

# The Beam Line

VOLUME 4, NO. 12

Stanford Linear Accelerator Center

AUGUST 8, 1973

## FAMILY DAY THIS SATURDAY

A day of barbequed lunches, movies, sports, an art show, and tours of SLAC is scheduled for Saturday, August 11 from 11 a.m. to 4 p.m., and is officially proclaimed Family Day 1973.

The Family Day Committee, consisting of Al Ashley (Personnel), Pat Decker (Fabrication Shops), Kathleen Maddern (Public Information),



SLAC Graphic Artist (and photographer) Walter Zawojwski and friend in the strange position of being photographed during our last Family Day.

Steve Kociol (Public Information), Willie Roberts (Klystron Group), and Gloria Strelchuk (Data Analysis), expects a good-sized group to take advantage of the guaranteed rainless day to partake of free lunches, inexpensive beer, entertaining movies, and tours of the site.

A number of groups will be helping SLACers show their families and relatives what's happening here. Vernon Price (Accelerator Operations) will help Public Information guides show people the accelerator via the Sector 4 stairway and will have people in the Main Control Center to explain how the machine is operated. Chief Lund tells us the SLAC Fire Department will put on a number of fire-fighting displays. The SPEAR ring and the large detector in the west interaction region will be open and people will be on hand for questions. Ron Seefred of Group E will have an optical spark chamber set up and triggering on cosmic rays in the Central Lab. Tom Richmond (Stanford Center for Information Processing) is planning some "hands-on" displays at the Computation Center. An art show is planned for the Auditorium-Cafeteria breezeway. Other displays and open areas are planned.

Movies will be shown in the SLAC auditorium continuously from 11:00 a.m. - 4:00 p.m. These include cartoons, nature films, and a popular movie on high energy physics.

During the previous Family Day in September, 1971, over 1200 people attended. We hope to see you at this one! Programs, telling you exactly what's going to be happening when, will be available at the SLAC Main Gate at 11:00 on Saturday the eleventh.

Your group can either join a guided tour (buses will leave near the Main Gate every 20 minutes)

or you can act as guide. BRING YOUR WALLET DOSIMETER (TLD) to get your group through the Sector 30 gate.



The 1971 Family Day Committee welcomed any kind of help. This gentleman responded by passing out programs at the Main Gate.

## First Summer Institute Held Here

The SLAC Auditorium became a lively classroom during July for what turned into a very successful summer institute for physics. Each morning participants almost filled the Auditorium and then "broke for break" into small assorted groups in the breezeway, with animated discussions and exchanges between colleagues on whatever aspects of the session sparked their enthusiasm.

Co-directed by SLAC Deputy Director Sidney D. Drell and Professor David Leth and coordinated by Administrative Assistant Martha C. Zipt, the summer institute attracted 264 physicists from 64 universities and laboratories to SLAC during the period between July 9 and July 28. Seventy-four of the participants were from Stanford or SLAC while 142 came from 64 other U.S. institutions and 28 came from 10 foreign countries.

Ever since February, Martha has been meticulously plowing through all the necessary advance work to arrange for publicity, send applications for attendance, record acceptance notices and take reservations for housing. During the two weeks prior to the opening session, Betty Pennington, Group B secretary and Gail Martinez, summer assistant to the Theory Group, also worked in a flurry of activity with Martha to get every last detail as ship-shape as possible.

The institute was initiated because of SLAC's wish to contribute in an active way to the continuing educational process of research scientists in the field of high energy physics. The participants were primarily young Ph.D.'s or, in a few cases, graduate students nearing completion of their doctoral studies. Lecturers at the institute were drawn from SLAC and other research centers around the country, as well as from CERN.

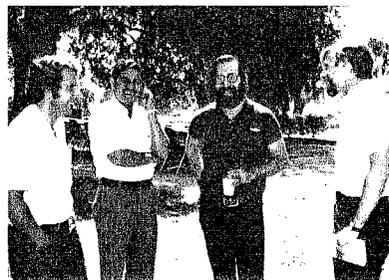
There were a number of unique features to the Institute. First, it was the only summer school of its type conducted in the United States this year. Second, the format consisted of two one-week pedagogical sessions in which topics at the state of the art were discussed. After each week of lectures, a two and one half day "topical conference" featuring outside speakers was held. Third, the Institute was designed for both theorists and experimentalists.

Immediately preceding the SLAC institute a two week summer school for graduate students in theoretical physics was concluded at UC Santa Cruz by their physics faculty. A substantial number of the participants also attended the SLAC Summer Institute.

"One of the reasons this type of institute is necessary," said Dr. Drell, "is that the job situation for physicists is such that many young physicists have had to move away from research centers. SLAC is able to bring them back to a laboratory on the forefront of high energy physics research and bring them up to date. SLAC feels it can contribute to the continuing education of these young scientists."



Bing-liu Young from Iowa State and Kwan-Wu Lai from Brookhaven confer during breaktime.



From left to right are D. Sijacko, H. Rizvi, S. Kasdan and D. Caldi in a lighter moment outdoors.

## New Evidence for Quarks?

There is a growing evidence that the proton and neutron, long regarded as the fundamental building blocks of atomic nuclei, are themselves composed of smaller building blocks called "quarks" or "partons." Speaking at the American Physical Society meeting in Washington, D.C. in April, Dr. Jim Dakin of SLAC's Group +2/3, said that these quarks provide the simplest explanation for some new experimental results from SLAC. The results were from experiment E-65 conducted in Building 109.

High-energy electrons bouncing off of protons and neutrons were observed to knock out energetic particles which were more often positively than negatively charged. This positive charge excess is most surprising in the case of the neutron target, whose total charge is zero.

If the neutron is made of two quarks with charge  $-1/3$  and one quark with charge  $+2/3$ , then the electron will most often strike the positive one. Because its charge is two times larger, it is a four-fold more attractive target than either negative quark.

Single quarks have never been observed directly in experiments. It is assumed that when a quark has been struck, it must pair up with another quark before leaving the neutron or proton.

A high energy electron is an ideal tool for this type of experiment because it can bounce off of one quark within the neutron or proton without disturbing the other quarks. Evidence from experiments which measure only the scattered electrons, not the ejected particles, suggests that the quarks are very much smaller than the proton.

Quarks were first hypothesized a decade ago by M. Gell-Mann and G. Zweig to explain the then growing list of known particles. It was shown that various combinations of 3 basic quarks could explain the existence and properties of nearly 100 known particles.

New evidence for quarks was shown when Dr. Gary Feldman of SLAC reported the positive charge excess from proton targets at the January meeting of the American Physical Society. To further test the quark hypothesis, SLAC experimenters then looked to see whether a similar effect would be produced with a neutron target.

Dr. Dakin pointed out that while the positive excess from the neutron target was predicted by and supports the quark hypothesis, other theoretical explanations can no doubt be found. Until experimenters succeed in shaking loose and observing single quarks, the existence of these elusive particles will remain in doubt.

continued on back page

# Around the World at SLAC

If you were a stranger to SLAC and came in one day just to poke around in Central Laboratory or the Research Yard, you would hear quite a variety of foreign accents during one day. Many of the people would be permanent SLAC employees, but a good number would be visitors, guests of SLAC, or experimenters from foreign countries.

The constant flow and interchange with scientists from facilities around the world turn SLAC into virtually a physics freeway of give and take with labs in foreign countries.

The open lab policy here for international cooperation is carried out in several ways:

-- A person from another lab may express his personal wish to come here for a time (or vice versa when a SLAC person wishes to go to a foreign research center), and if the exchange is found suitable, the transfer is made. The foreign scientist would then come to SLAC to work within a particular group on a daily basis for sometimes up to three years, functioning as a regular SLAC employee and contributing to the group effort while at the same time utilizing SLAC facilities for interfacing his experience and acquired information back to his home lab. For instance, SLAC has benefited greatly in recent months from the aid of several foreign members in the SPEAR group: J. I. Augustin and J. Haisinski, ORSAF, France; Manlio Matera, Frascati, Italy; Michael Harold, Rutherford Labs, England; and Helmut Wiedemann, DESY, Germany. These men participated in the day-to-day work of running SPEAR as well as in the larger open road of international exchange.

"International relations" sounds quite formal, but when effected in a shirt-sleeve and elbow-to-elbow situation, interaction with foreign countries becomes as natural as a morning cup of coffee.

In the Theory Group some of our guests or semi-permanent visitors include: David Broadhurst and Alex Hanke, England; Garrett Schierholz, Michael Schmidt and Wolfgang Kinzelbach, Germany; Yitzhak Frishman and Moshe Kugler, Israel; Roberto Pettorino and Carlo Alabizo, Italy; and Hector Moreno from Mexico.

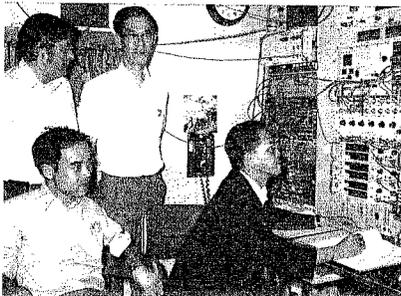
-- Other exchanges take place sponsored by the National Academy of Sciences or the National Science Foundation. Arrangements between the Soviet Union and the United States tend to be more formal in that they follow memoranda of understanding between these two countries. For example, there exists an arrangement between the U. S. Atomic Energy Commission and the State Committee for Utilization of Atomic Energy. The effect of these formal exchanges is just the same as in more casual visits -- collaboration.

In another area, the Synchrotron Radiation Project of the Stanford campus which is using SPEAR as their synchrotron source and which is sponsored by the NSF, will most likely be visited by scientists from Sweden and England.

-- All the way from "Bonjour" to "Здравствуйте" can be heard at some of the international physics

conferences in which SLAC participates. The last big gathering of the physics tribes was at the 1973 Particle Accelerator Conference co-hosted by SLAC and held in San Francisco in March. It drew 136 participants from 18 foreign countries, 20% of the total attendance, and there were more foreign participants at this conference than at any of the previous conferences of this series. In May of 1974 SLAC will host an International Conference on High Energy Accelerators which is formally set up by the AEC and sponsored, again in a series, by the International Union of Pure and Applied Physics. Perhaps half of the 500 attendees at this Conference will be from other countries.

-- The U. S. Department of State recently set up the visit of a small delegation of scientists from the People's Republic of China who met with SLAC physicists in our casual Orange Room. It is through the channel provided by the State Department that SLAC and the Ministry of Science of the People's Republic of China seek participation together in high-energy physics in what is hoped to be an increasingly cooperative exchange of ideas.



Standing at left in the Beam Shack is Roger Gearhart (EPD) together with Mr. Tomoaki Takayama (standing, r.), Dr. Kumo Tamai (seated, l.), and Professor Toshio Kitagaki, all members of the Tohoku University experimental group.

-- Foreign labs also participate at SLAC through proposals for experiments. Tohoku University in Sendai, Japan and several members of its Physics Department visited SLAC during July, together with MIT, the University of Tennessee, and Brookhaven, to take pictures with the 52" bubble chamber. Their experiment, (BC-52), was called

"p Interactions at 8 and 11 GeV/c." The significance of Tohoku University's participation here is that it is the first Japanese proposal made to SLAC and is indicative of continuing cooperation between Japan and the U. S. in high-energy physics. Head of the group, Professor T. Kitagaki, offers the following thoughts: "International cooperation and collaboration will be very important for the field of high-energy physics. For example, in Japan we are now also constructing an accelerator (12 GeV proton synchrotron) and we anticipate future collaboration with foreign countries. I am very impressed by everything here at SLAC. I see that much experimentation and effort in progress here is very unique and can be done only at SLAC. Our experiments here will bring fruitful physics for us, I am sure."

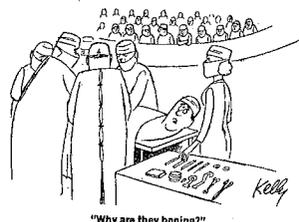
In summary one may say that international cooperation in high-energy physics provides unique opportunities for understanding among nations through the exchange of technical and social experience. These meetings do on occasion bear fruit in that scientists can advise their governments on ways of finding technical solutions to international problems.

## Lewis Keller to Head EFD

In August we will see a change in the Experimental Facilities Department when Ed Seppi, currently head of the group, will turn over the reins to Dr. Lewis Keller, a member of the Senior Physics Staff of EPD since September of 1970.

Dr. Seppi has decided to take a position with Varian Associates. After his nine years of valuable contributions to SLAC and many friendships with others on site, we naturally regret his departure but wish him all the best in his new position!

Dr. Keller came to SLAC from Argonne and has collaborated on several experiments here and, among other things, is involved with work on intermediate range schedules and on primary and secondary beams in ESB.



## 1973 Sport Spectacular by Ken Moore

### Long Distance Run

The Second Annual Long Distance Run around the accelerator will take place on Friday, August 31 at 12:00 noon.

All interested SLAC employees are welcome to participate in this event with a special invitation to students working at SLAC during the summer months.

There must also be some high school runners here who will challenge the SLAC regulars for the winner's trophy!

Four categories have been assigned: (1) 35 years and under, (2) 36 to 49, (3) 50 and over, and (4) Ladies. There will be 1st, 2nd, and 3rd place winners in each category and ribbons for all who enter the Long Distance Run.

The starting line will be at Sector 30. The distance is 3.8 miles. Try to be there ten minutes early to sign up so that we can get started on time.

If jogging isn't your "thing", but bicycle riding is, you have not been neglected, as we have just the event planned for you.

### First Annual Bicycle Race

A trial bicycle race was held on July 3rd and the response was good, so we are including this added attraction to our Long Distance Run.

For safety reasons we will have a staggered start for this event: one bicyclist leaving the starting line every 10 seconds.

This race will be twice around the accelerator, approximately 7.6 miles.

The starting line will be at Sector 30, and the race will start a few minutes before the Long Distance Run.

Runners will keep to the inside at all times and bicycles will pass on the outside. Again, please be there ten minutes early to sign up.

Categories will be the same as in the Long Distance Run, with a winner's trophy and ribbons for all who participate.

The spectators have not been overlooked, either! We will have live music provided by a group of SLAC musicians who will entertain you at Sector 30 while the races are in progress. A concession booth selling cold beverages will be on hand, manned by SLAC volunteers.

So plan to spend your lunch hour at Sector 30 -- you'll be glad you did.

### Extra News

At the "Runner's World" 50-mile relay held at California State University at San Jose, held July 14th, a combined Stanford University and SLAC team entered under the name "The Stanford Slackers" and took 2nd place honors.

A tremendous effort by Alex Gallegos (SPEAR) and Bill Devita (Stores) made this noteworthy accomplishment possible. Congratulations, Alex and Bill! On August 31st, you're the guys to beat!

The trial bicycle ride held on July 3 showed there is lots of talent in this field at SLAC. Looking very impressive were big Don Burwell (Data Assembly) who keeps in shape by bicycling to work from Sunnyvale, and newcomer Norman Jacobs (Utilities). The ladies were represented solely by Gloria Cardenas (Stores) who would like more ladies to enter. How about it girls!

Bicyclist expected to make the most improvement in the upcoming race is Ron Hoover (Crafts Shop). Ron, glad you finished the trial ride, but taking a shortcut through the gallery is a no-no! See you at the starting line.

## AEC Happenings - Hooper Retires

Howard Hooper retired from the Atomic Energy Commission on June 29, 1973, after 34 years of government service. He joined the AEC, after 11 years in other branches of the government, in 1947. Prior to coming to SLAC, he spent time at Oak Ridge National Laboratory and at the Chicago Operations Office of the AEC.

He took over as Area Manager of the AEC's Palo Alto Area Office on July 30, 1967. When the Area Office was reorganized into a smaller group entitled the Office of Program Coordination and Management - SLAC in July, 1972, Mr. Hooper remained as Director.

We wish Howard a happy retirement.

Mr. Hooper was replaced on July 1 by Stanley Stamp, who is now the Director of the Office of Program Coordination and Management - SLAC. Mr. Stamp has been with the AEC since June, 1958, most recently the "SNA" project manager at Atomics International, Canoga Park, dealing with reactor systems development.

Another AEC addition to SLAC is Mr. Dennis Neely, a recent employee of the Commission. Mr. Neely came to SLAC May 21 and will be assisting Mr. Stamp.

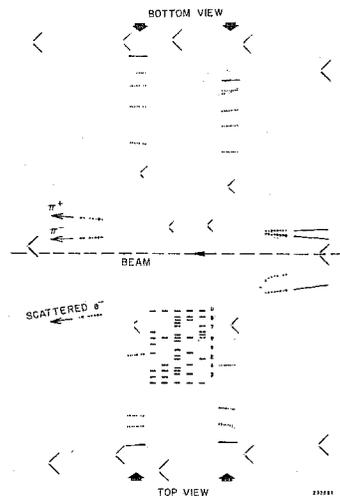
One other item is worthy of note. The San Francisco Operations Office of the AEC has now moved from Berkeley to Oakland (1). Its new address is 1333 Broadway, Oakland 94612. The general information telephone number is (4) 273-4186.

## Evidence for Quarks

continued from front page

The SLAC experiment which produced these results was difficult because billions of electrons had to strike the proton target for every particle which was knocked loose. A method had to be devised for shielding the effects of the billions of unwanted electrons from the magnetic apparatus.

This problem led to the development at SLAC of a superconducting tube four meters long, which provided a magnetic field free path for the unwanted electrons. The perfection of this new technique was reported by Fred Martin at an American Physical Society meeting a year ago and in the BEAM LINE, Volume 3, No. 2 (May 1, 1972).



This is a spark chamber photograph of an event in which an electron (e<sup>-</sup>) has scattered knocking both a positive and a negative pi meson (π<sup>+</sup> and π<sup>-</sup>) out of a proton. The path of the un-scattered electron beam is indicated by the dotted line. The target where the proton was struck is located along the beam line, but far outside the picture on the right.