Contacts

Software authors and prospective reviewers of software are encouraged to contact John S. Risley, Editor, Physics Academic Software, Department of Physics, North Carolina State University, Raleigh NC 27695-8202; telephone (919) 737-2524.

High-school and university physics teachers interested in organizing or joining physics networks are encouraged to contact the Physics Alliances Project, American Physical Society, 335 East 45th Street, New York NY 10017; telephone (212) 682-7341.

Information about the Introductory University Physics Project can be obtained from John S. Rigden, Director, Physics Project, American Institute of Physics, 335 East 45th Street, New York NY 10017; telephone (212) 661-9404.

physics and cosmology, and he hopes to see the production and publication of a wall chart displaying a kind of periodic table of elementary particles.

In addition, AAPT has just published the proceedings of the Fermilab conference: *Quarks, Quasars and Quandaries.*

Everybody involved in the Teaching Modern Physics project seems to agree that it would be wildly premature to attempt to design a high-school course centering on modern physics. Instead, as Nelson puts it, the preferred strategy is to scatter bits of modern physics throughout introductory courses to give them some "sparkle." This strategy has come to be known as the "Resnick effect," after the noted textbook author, who was a participant in the project and now will bring lessons from it to the AIP Introductory University Physics Project.

Asked to assess how well they succeeded at Fermilab and in San Francisco in getting teachers to focus on the area where particle physics and cosmology meet, Bardeen gives a quite differentiated answer: Not much came of efforts to think about grand unified theories, she says, and relativity is "a big question mark"; cosmology, "not surprisingly," went well; particle physics, "more surprisingly," turns out to be quite catchy (students have heard of quarks, for example, and are receptive to new material); it is "not so clear," however, how well the cosmology–particle physics combination works—the teachers had a lively discussion but found it difficult to produce usable materials.

Teaching astronomy. A different approach to introducing students to physics by introducing them to the universe has been pioneered in Massachusetts by Irwin I. Shapiro, director of the Harvard–Smithsonian Center for Astrophysics.

About five years ago, just before concern began to grow nationally about the quality of US physics education, it occurred to Shapiro that everybody likes space science and astronomy but that those topics figure hardly at all in high-school science curricula. On doing a little research, Shapiro found that this anomalous situation is of relatively recent origin—in the 19th century astronomy still loomed large in high-school instruction. Moreover, as a father of two teenagers, Shapiro was "appalled" by the number of concepts thrown at students in science textbooks. This gave him the idea of designing a high-school astronomy curriculum that would make recurrent use of a few very basic concepts such as the inverse square law and the Doppler effect.

Two years ago, after making a formal proposal to NSF that led to a grant of $833 000 for Project STAR (Science Teaching through its Astronomical Roots), Shapiro hired an imaginative businessman named Philip Sadler to direct the project. Sadler, who founded a company that produces inflatable planetariums, had the idea of surveying high schools to find out what they do with astronomy. Sadler proceeded to survey 11 000 high schools and found that 60% taught some astronomy as part of Earth science, general science or physics, and about 15% as a separate course. He located more than 1000 high-school astronomy teachers and surveyed them too, finding that 77% considered astronomy their hobby, an astonishing and probably "unique" situation, Sadler notes. With virtual unanimity, the teachers said they wanted and needed a high-school text dedicated to astronomy and appropriate materials for demonstrations, observations and experiments.

Shapiro talks with enthusiasm about some of the items Sadler has designed, which include a translucent model of the celestial sphere, an instrument constructed from a flashlight and a piece of fiberoptic cable to measure the apparent brightness of stars, and a telescope. The telescope is constructed out of plastic lenses and cardboard tubes from inside paper towel rolls, costs 50 cents and has a power equivalent to Galileo's first instrument!

Last year a science panel at the Harvard–Smithsonian met regularly with ten Boston area teachers who all were testing units the panel had developed. This last summer 18 teachers from around the country came for a summer institute, where a package for a 6–10-week course was devised. The course is designed for 11th- and 12th-grade students, who typically do not take science but do have enough math to do simple but interesting calculations and estimations. This fall the course is being tested in 35 classrooms.

Shapiro and Sadler hope to get a follow-up grant from NSF to develop a full one-year course in astronomy. Their objective would be to produce a textbook and other materials analogous to the PSSC course or Harvard Project Physics.

More lessons. Project STAR has produced experiences that are essentially similar to the kinds of experiences people had in the AAPT–Fermilab program.

Sadler said Project STAR also considered introducing some modern physics into the astronomy course. "But it's the 2000-year-old concepts that really give kids trouble," Sadler says. "Students need to be taught physics by familiarity with everyday phenomena. You can talk about what scientists say about supernovas and learn to repeat that there are two kinds. But if you don't know about the inverse square law, which we work on a lot, you are at a loss to make any really meaningful predictions."

"Teachers are not the best paid of professionals," Shapiro observes. "What's their incentive to try something new? Unless you deal hands-on with the teachers *and students* from the start, forget it. You have to deal with the ultimate consumers from the start, and you have to address their naive conceptions, the preconceptions that kids have about the world." Recognize that they all think seasonal change depends on the Earth's distance from the Sun, says Sadler. Recognize that they don't realize the stars move at night.

"What was disappointing in general," Shapiro says, "was how little is understood. We wanted to do little, but we couldn't do little enough."

In short, "It's not easy."

—William Sweet

Student Pugwash awarded major grants

Student Pugwash USA, an eight-year-old organization inspired by the meetings of scientists held since the late 1950s to promote East–West understanding on arms control, has been awarded two major grants in the past

year that are helping the group strengthen its base and diversify its activities.

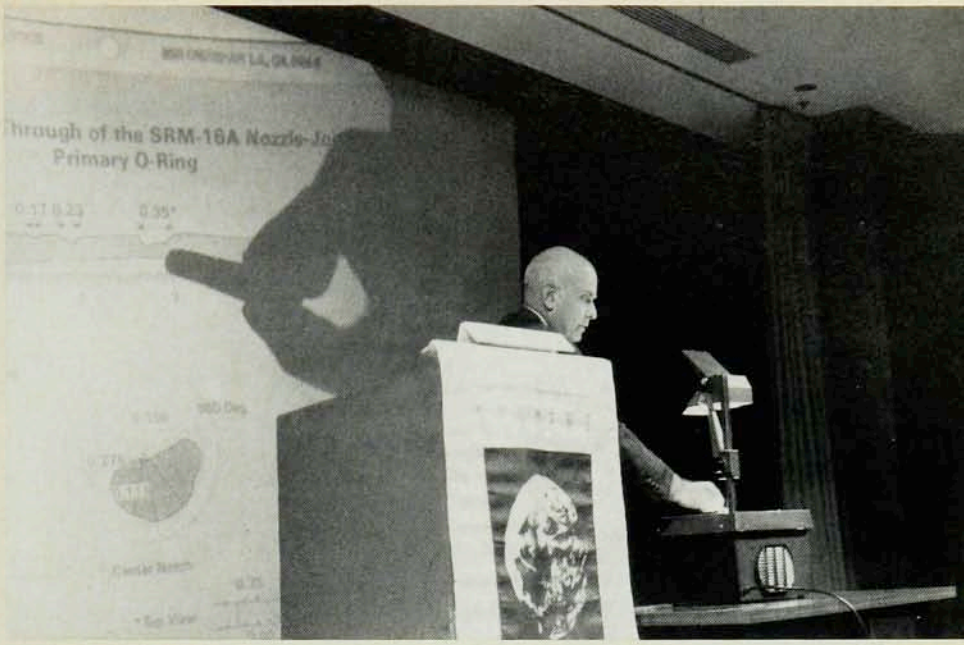
In December of 1986 the organization was awarded a three-year, $300 000 grant from the MacArthur Foundation. The Carnegie Corporation of New York presented a similar, $100 000 grant to Student Pugwash in April. This September, Apple Computer contributed hardware and software worth $25 000 for use in the Student Pugwash Washington, DC, headquarters and in chapter centers. The six terminals, a laser printer and modems will facilitate publication of newsletters and will increase communication with the 30 chapters in universities throughout the nation.

The new grants from MacArthur and Carnegie will enable Student Pugwash to increase the number of university chapters and to broaden their regional distribution. Most chapters are currently in the Northeast and on the West Coast. The added resources will also fund a variety of speeches and colloquiums that are given yearly at Student Pugwash chapters and allow the publication of an alumni directory that goes to press next month.

The grants also will enable Student Pugwash to expand on existing activities. The group has been actively disseminating employment information to university students in the past few years. The *Technology and Society Internship Directory* offers students a list of public sector opportunities in Washington, DC. "Alternative" job fairs have been sponsored by local chapters at MIT, Cornell and Caltech. The fairs attract non-defense-oriented companies and a large number of students. According to Scott Saleska, chapter coordinator in the Washington office, over 500 students attended the last MIT job fair. A "new careers program" is also being formed. "This program," says Ben Austin, Student Pugwash's conference coordinator, "will recruit a smaller number of students for more selective internship opportunities."

Background. Student Pugwash USA was founded in 1979 (see PHYSICS TODAY, September 1985, page 71). Run by students and recent graduates, its primary purpose is to stimulate interest in public policy issues associated with science and technology among students worldwide. By comparison with the elder Pugwash, the younger group is interested in a more varied set of issues and does not confine itself to arms control topics.

A biennial international conference is the keystone activity of Student Pugwash. The conference provides a forum for intergenerational and interdisciplinary exchange of ideas and perspectives on issues involving science, technology, society and ethics. According to Austin, the biennial event is nonpartisan and does not endeavor to resolve any of the questions it tackles.



Roger Boisjoly, a former Morton Thiokol engineer, shows a transparency about the Challenger's O-ring seals to participants in this summer's Student Pugwash conference.

The fifth biennial Student Pugwash International Conference was held at Stanford University from 28 June to 4 July. Participants included 50 senior delegates and 100 students from 23 countries. The senior panelists who attended this year represented a wide spectrum of professions. Participants included corporate leaders, scientists from both the public and private sectors, military experts, politicians and activists. Students of highly diverse educational backgrounds and interests, both within and outside of the sciences, were invited to the colloquium. The theme for the week-long dialogues was "Choices for our generation: Ethics and values at the cutting edge of technology."

The keynote address was on the ethical dimensions of Morton Thiokol's role in the space shuttle Challenger disaster. In that address, says Austin, Roger Boisjoly, a former engineer at Morton Thiokol and senior scientist in charge of the booster seal program, described the struggle between staff and management at the corporation over the use and safety of the O-ring seals. Boisjoly presented the original transparencies used to depict to management the engineering group's dissatisfaction with the seals. The preceding night Sidney Drell of the Stanford Linear Accelerator Center had discussed the conflicts between industry and academia.

The biennial conference, originally funded completely by the National Science Foundation, has gained financial support from a coterie of foundations as NSF has gradually curtailed its assistance. Sponsors for this year's event included the Sloan Foundation, the Pew Charitable Trusts, Cray Research Inc and the Exxon Education Foundation. The MacArthur and Carnegie Corporation grants are primarily for non-conference activities.

For information on Student Pugwash activities and programs write to Student Pugwash USA, 505-B 2nd Street NE, Washington DC 20002.

—RICHARD HART

High-school students make $YBa_2Cu_3O_{7-x}$

Long famous for its production of a substance with unusual and interesting properties, namely garlic, Gilroy, California, now is becoming known in the physics community for its use of another substance with unusual and interesting properties—yttrium barium copper oxide.

Last spring, a Gilroy science teacher named David Prybil and nine high-school students produced pellets of $YBa_2Cu_3O_{7-x}$ and used them to dem-