentioned the article to me was indignant. "She (VR) says that letters of recommendation for women are no good, and she's wrong," was his comment. Well, she says more than that. This article contains a bit of personal reminiscence, a bit of women's history, and a lot of good insight into the SUBTLETIES of discrimination. It is also accompanied by two pages of "statistics" from Betty Vetter, Director of the Commission on Professionals in Science and Technology. The article deals up several possibilities for extended discussion. Among them are: (1) Attitudes of men towards women's "intellectual" abilities—are women *really* more suited to repetitive, tedious jobs? (2) Difficulties faced by women when they find themselves isolated in graduate school or on the job. (3) Reactions of women to outright sexism. (4) The tendency of "successful" women to minimize the difficulties they have had with discrimination. There is also the statement contested by my male colleague that "The letters of recommendation that her (a female student's) advisor writes will not be discriminatory but may be subtly different and tentative." (Not "no good.") I told my colleague that I agreed with Vera. Letters for women which I have read (in the process of screening over 250 applicants for 3 academic astronomy positions in the past two years) have always been more tentative than those for all but the most poorly qualified man. It seems that men are afraid to strongly recommend a woman, because she might "let them down." This is a phenomenon which needs to be discussed.

—Susan M. Simkin

WOMEN'S WORK

For women in science, a fair shake is still elusive.

by Vera Rubin

(excerpted from the article published in *SCIENCE 86*, July/August issue)

I was an astronomy student at Vassar College on October 1, 1947, 100 years after the night that Maria Mitchell discovered a comet. Only recently have I realized that no note whatsoever was taken of the centennial of this discovery by the first prominent female astronomer in the United States. Perhaps on that day one of my friends or I irreverently tied a bright scarf around the stern-looking bust of Mitchell in a niche of the observatory building, where she taught for many years. But she deserved more.

What I do remember of 1947 is that I wrote a postcard to Princeton University asking for a catalog of the graduate school. Sir Hugh Taylor, the eminent chemist and dean of the graduate school, took the effort to answer by writing back that as Princeton did not accept women in the graduate physics and astronomy program, he would not send a catalog. Princeton did not accept women in graduate physics until 1971, in graduate astronomy until 1975, and in graduate math programs until 1976.

For me as a youngster, the account of Mitchell's comet discovery that I found in library books was an exciting part of the lore from the scientific past, along with Benjamin Franklin's kite. Like the kite, it should be a part of every American child's heritage. Yet in 1976, when the Smithsonian Air and Space Museum presented as its first planetarium show a history of 200 years of American astronomy, only male astronomers—all but one of them white—were included. Little boys learned that they could become astronomers. But little girls, who also streamed into the show in enormous numbers, saw that only men were astronomers. After months of effort to have the planetarium show corrected, I received a statement that the talk was recorded and could not be altered.

All of us, men and women alike, need permission to enter and continue in the world of science. In high school and college, students need the permission of parents and teachers. During graduate and postgraduate years, young scientists need the permission of college officials, funding officers, mentors, and colleagues. While such permission has generally been granted to bright men, it has always been less readily granted to young women and continues to be denied to many women even today. In many fields of science, women constitute such a distinct minority—less than five percent of all physicists and seven percent of all astronomers—that they suffer many of the social ills common to minorities.

The daughter of an intellectual Nantucket family, Maria Mitchell learned from her father how to search the sky with a telescope and how to calculate orbits. Employed during the 1840s and 1850s as the librarian of the Nantucket Athenaeum—the intellectual center of Nantucket and home of literary and philosophical societies, where giants like Thoreau, Agassiz, and Audubon lectured—she studied the advanced astronomical and mathematical texts available to her. Evenings she spent with her father on the roof of their home studying the sky with a telescope. On October 1, 1847, while her parents were downstairs entertaining guests at dinner, the 29-year-old librarian discovered a comet. She promptly announced her discovery to her parents, and Mr. Mitchell immediately posted a note to William Bond, director of the Harvard College Observatory. In 1831, the king of Denmark had offered a gold medal to the next person who discovered a comet with a telescope. (Comets were then generally discovered by eye.) Though the comet was also spotted in Europe, Mitchell's discovery was adjudged to be the first, and the medal was hers.

For the United States, Maria Mitchell became the symbol of women's emergence into the public world of science. In 1848 she became the first woman elected into the American Academy of Arts and Sciences—95 years were to go by until the next woman was admitted. And she was an active member of the American Association for the Advancement of Science. Nevertheless, when Joseph Henry, the first secretary of the Smithsonian Institution, announced in 1848 an "account of a new comet, the discovery of which is one of the finest additions to science ever made in this country," he never identified the "American lady" who made the discovery.

By the 1880s, more women were being hired as computers to do calculations and make measurements of photographic plates in observatories. A male graduate student of mine once quipped that American astronomy became preeminent over European astronomy because of two discoveries: Hale discovered money and Pickering discovered women.

George Ellery Hale, an eminent astronomer and organizational genius, learned how to raise money for building large, powerful telescopes by going to wealthy friends and others interested in revolutionizing American astronomy. Hale built the 40-inch refractor at Yerkes Observatory in Wisconsin, the 60- and 100-inch telescopes at Mt. Wilson in California, and the 200-inch telescope on Palomar Mountain in California. Though Hale's efforts helped put Americans at the forefront of astronomy, Hale harked back to the 19th century in his attitudes toward women. He and other astronomers dubbed the living quarters on Mt. Wilson (and later Palomar) The Monastery and banned women from using the telescopes—a restriction not lifted until the mid-1960s.

Edward C. Pickering, as director of the Harvard College Observatory from 1877 to 1919, responded to the competitive forces in astronomy by combining observational astronomy and physics into a new technology—the field of astrophysics. Photographing the heavens each clear evening, astronomers used spectroscopy—examining the constituent wavelengths of a star's light through a prism attached to a telescope—to distinguish between different types of stars. Pickering needed helpers to search the thousands of photographic plates his equipment was generating and to carry out long, detailed calculations to determine the positions and other information about those heavenly bodies recorded on the plates. Planning and directing the science was a man's job; tedious detail work was considered suitable work for women amateurs. Pickering learned that the women he hired were "capable of doing as much good routine work as astronomers who would receive much larger salaries."

Historians have dubbed the women Pickering hired to perform such meticulous study "Pickering's harem." Working with incredible patience and unflagging industry, they were observers, computers, and discoverers. Some became full-fledged mathematical astronomers, computing orbits of planets and asteroids. Some compiled star catalogs, devising systems to estimate stellar brightnesses. Some, like Williamina Fleming, were put in charge of managing the staff and hiring other women assistants.

Many of the women working at the Harvard observatory were outstanding. Annie Jump Cannon established the system with which she classified the spectra of more than 350,000 stars. The results of her classifications are published in a work named, ironically, *The Henry Draper Catalogue*. This compilation laid the groundwork for modern stellar spectroscopy.

In 1925, Cannon received, among other honors, the first honorary degree Oxford University ever bestowed on a woman. But through four decades of work at the observatory, she received no academic recognition from Harvard. Not until 1938, shortly before her death, was she made a professor of astronomy. As early as 1911, a visiting committee of the observatory reported: "It is an anomaly that, though she is recognized the world over as the greatest living expert in this line of work. . .she holds no official position in the university."

Henrietta Swan Leavitt joined the observatory staff permanently in 1902. In 1910 she made perhaps the greatest discovery of the Harvard women of this era. She identified the Cepheids—stars in the Magellanic Clouds whose brightnesses vary. In so doing, she discovered that the period of a star's variability was related to the star's intrinsic brightness. The longer the cycle from faint to bright to faint, the truly brighter the star. This discovery evolved into the most fundamental method of calculating distances in the universe.

However, Leavitt was not permitted to pursue her discovery; her job was to identify and catalog the variables. Pickering also assigned her the difficult job of comparing color indices and magnitudes on plates from different telescopes. According to Cecelia Payne-Gaposchkin, another of the eminent women astronomers who came later to the observatory, this was a "harsh decision, which probably set back the study of variable stars for several decades, and condemned a brilliant woman to uncongenial work." She died at a young age, before Professor Mittag-Leffler of the Swedish Academy of Sciences would be able to nominate her for the Nobel Prize he thought she deserved.

The belief persisted that the role of women in doing science was different from the role of men. In a graduation address delivered to the 1921 class of Bryn Mawr College, Simon Flexner, Director of Laboratories at the

Rockefeller Institute, discussed "The Scientific Career for Women." He distinguished discoveries based on "genius" or "imaginative insight"—and here the scientists he mentioned were men—from the predictable discovery demanding "knowledge, often deep and precise, and method, but not the highest talent." Here his example was Madame Curie.

Cecilia Payne-Gaposchkin received in 1925 the first Ph.D. in astronomy Harvard granted. Her thesis on stellar atmospheres was described by Otto Struve, an eminent astronomer at Yerkes Observatory at the time, as "undoubtedly the most brilliant Ph.D. thesis ever written in astronomy." She chose to remain at Harvard, since few other positions were available to her. But her career there was orchestrated by the observatory directors. She virtually never obtained the freedom to choose her own research directions, and her achievements were less remarkable than they might have been. For most of her professional career she remained untenured. Like Cannon, she was made a professor of astronomy and granted tenure at the end of her career.

Payne-Gaposchkin's autobiography, *The Dyer's Hand,* published after her death, tells a tale of disappointment after disappointment, of opportunities denied. One of the most brilliant astronomers of her time, Payne-Gaposchkin was never permitted to work on astronomy's significant problems and never elected to the National Academy of Sciences.

By 1950, women astronomers with Ph.D.'s from American Universities numbered about 50 in a total community of about 300. Almost all of them were employed by women's colleges; a few had access to other opportunities through a father, uncle, or brother who could sponsor them in the world of science. Almost all were single. They could look back on 100 years of American women doing astronomy and note that limited opportunities had generally restricted the contributions women had made. They could not know that as a total percentage of the astronomy community their numbers would soon begin to shrink. At the founding of the American Astronomical Society in the 1890s, the 11 female charter members constituted about 10 percent of the society. By 1985 women members numbered about 300 out of 4,000—about seven percent.

Since the 1950s opportunities for women in astronomy have increased, but serious problems have not disappeared. A student who thinks she might like to be an astronomer will often enter a department where she will be the only woman student; there will no women on the faculty. If fortunate, she will find a sympathetic adviser and congenial colleagues with whom to study. Even so, she will be treated differently from male students. One faculty member may proclaim openly that he doesn't want a woman to work with him. Her work will be scrutinized with a care that most of her male counterparts will be lucky enough to escape. She will stand out in everything that she does. And if she persists and obtains a degree, her adviser may well sit her down and suggest that she not set her sights too high in seeking a postdoctoral position.

This kind of gatekeeping also serves to limit opportunities. The letters of recommendation that her adviser writes will not be discriminatory but may be subtly different and tentative. If she is married, she may not receive job offers: "We thought her husband would not want to move" is the usual excuse. And when she goes to a meeting, she is likely to be the only woman attending.

Permanent jobs in astronomy are scarce and hard to get for young men and women alike. Affirmative action seems to have made few inroads in the filling of academic positions. It is common for an astronomy department to receive 100 or more applications for a job; usually no more than one or two of the candidates are women.

Women constitute only a tiny fraction of tenured professors of astronomy. Many important astronomy departments, such as Harvard's, and the Mt. Wilson and Las Campanas Observatories of my own Carnegie Institution of Washington, have no women on their permanent staffs. I think this is in part because the field of astronomy is still so dominated by a male establishment. A single member of a department search committee who is reluctant to add a woman to his staff can have an enormous influence for many years. Cases have occurred in which an application list of many has been carefully narrowed down to three: two men and one woman, in that order. Following job offers to the top two, who decline the offer, the decision is then made to reopen the competition rather than offer the job to the third. Rarely does this happen when the top three candidates are male. Unfortunately, as the job market becomes even tighter, it is unlikely that the number of women in tenured academic positions will increase.

The saddest part, of course, is that only about one-fifth of the women who enter college intend to study science. Lack of support and encouragement at an early age has by then taken its toll. A young woman who enters graduate school to study science is a rare creature indeed, to be encouraged and supported. But instead, the colleges are often a part of the problem rather than part of the solution. In spite of these difficulties, women are becoming astronomers—and successful ones. They are asking important, imaginative questions about the universe and getting answers no less often than their male colleagues. Only for the past 20 years or so have they been permitted to apply for telescope time on all telescopes—time being allotted on the basis of the excellence of the proposal. Now about one-third of the telescope time of the national facilities, which include Kitt Peak Observatory outside of Tucson, Arizona, and Cerro Tololo Observatory in Chile, is assigned to women.

A cable that was sent to me in 1978 is a testament to that. "Dear Madame," it reads, "You might appreciate hearing that four women astronomers are observing on Cerro Tololo tonight, on the four largest telescopes! We are M. H. Ulrich, M. T. Ruiz, P. Lugger, and L. Schweizer." I hope the sky was very clear that night.

(Vera Rubin is one of three female astronomers in the National Academy of Sciences and one of 57 women, along with Mildred Dresselhaus, elected to the 2,610-member academy since it was chartered in 1863.)

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3. Resonances in ^{12}C in the 19 to 22 MeV Region

Professor Geraldine L. Richmond
Chemical Physics Institute
University of Oregon
Eugene, OR 97403
503-686-4635
1. Optical Second Harmonic Generation: Can It Be Used to Study Ionic Adsorption on Electro-chemical Surfaces?
2. Europium as a Laser-Induced Fluorescent Probe of Metal Binding Sites in Biomolecules

Dr. Roberta P. Saxon
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94022
415-859-2663
1. Excited States and Photodissociation of Small Molecules

Dr. Lynn F. Schneemeyer
AT&T Bell Laboratories, 1A-365
600 Mountain Avenue
Murray Hill, NJ 07974
201-582-5318
1. Nonlinear Transport Phenomena in Potassium Molybdenum Bronze

Professor M. B. Stearns
Arizona State University
Physics Department
Tempe, AZ 85287
602-965-1606
1. Origin of Magnetism in Iron
2. Bond Length Determination with EXAFS

Dr. J. A. Thompson
Physics Department
University of Pittsburgh
Pittsburgh, PA 15260
412-624-4330
1. Direct Photon Production at the CERN ISR

Dr. Margaret H. Weiler
Research Division
Raytheon Company
131 Spring Street
Lexington, MA 02173
617-860-3100
1. Semiconductor Devices for High Frequencies

Dr. Alice White
AT&T Bell Labs, Rm. 1E-433
600 Mountain Avenue
Murray Hill, NJ 07974
201-582-3000
1. Mechanisms of Buried Oxygen Formation by Ion Implantation
2. Destruction of Superconductivity in Quench-Condensed 2D Films

Dr. Barbara A. Wilson
AT&T Bell Laboratories, 1D-465
600 Mountain Avenue
Murray Hill, NJ 07974
201-582-3973
1. Novel Heterostructures in the AlGaAs System

Are you an APS member? If you are, see box.
If you are not, check here if you wish to receive an application. ☐

QUESTIONNAIRE FOR THE ROSTER OF WOMEN IN PHYSICS
COMMITTEE ON THE STATUS OF WOMEN IN PHYSICS
THE AMERICAN PHYSICAL SOCIETY

The information from this questionnaire will be used to compile rosters of women in physics, to form a mailing list for the CSWP Gazette, to select women to receive announcements of probable interest to them, and to compile demographic data on women physicists. This information will not be made available to commercial or political organizations as a mailing list. Being listed on the roster only identifies the woman as a physicist and does not imply agreement with or support for the activities of the Committee on the Status of Women in Physics.
INSTRUCTIONS: Please indicate your responses to the following by printing one character within each pair of tick marks. Abbreviate as necessary.

NAME: 1 (last) 16 1 (first) 14
1 (middle) 14 1 optional: (maiden) 16

My Roster of Women in Physics data provided is:
☐ A new entry ☐ A revised/updated entry ☐ I don't know which
If this is a revised/updated entry, please provide your Roster Registration number, if known _____
(Your Roster Registration number appears in the upper right hand of mailing labels produced from the Roster.)

On the following line, please enter your full name and title exactly as you wish it to appear on your mailing label.

1 30

Please enter the address and phone number at which you prefer to be contacted and indicate whether: ☐ Home or ☐ Business

ADDRESS line 1: 1 28
Address line 2: 1 28
Address line 3: 1 28
City/State/Zip: 1 (city) 19 (state) (zip)
Primary phone: (area) / (number) Alternate phone: (area) / (number)

DEGREES	YEAR received or expected	INSTITUTION
BA/BS		1 28
MA/MS		1 28
PhD		1 28
THESIS TOPIC (highest degree)		1 28
(continue if necessary)		1 28
EMPLOYER NAME:		1 28
DEPT/DIV ETC:		1 28
POSITION TITLE:		1 28

COMMENTS: _____

IMPORTANT: If you are an APS member, please attach your *Physics Today* or APS *Bulletin* mailing label here. We are finally trying to coordinate APS and Roster addresses. No Roster information will be put in APS membership files. Thank you.

Highest Degree (check one) — Current Interest (check one)

FIELD OF PHYSICS

1 ___ Astronomy & Astrophysics	1 ___	
2 ___ Acoustics	2 ___	
3 ___ Atomic & Molecular Physics	3 ___	
4 ___ Biophysics	4 ___	
5 ___ Chemical Physics	5 ___	
6 ___ Education	6 ___	
7 ___ Electromagnetism	7 ___	
8 ___ Electronics	8 ___	
9 ___ Elementary Particles & Fields	9 ___	
10 ___ Geophysics	10 ___	
11 ___ High Polymer Physics	11 ___	
12 ___ Low Temperature Physics	12 ___	
13 ___ Mathematical Physics	13 ___	
14 ___ Mechanics	14 ___	
15 ___ Medical Physics	15 ___	
16 ___ Nuclear Physics	16 ___	
17 ___ Optics	17 ___	
18 ___ Plasma Physics	18 ___	
19 ___ Physics of Fluids	19 ___	
20 ___ Thermal Physics	20 ___	
21 ___ Solid State Physics	21 ___	
22 ___ General	22 ___	
23 ___ Condensed Matter Physics	23 ___	
24 ___ Space Physics	24 ___	
25 ___ Other (please specify below)	25 ___	

_____
_____

CURRENT WORK STATUS
(Please check one or more as applicable)

1 ___ Student
2 ___ Post Doc/Res Assoc
3 ___ Unemployed
4 ___ Retired
5 ___ Employed
6 ___ Self-employed
7 ___ Full time
8 ___ Part time

FOR HIGHEST DEGREE (Please check one)

1 ___ Theoretical
2 ___ Experimental
3 ___ Both
4 ___ Neither (please explain below)

_____
_____

TYPE OF WORKPLACE FOR CURRENT OR LAST WORK (Please check one or more)

1 ___ University
2 ___ College—4 year
3 ___ College—2 year
4 ___ Secondary School
5 ___ Government
6 ___ National Laboratory
7 ___ Industry
8 ___ Non-Profit Institution
9 ___ Consultant
10 ___ Other (please specify below)

_____
_____

TYPE OF ACTIVITY
(Please enter a 1 for the activity in which you engage most frequently, 2 for the second most frequent, etc. for all significant aspects of your current or last work)

1 ___ Basic Research
2 ___ Applied Research
3 ___ Development and/or Design
4 ___ Engineering
5 ___ Manufacturing
6 ___ Technical Sales
7 ___ Administration/Management
8 ___ Writing/Editing
9 ___ Teaching—Undergraduate
10 ___ Teaching—Graduate
11 ___ Teaching—Secondary School
12 ___ Committees/Professional Org.
13 ___ Proposal Preparation
14 ___ Other (please specify below)

_____
_____

Thank you for your participation.
Please return the questionnaire to:

Dr. Miriam Forman
American Physical Society
335 East 45th Street
New York, NY 10017

Are you interested in receiving information on employment opportunities? _____Yes _____No