# SLAC BEAM LINE

"There are therefore Agents in Nature able to make the Particles of Bodies stick together by very strong Attractions. And it is the Business of experimental Philosophy to find them out." -- Isaac Newton, Opticks (1704)

*Volume 6, Number 8* *August 1975*

IN THIS ISSUE



## SLAC SUMMER INSTITUTE

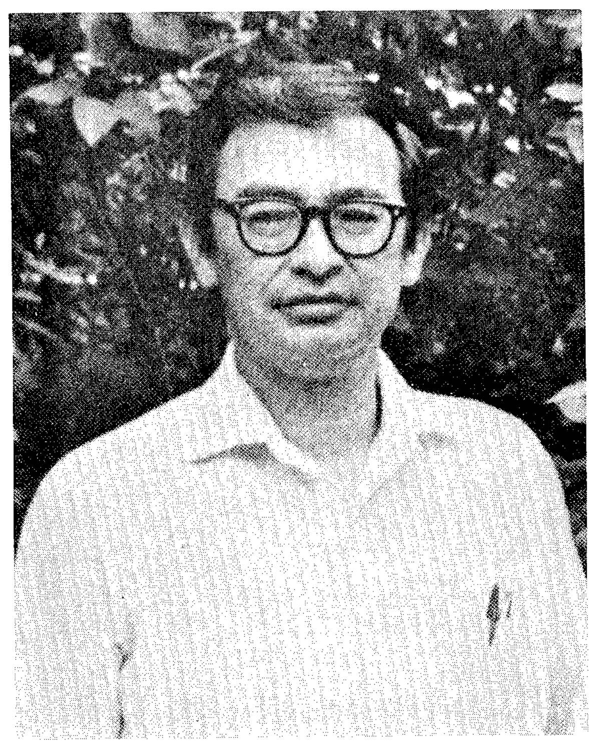
The third annual SLAC Summer Institute on Particle Physics was held from July 21 to July 31, with a total of 218 physicists participating. This annual program is a part of SLAC's commitment to the continuing education of young physicists. The Institute acquants young, postdoctoral physicists with the latest experimental and theoretical work being done at high energy physics centers throughout the world.

The participants in this year's Institute came from 60 different institutions; about 10% were from universities in foreign countries, including India, Japan, Belgium, Mexico, Germany, Korea, France, Canada, Italy, England, and Singapore. The meetings were held in the SLAC auditorium. The program for the Institute was organized by D.W.G.S. Leith and R. Blankenbecler of SLAC, who were assisted by M. Zipf and S. Traweek.

Two of the main topics of study during the Institute were the recently discovered, long-lived particles (called the psi particles at SLAC) and the possible existence of substructure in the hadron family of particles (proton, neutron, mesons, etc.). These as yet unobserved building blocks of hadronic matter are usually called "quarks" or "partons." Among the recent observations that were presented were evidence for another long-lived particle; evidence concerning the spin and other properties of the constituent quarks; and the possible existence of a new "U" particle, discovered at the SPEAR colliding beam facility at SLAC, that may be a member of the lepton family of particles that includes the electron.

One of the main conclusions of the meeting appeared to be the idea that the quark or parton model of hadrons as consisting of simpler subparticles seemed to provide a generally successful description of the properties and interactions of these particles. There was some agreement, however, that more than the three fundamental types of quarks originally proposed would be needed to account for the data. Although the general quark picture seems quite persuasive, an obvious question concerns the fact that no quarks have yet been detected experimentally--their existence is still a matter of inference. Perhaps this and other fundamental riddles will find their solution at the large new colliding-beam facility called PEP, which has been proposed jointly by SLAC and the Lawrence Berkeley Laboratory for construction at SLAC.

--Sharon Traweek



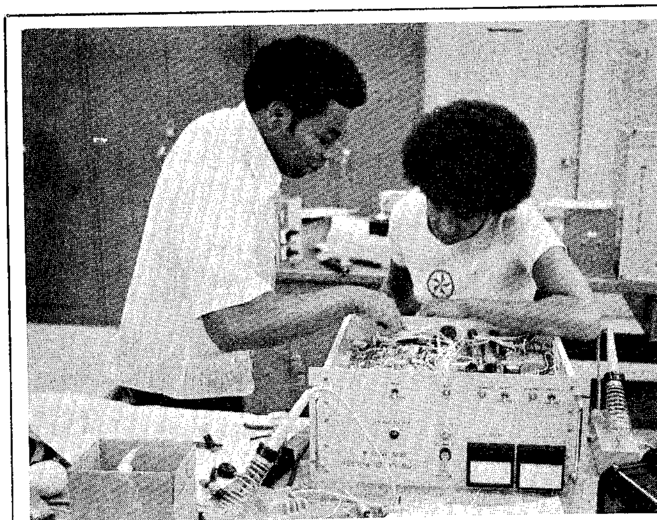
*--Photo by V. Llamas*

This is Dr. Fred Young, a laser-fusion physicist from Los Alamos Scientific Laboratory in New Mexico. Dr. Young is one of four Visiting Scientists at SLAC who have served as lecturers in this year's Summer Science Program. For a description of the SSP, see page 2 in this issue.

# SLAC SUMMER SCIENCE PROGRAM

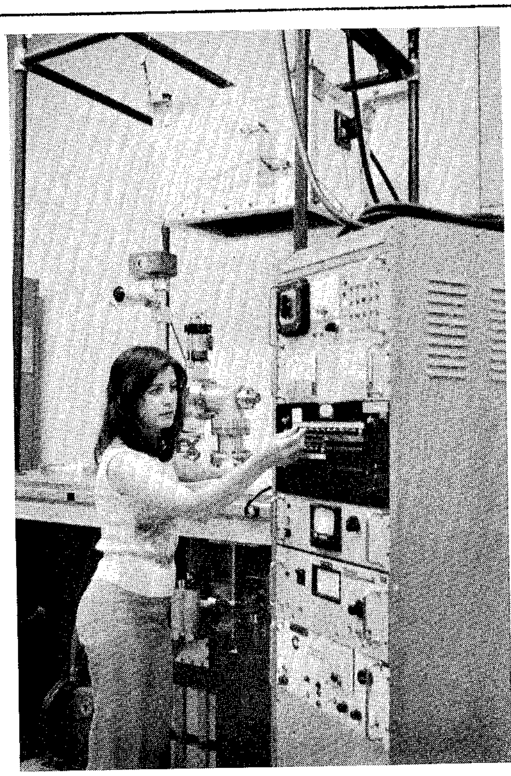
Those participating in SLAC's Summer Science Program this year include 28 students from colleges and universities throughout the United States, and an additional 6 students from local high schools. The participants were recruited and selected by Dr. Ernest Coleman, who is the Director of the SSP, and by Dr. Vicente Llamas, SSP's Associate Director. The job of identifying summer positions that would be available at SLAC, and of matching up these positions with the participants' background and interests, was done by Rich Blumberg and Ron Koontz of SLAC. About half of the 34 SSP students have indicated an interest in or are already majoring in physics. The other half have majors in the fields of mathematics, biology, chemistry, computer science and engineering.

The SLAC Summer Science Program has been developing since 1969, and during its seven years of operation (including this summer) a total of more than 170 students have been involved--with some repeating in the program. Both Drs. Coleman and Llamas have had extensive experience in programs of this kind. Dr. Coleman became the SSP Director in 1971, a year in which there were 16 students in the program. This year, in Dr. Coleman's absence, Dr. Llamas has been directing what has been the largest SSP group so far. Llamas was involved in setting up a similar program at Fermilab in 1970, and he continues to act as a consultant to and evaluator of that program.



*--Photo by V. Llamas*

Last-minute checking of a low-level pulser is being carried out here by SSP student Mary James of Hampshire College and her supervisor Fred Hooker of Accelerator Physics.



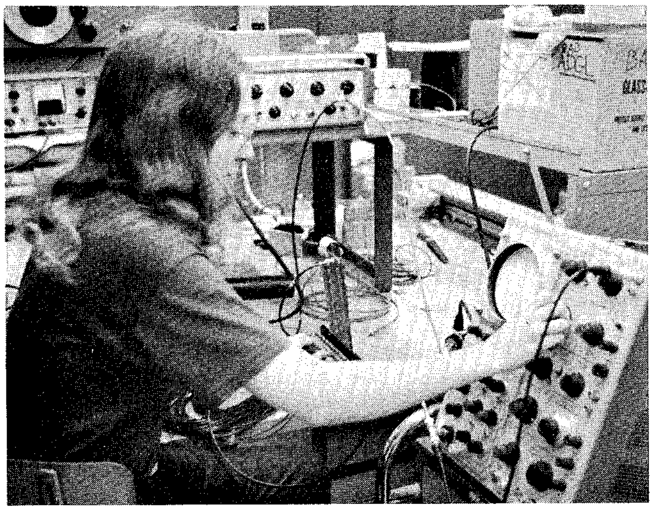
*--Photo by V. Llamas*

SSP student Angela Sanchez, from New Mexico Highlands University, is shown here monitoring an electron-gun bake station. Her supervisor is Tom McKinney of the Accelerator Physics Department.

The primary goal of the SSP is to develop and encourage an interest in physics in students of high ability from disadvantaged backgrounds, and to promote within them the capacity for independent research. In addition, since experimentalists depend heavily on their technical skills in carrying out research, the participants are assigned to positions that include activities in these basic skills. The academic aspects of the program are designed to increase the students' interest in basic research as well as to expand their understanding of physics. That the program has been successful here at SLAC is suggested by the number of students who come back for a second year. Over one-third of this summer's participants have attended the SSP before, and most of these are working with the same supervisors.

Included in the academic program are the following courses: *Introduction to Fortran IV*, *Bubble Chamber Physics*, *Laser-Driven Fusion*, *Thermodynamics and Statistical Mechanics*, and *Topics in Modern Physics*. The latter has included lectures on "Recent advances in high energy physics" (E. Coleman), "The klystron" (R. Koontz), and "The quantum numbers of fundamental particles" (V. Llamas), as well as several others. In addition, tours are scheduled of the Lawrence

Berkeley Laboratory, IBM's Research Division, Ames-NASA Research Center, Lawrence Livermore Laboratory, and the Exploratorium in San Francisco. SLAC's Theoretical Physics group has been particularly helpful to the program because of their willingness to answer (or try to answer!) many of the questions generated by the students.



*--Photo by V. Llamas*

Marylin Webster of M.I.T. is shown here checking the timing circuits of some of the electronics instrumentation that will be used in an experiment at SLAC carried out by a collaboration of physicists from Princeton University and the Universities of Maryland and Pavia, Italy.

This summer, for the first time, the SSP has had the benefit of an arrangement whereby SLAC supervisors have had the primary responsibility for finding summer positions that are best suited to the goals of the program. Groups from the Research and Technical Divisions were contacted by Rich Blumberg and Ron Koontz, respectively, and those which indicated an interest in supervising an SSP student then submitted a personnel requisition which described the particular job that they could provide ans the skills that such work would require. Once the SSP participants had been chosen, Koontz and Blumberg reviewed their application forms and tried to match up the participants with the list of available positions. Once these match-ups were identified, advance notice was sent out to the participants in order to give them an opportunity to become better prepared for their assignments. As it turned out, six of the preliminary assignments had to be changed within the first two weeks of the program for various reasons, but the cooperation of SLAC advisors and supervisors in finding suitable new assignments was invaluable.

Four Visiting Scientists played key roles in the presentation of the academic courses mentioned above:

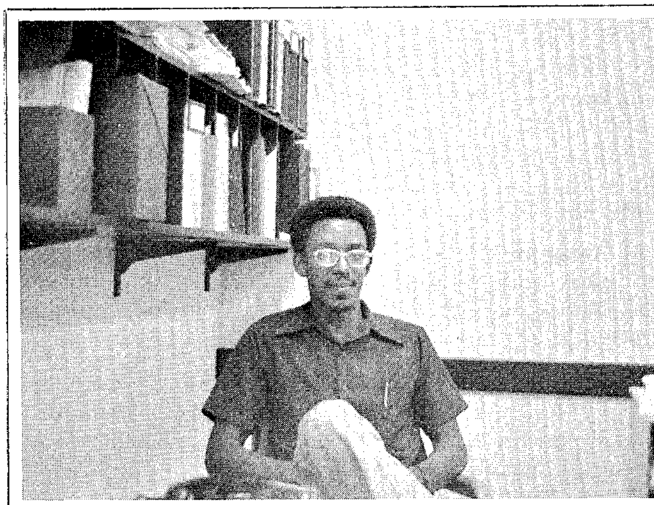
The classes on "Introduction to plasma physis" and "Approximation techniques in physical theory" were the responsibility of Dr. Carl Spight, who is Professor of Physics and Chairman of the Physics Department at Morehouse College in Atlanta, Georgia. Dr. Spight received his Ph.D. in plasma physics from Princeton University in 1971.

The class on "Laser-driven fusion" was the responsibility of Dr. Fred Young, who is Physics and Project Coordinator in the Laser Research and Technology Division at Los Alamos Scientific Laboratory. Dr. Young received his Ph.D. in high-energy solar physics from the University of New Mexico in 1972.

The "Thermodynamics and statistical mechanics" course was the responsibility of Dr. James Young, who is Professor of Physics at the Massachusetts Institute of Technology. Dr. Young received his Ph.D. in theoretical high-energy physics from M.I.T. in 1953.

The class in "Bubble chamber physics" and several other lectures in the "Topics in modern physics" course were the responsibility of Dr. Vicente Llamas, who is Associate Professor and Chairman of the Department of Physics and Mathematics at New Mexico Highlands University. Dr. Llamas received his Ph.D. in 1970 from the University of Missouri at Rolla.

The activities of the SLAC Summer Science Program will be described and evaluated in a comprehensive report that will be submitted to SLAC soon after the close of this summer's program. SLAC people who may wish to look at this report can obtain a copy by contacting Gerry Renner of the SLAC Employment Office (Bin 11). Any suggestions about and/or criticism of the SSP would be very welcome. Please send any such comments to Mr. Renner, who will see that they get forwarded to the appropriate person.



*--Photo by V. Llamas*

This is Dr. Carl Spight, of Morehouse College in Atlanta, Georgia, who served as one of four Visiting Scientists responsible for presenting academic courses to the students in the 1975 Summer Science Program at SLAC.

# WORLDWIDE EXPLORERS IN THE SUBATOMIC WORLD

By WALTER SULLIVAN
*New York Times*

[*Science writer Walter Sullivan recently spent a few days at SLAC and at the Fermi National Accelerator Laboratory, near Chicago. The following article is based on these visits and is reprinted here from the July 12, 1975 edition of the* New York Times.]

"Oh, my God!" said Wolfgang Kurt Herman Panofsky of Stanford University, as he paced in front of the computer display that showed what was happening inside a ring where beams of atomic particles blasted into each other.

Normally Dr. Panofsky--he is sometimes referred to as "the dumb Panofsky" because he did not quite match his brother's perfect academic record at Princeton--is highly articulate.

On this occasion, last fall, all he could say as he watched the fireworks display on the computer screen was "Oh, my God!" over and over. It was evident that the colossal experimental system over which he presides as Director of the Stanford Linear Accelerator was manufacturing short-lived particles never before seen.

It was one of those rare moments in high energy physics when something entirely unexpected--something that "shouldn't be there"--makes itself known.

When it was learned that the same particle had been detected (in a very different manner) at the Brookhaven National Laboratory on Long Island, cablegrams were sent to experimenters in Europe and the Soviet Union. Within days they had confirmed the finding.

Because of these discoveries and a variety of more recent findings, scientists working with the big accelerators--or "atom smashers"--know they are on the track of something historic.

Discoveries so out of line with current theory imply that a new, more subtle level of phenomena is being probed. Some believe it relates to constituents of the "basic" particles called "quarks." Or that it relates to a special property known as "charm." However, key predictions of these theories have not been proved.

Only a few physicists are in on discoveries as momentous as those made last fall. Is the rest all drudgery? Are the teams that do the research--theorists, computer specialists, experimenters and engineers--so large that any feeling of personal achievement is submerged?

And is the scale of the experiments so grand and their complexity so great that their fruits seem artificial, with no link to our daily experience and needs?

There is no question that the experimental devices have become enormous. The Stanford Linear Accelerator (better known as SLAC) in Palo Alto, Calif., is a multimillion-dollar installation whose main facility for accelerating electrons is two miles long.

Even larger is the Fermi National Accelerator Laboratory (known as Fermilab) in Batavia, Ill.

Around a ring four miles in circumference it accelerates protons to the highest energy achieved anywhere--more than 400 billion electron volts. Fermilab cost $250 million and its annual budget is $36 million.

It is also evident that the research teams are very large. The SLAC announcement of last fall's discovery was signed by 35 authors. The negative aspects of such bigness are set forth in the May-June issue of *The Center Magazine* by an avowedly disgruntled physicist, Dr. Robert Yaes of Memorial University in St. John's, Newfoundland.

"Bright young physicists," he wrote, "will be able to exercise little of their ingenuity, originality and creativity when they are junior members of enormous research groups and are told exactly what to do. Many physicists are now being subjected to a routine of boring, meaningless, alienating work."

### *DRUDGERY INVOLVED*

A brief time spent with research teams both at SLAC and at Fermilab has confirmed that a certain amount of drudgery is involved. But, particularly in the wake of last fall's discoveries (a second particle was found at SLAC, plus the suggestion of a third), morale was high.

True, the research teams are large. Using a music analogy it can be said that a generation ago soloists were still in demand. Today, to break new ground, many physicists find that they have to play in the orchestra. However, those interviewed at the two centers seemed happy to be in the orchestra so long as they felt its performance was outstanding.

In this respect they are lucky. The experiments of significance today are larger in scale --and fewer in number--than before. While a brilliant physicist has no trouble finding a spot with one of the research teams, those who are merely "competent" may be unable to do so.

And, as noted by Dr. Burton Richter, head of the team that made the SLAC discovery, "Life is tough for those who start slow and hit it later."

The SLAC researchers proved to be living in two worlds. One is the familiar California scene of towering eucalyptus trees, flower-studded suburbia and teeming freeways. The other is a world of bizarre concepts, huge and complex research tools, and long hours of experimentation.

*'WIVES AT BOTH ENDS'*

"We are married to that machine," one experimenter said, "and the wives at both ends get restless."

The concepts are bizarre in that they deal with phenomena remote from ordinary experience, such as the existence of antimatter, quarks and charm, or the increase in weight that, because of relativity, occurs when matter approaches the speed of light.

In the SLAC experiments that revealed the new particles, tiny packets of matter (electrons) were collided head on with similar packets of antimatter (positrons). The positron is identical to the electron except that its electric charge is positive rather than negative.

When particles of matter and antimatter meet both are completely converted into energy. But when they collide head on at high velocity the energy of the collision also enters into the reaction. According to the formulations of Albert Einstein, energy can be transformed into matter and vice versa.

In the electron-positron collisions some of the energy is immediately transformed back into matter, producing a variety of particles. Because at very high velocity the particles become heavier, having two beams of particles collide head on is far more effective than firing one beam at a stationary target.

*MOUSE BECOMES ELEPHANT*

The stationary electron has been likened by Dr. Sidney Drell of SLAC to a mouse that becomes an elephant when accelerated. Changing an elephant into a mouse would have little effect. At SLAC, elephants charge one another. If one target were stationary the accelerator, to achieve the same effect, would have to be 6,000 miles long.

The two-mile accelerator produces 360 bursts of high-energy electrons every second. Thirty of these are diverted into the colliding-beam facility, some being used to produce positrons. The packets of electrons and positrons circulate in opposite directions inside the ring, magnets keeping each beam compressed to toothpick size.

"The vacuum people are the real heroes," said Dr. Roy F. Schwitters as he showed a visitor the ring. Even a few atoms of air inside the tube through which the particles are flying could knock them out of orbit as they whirl around the ring for hours at almost the speed of light.

To record what happens when the beams collide, the collision area is enclosed in a massive series of detectors. When a newly created particle flies out it first activates a triggering system that turns on the main detectors.

These include spark chambers that contain 100,000 electrically charged wires. The particle, which cannot be seen, leaves a trail of ionized gas along which sparks flash between oppositely charged wires.

An 8-inch wall of iron encloses this complex and within it is a strong magnetic field. This bends the path of the particle in one direction, if its charge is positive, in the opposite direction if its charge is negative, and not at all if uncharged.

Many of the collisions produce electron-positron pairs and there are 24 "shower counters" to record them. Finally, above the iron box is the "muon counter."

The muon is very similar to the electron but some 200 times heavier and shorter lived. Muons have great penetrating capacity and thus escape the iron box to be recorded by spark chambers in the muon tower.

*COMPUTERS KEEP SCORE*

The output of all these detectors is digested by computers and displayed almost simultaneously on a scope. There, for example, an electron-positron pair appears as two luminous lines radiating in opposite directions from the collision point. Or, occasionally, one sees the traces left by one or more heavy particles, such as the proton.

It was when the energy of the collisions, last fall, touched 3.105 billion electron volts that all kinds of streaks began flashing on the scope. Sometimes as many as 14 prongs radiated from the collision site. It was evident that particles whose mass was equivalent to an energy of 3.105 billion electron volts were being produced and were then decaying into a shower of other particles.

Three computers are involved in these observations. They are programmed to reject spurious events, such as those caused by high energy particles from space (cosmic rays). But a constant worry is that this digestion of data by computer is introducing a bias in the results.

As Dr. Richter put it, computers are "a depressingly important component of our life." Skill in programming and a feeling for the ways in which such devices can mislead is therefore an important requirement for the new generation of physicists.

Building this detection array took two years and required the skills of many specialists. Some members of the experimental team joined it later and missed what in some respects, was more challenging than the data collection which followed.

*EUROPEAN MODE*

Some projects run the risk, of course, that, after a prolonged construction period, the proposed experiment will have become obsolete.

A radical change has thus occurred since the early part of this century when the most fruitful physics experiments were done by one or two people on a table top at nominal cost.

Instead of building accelerators, experimenters like Ernest Rutherford used naturally accelerated particles. He discovered the atomic nucleus with a beam of alpha particles emitted by polonium.

In Europe such experimentation remained the tradition until World War II. To spend large sums or to employ engineers instead of one's own wits was looked down upon.

However, there were those who believed that to probe deeper into the atom would require far more powerful accelerators. When these instruments--and the team approach to experimentation --began to appear, notably at the University of California at Berkeley, some Europeans began to migrate westward.

Today, as was evident at Fermilab, a further development has forced experimenters not only to work with big machines but, in a sense, to live with them.

*TYPICAL COMPLEXITY*

While the senior researchers stay closer to their home campus, one of the leading experimenters at Fermilab, Dr. Carlo Rubbia, professor of physics at Harvard, is sometimes referred to by students there as "the Alitalia professor." The reason is that he shuttles back and forth across the Atlantic, spending much time at CERN, the European atomic center near Geneva, as well as at Fermilab.

The experimenters are wedded to such centers because of the computers, data banks and other facilities there.

A decade ago the raw data consisted chiefly of particle track photographs that could be brought to the university for study. With the voluminous tape-recorded or photographic output of current experiments, this is no longer feasible.

The experiment being directed at Fermilab by Dr. Rubbia, along with Dr. David B. Cline of the University of Wisconsin and Dr. Alfred K. Mann of the University of Pennsylvania, is typical in this regard.

As in the SLAC colliding beam, the purpose is to achieve clearcut results by using a beam of particles of minimum complexity. Electrons and positrons, for example, behave like points with an electric charge. While they have mass, they apparently have no "size." In the Harvard -Pennsylvania-Wisconsin experiment a beam of neutrinos is used. They have neither mass nor electric charge and they interact with other particles only in terms of one force--the so-called "weak force" responsible for radioactivity.

Close to midnight, on a recent evening, protons from the four-mile ring were being switched and shunted to feed 16 separate experiments. The one dependent upon a neutrino beam is designated 1-A, having been the first experiment planned for the laboratory as it neared completion several years ago.

*ASTONISHING REPORT*

Its most recent goal has been to verify an astonishing report from India. Detectors 7,600 feet underground in the Kolar Gold Mines have recorded evidence indicating that particles of great mass are penetrating the observation chamber from below and the sides, as well as from above.

It is suspected by Indian and Japanese physicists that these are previously unknown particles generated inside rock surrounding the chamber by very high energy neutrinos. Some of these particles have passed through the entire earth, the physicists believe.

Since matter, on the scale of atoms, is largely composed of force fields, a neutrino, which ignores all but one of the forces in nature, can fly through matter with almost no liklihood of interacting. Although the report from India is tentative, Experiment 1-A is equipped to test it.

Every seven seconds the accelerator delivers to the 1-A experimental area a pulse of some ten billion neutrinos. So great is this production rate that, even though neutrinos interact only rarely in the target material, there are enough interactions to simulate, in a matter of days, the effect postulated for the gold mine over years.

*KAONS AND PIONS*

The starting point of the experimental array, whose development, like that at SLAC, took two years, is where protons extracted from Fermilab's four-mile acceleration ring pass through 12 inches of aluminum. In doing so they collide with protons and neutrons in the aluminum, generating a shower of short-lived particles (kaons and pions).

When these particles decay a fraction of a second later, the sought-after neutrinos are one of the products. To allow time for this decay the kaons and pions fly down a vacuum pipe three feet in diameter and 1,300 feet long. Everything except the neutrinos is then stopped by walls of aluminum, steel and a dirt bank or "berm" 3,300 feet long.

The resulting beam, composed almost entirely of neutrinos and antineutrinos, passes through a succession of tanks filled with 60 tons of mineral oil. The tanks are subdivided into 16 sections in each of which devices record light flashes given off by the oil when electrically charged particles pass through it.

*THE MUON PENETRATES*

When the chargeless neutrino hits a nuclear particle in the oil, generating a shower of particles, the energy involved in the interaction can be determined from the resulting light flashes--an essential element for the analysis. One type of particle, the muon, is able to penetrate to the next stage of the array--a sequence of four massive, magnetized iron plates, each four feet thick.

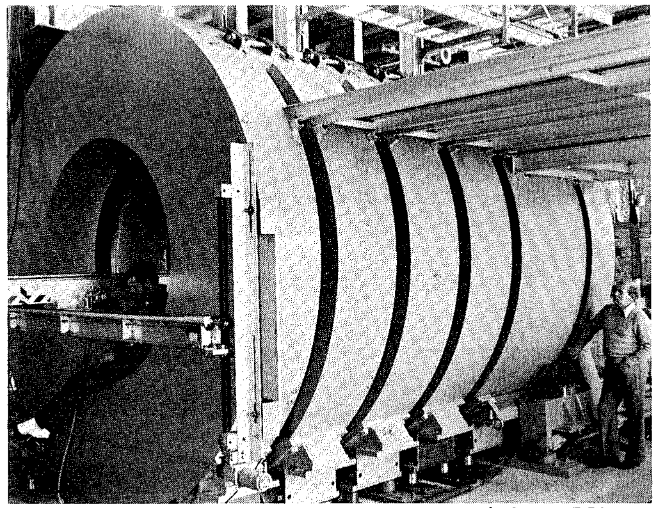
Between the four plates are thin plates electrically charged so that sparks leap between them along any path ionized by the passage of the muon. Through a system of mirrors the sparks are photographed so that the muon paths can be reconstructed.

On some 50 occasions in recent months the production of muon pairs with opposite charge has suggested to the experimenters the existence of yet another heavy, short-lived particle, which they are calling the Y particle.

Fermilab is an impressive installation. Its 16-story central building towers above the acceleration ring, inside of which native prairie is being restored. A bison herd grazes near by. The tower dominates the landscape much as does the Vehicle Assembly Building at the Kennedy Space Center in Florida. Like the space program, its place in contempory life has been likened to that of a great cathedral in manifesting the greatness and pride of an era.

However, the communities over which the cathedrals towered were much more intimately involved in the motivation for their construction than those who inhabit the countryside around Fermilab. The latter encourages visits, but few depart with a real understanding of what is being done there, even though atomic phenomena in a real sense lie at the basis of everything from thought to star explosions.

At an after-hours get-together some of the SLAC physicists conceded that on rare occasions they wished the fruits of their efforts were more immediately applicable. But James E. Paterson, the Scotsman who operates the colliding beams, rejected current "relevance" as a criterion. "What is relevant today," he said, "will not necessarily be so in ten years." He and his colleagues are clearly looking far down the road.



*--Photo by Dick Muffley*

## LASS SOLENOID REACHES FULL FIELD

On Friday evening, July 25, the large superconducting solenoidal magnet that will be used in the LASS facility was powered up to a field of 23 kilogauss--the full field that has been planned for the scheduled experimental program. The LASS solenoid is shown in the photo above. Magnetic measurement technician Tom Porter is on the left in the photo, and engineer Henning Petersen is on the right. The magnet uses four separate circular coils to produce a strong magnetic field that is directed along the axis of the cylindrical structure. The complete Large Aperture Solenoid Spectrometer (LASS) will also include a second large magnet (but not *that* large) and a great number of counters and wire chambers of various kinds.

There have been some problems in getting the complex LASS system put together and operating correctly, but it now appears that the corner has been turned in this project. Magnetic measurement of the solenoid will take place during the next several months, and by about the end of the year the complete LASS system should be assembled and undergoing tests. All going well, the first physics experiments with this powerful new facility should begin during the Spring of 1976.

LAST RESORT

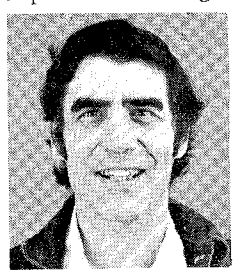
"I like to do experiments. This gives you something to do other than just sit down and work all the time." (Sheri Lee, age 12)

--*Chemtech,* July 1975

## AL DUNHAM LEAVES SLAC

Al Dunham, who came to SLAC eight years ago, has decided to move on. Al started in 1967 in the Accelerator Electronics group, whom he worked with for five years doing Klystron Gallery maintenance. He then moved to the Accelerator Physics group, where he has since participated in equipment construction and modification, and also in maintenance of the modulator for the electron-beam injection gun. As a sideline, he has also been involved in the creation of the plastic "beam trees" that many SLAC people have seen and admired.

Al and his wife will soon be moving to some property they own in Paradise, California. In the fall Al will begin attending Chico State College, where he plans to complete his degree in industrial technology.



A hobby of Al's in the past, and one that he intends to continue, is the maintenance of a small TV shop. In addition, he will be spending some of his spare time in farming work and in the cultivation of an orchard on his one-acre lot. He hopes in time to reach a reasonable level of self-sufficiency. The fact that Al is a retired Navy Lieutenant has certainly helped in making it possible for the Dunhams to embark upon this new venture in Paradise.

Al's many friends at SLAC are sorry to see him go, but wish him the best of luck in his new occupations. The work he has done here at SLAC is greatly appreciated by all those who have come in contact with it.

--Kathy Slavin

## RECONFIRMED PEP RECOMMENDATION

In the September 1974 issue of the *Beam Line* we reported the strong recommendation given to PEP by the High Energy Physics Advisory Panel (HEPAP). This Panel consists of a number of distinguished particle physicists who have the responsibility of advising ERDA on the scientific aspects of the program that ERDA sponsors in the field of high energy physics research. The Panel's recommendations last fall were arrived at after a special HEPAP Subpanel on New Facilities had been convened, under Professor Victor Weisskopf of MIT, to assess future accelerator possibilities.

This year HEPAP decided to update the 1974 assessment by establishing a 1975 Subpanel on New Facilities, this time under the Chairmanship of Professor Francis Low of MIT. The Subpanel met at Woods Hole, Massachusetts, during the week of June 15-21. Their charge was to review the 1974 recommendations in light of the following factors: (a) The new physics discoveries; (b) The new construction proposals that had been submitted by Cornell University and by the Fermi National Accelerator laboratory; (c) The present status of all current proposals for new facilities; to assess the new proposals; and to make specific recommendations regarding new facilities.

As a result of the Subpanel's review, the first recommendation was as follows:

I. We reaffirm the Weisskopf Subpanel's recommendation for authorization in FY1976 of the SLAC/LBL proposal to construct the electron-positron colliding-beam facility PEP. The facility will operate at energies between 5 and 18 GeV with a peak luminosity of $10^{32}$ $cm^{-2}$ $sec^{-1}$ at 15 GeV. If construction funds are not available in FY1976 we recommend as our highest priority the construction funding of this project in FY1977.

The Subpanel considered various possible levels of support for high energy physics in the coming years, and in each case its recommendations gave the highest priority to PEP. The Subpanel's recommendations were subsequently accepted by the full Panel and sent to ERDA.

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