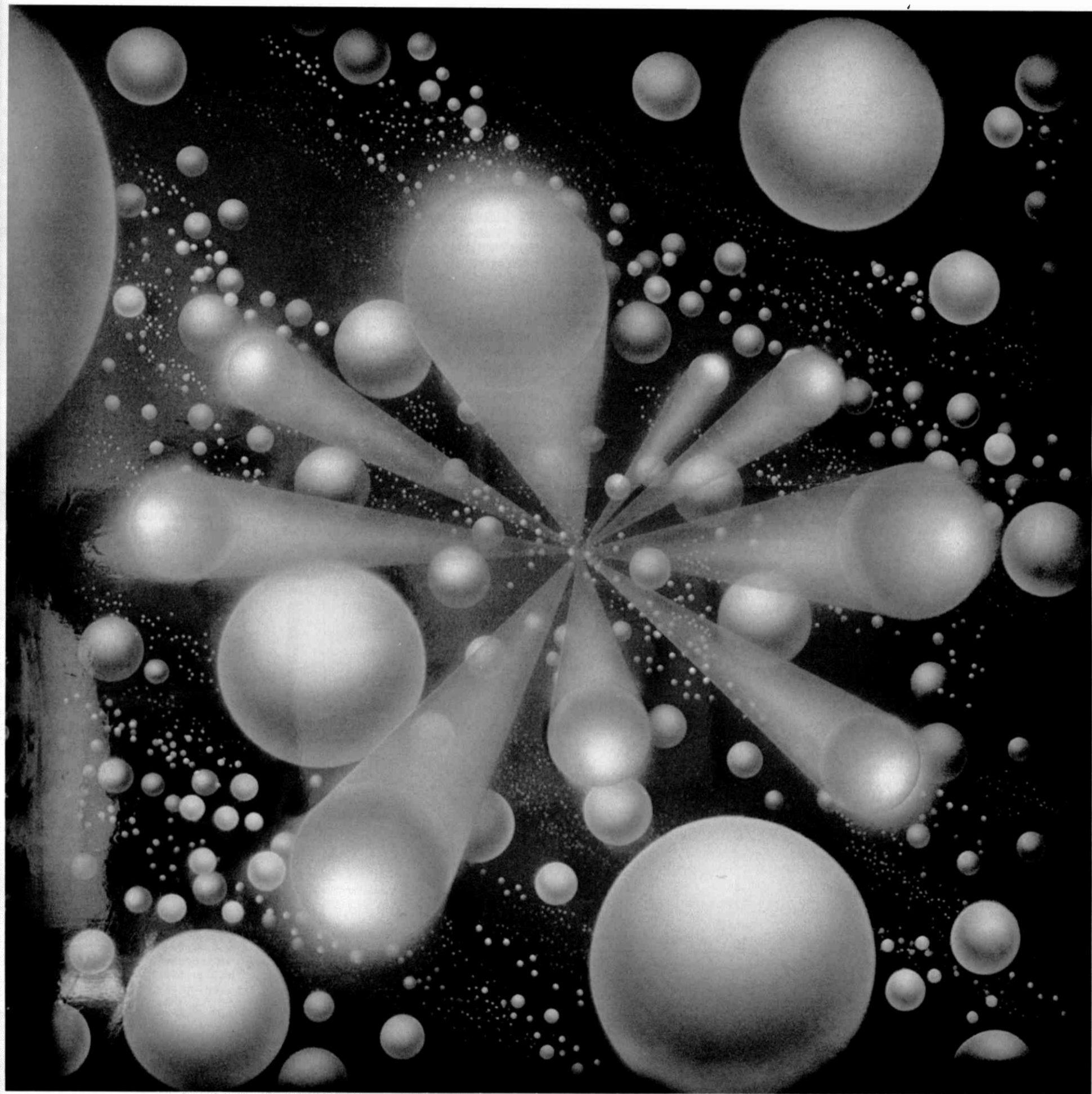


# ***The Beam Line***

**Stanford Linear Accelerator Center**

VOLUME 3 NO. 3

JUNE 20, 1972



## **' The Singing Spheres '**

*from an original painting by Walter Zawojki.*

# SLAC...in Upward Rhythm

By Kathleen Maddern

Are you one of those people who considers physics "over your head" — too full of mathematics and based on theories impossible to comprehend without years of study? If so, your feelings are shared by many other people.

Each year thousands of non-physics-oriented visitors are drawn to SLAC. Why? Simple curiosity? SLAC appears not to "produce" anything of retrievable value to minds who search for a material output which can be identified and, all too often, neatly categorized. Therefore, the persons who sincerely come here looking for more understanding of SLAC's operation are perhaps also searching for a reason to trust us, a reason to believe that the efforts in progress here which are supported by their tax dollars are leading toward a fruitful harvest.

What do we offer them in the way of satisfaction of their curiosity? Our tour program provides a brief introduction to simplified phases of physics — explaining the presence of subatomic particles, the way the beam propels electrons, other aspects of SLAC, and a tour around the site, usually to the visitor's alcove in the Klystron Gallery and the Research Yard area. Thus, the visitor's curiosity to see the physical machinery of SLAC is somewhat satiated.

But what about that next level of curiosity? The level which persistently asks, "What really does all this mean?"



There's a buzzing excitement in the air as you walk down the aisle to find a seat for the symphonic concert. As the audience grows larger before the performance starts, everyone feels great anticipation of something about to happen. The orchestra members are on stage, tuning up their instruments in a wild mixture of tootles, zings, honks and bongs. Each player is listening intently to whatever sound he is producing in order to be warmed up and in total harmony with the other instruments once the conductor gives them their first beat.

The audience is filled with curiosity as to what kind of performance it will be, particularly if it is a new work which is being performed for the first time.

Visitors to SLAC are greatly like the audience waiting for a new work to be performed. No one knows exactly what will come of the efforts in progress here, but almost everyone feels that we're tuning up for something big.

SLAC's two-mile tunnel running just under the 280 freeway is as powerful a prod to anyone's curiosity as might be a flare signal in the night sky. —"What on earth is that?"

All that machinery, all those people for what?

Even after a tour of SLAC, visitors have been heard to say, "It's fascinating, but I still don't understand it."

No? Perhaps you have yet to experience the many-colored spectrum of physics which would easily call you to immerse yourselves in the beauty of SLAC's search on a different plane than one expects.

One does not have to be either a mathematician or a physicist to share in the excitement of seeking a measure of truth in the Cosmos in which we exist. The basis for any scientific experiment is to discover and identify a truth in Nature. (Who said "Truth is beauty"?)

SLAC's particular search within one droplet of the infinite ocean of truth is

deeply thrilling. It is an uplifting search where men are adding to the pyramid of high-energy physics knowledge and are expanding the curvature of their combined energies toward the ever-alluring unknown. This is the age when men are soldering their souls together and straining toward the inseparability of individual efforts from mass progress.

Each musician, each physicist, though his instrument or theories must be impeccably tuned and formulated for greatest clarity and richness, must at the same time utilize the very wealth of his individuality in order to potently participate in the constructive effort of reaching outward and upward toward his own fulfillment in unison with others in his field.

SLAC's real power lies in her tremendous potential for fusing people together under the awareness of higher energy forces present in Nature. Through the efforts of individuals driving themselves toward a horizon which always recedes before them, new realms of the worlds within an atom are opening up for man's scrutiny and inspiration.

Perhaps man's active curiosity about this intangible work at SLAC is intricately bound to the active nature of the very components of his own being. The atom. If no energy is ever lost in our universe but is merely transposed to a different form, then the very particles composing man himself are never lost — scientific evidence is thus provided that the essence of man is above the caprices of his usual conception of time and space, although his physical form obviously undergoes some change during a given lifetime.

By delving deeper for knowledge of the particles which comprise everything in our universe (from what we know of it, at least), high-energy physics approaches the awesome threshold of the elementary mystery of our existence. Even more awesome is the distinct power given to

man's "pooled" mind to conceive of such a tool as SLAC, to engineer the construction of it, and to put it into operation for the purpose of vital introspection into the energy from which all originates.

High-energy physics is not a tame lap-dog which is fed from day to day for the purpose of a leisurely life of investigation into the various dark corners and crannies of a comfortable household. Instead, it is a powerhouse, a mechanical and mental extension of man which enables him to emigrate freely to untapped dimensions of life where the distinction between the seen and the unseen begins to vanish.

SLAC already represents a fruitful link for man's entry and expansion into an in-between world — a world between the present day problems which are seen by all and the realms on the other side where solutions lie unseen, merely waiting for man's exploration to bring them into manifestation.

(Ed. note: In conjunction with this article see "Philosophy of Science Course to Start" on this page as to what SLAC is offering which relates science to man's life.)

## Mini-Courses a Success

Many thanks to the Stanford Bowman Alumni Association for their excellent organization of the "mini-courses" offered on June 4 to everyone in the Stanford community, as well as the general public. A good number of SLAC people were there for the day's courses, luncheon, and boat races on Lagunita — it is a great boost in the direction of "continuing education" for working people, and we extend our best wishes for another presentation next year just as successful as this one!



Professor Elizabeth Rauscher during a recent lecture series at LBL.

## Philosophy of Science Course to Start

As announced recently, a 20-session series of illustrated lectures, scientific demonstrations and "rapsessions" on "The Philosophy of Science" will be presented at SLAC commencing June 26 and continuing for a 10 week period. The course will be conducted by Professor Elizabeth Rauscher, a theoretical

physicist from the Lawrence Berkeley Laboratory, where the same series of lectures was successfully presented before an enthusiastic audience last Fall.

Applications to attend the series, with or without University credit, may be obtained from the Public Information Office (ext. 2204).

## Where Will We Go?

By John Kieffer

Where Will We Go?

Once, out of the past, I saw a star, and  
I read a promise by its light.  
"Some roads will lead this way, choose  
your own with care";  
And so I have tried to look up the roads  
open to man, and to men.

Mayhaps I have succeeded, for I have seen  
things not of the now.  
I have seen some things that could have been,  
but we have passed and left behind  
Those forks on the road of man's destiny.  
Some were good, and some were bad, but they  
are all behind us now.

Of those paths still ahead are  
many choices; and some are ways of  
multiple travel.  
Some lead man down, thru a dark countryside,  
Lighted only by the hot/cold blue-white  
glow of old ruins,  
To a feral terminality.

And some paths lead to conditions of such  
controlled crowding,  
That the balance is being held between  
population and pollution  
To such a fine line, that almost any change  
will mean  
A sudden death for most, and little chance  
for the remaining few.

But there are other roads, paved with golden  
sunlight and pale starshine,  
Where men may yet go, and given courage, go  
upon many roads the several ways of man.  
Let us only cross that ridge-line, where  
the path to despair falls down in profusion  
And reach that plateau where the narrow way  
becomes broad, and stretches up to the  
universe.

Now look up those roads, and let men  
make their choices, for these are  
all paths of man.  
One is the road of the mind, where each  
man is truly free, and all men are  
bound to their brothers.  
On this way where thought controls those  
powers of thought now only seen in  
glimpses,  
And the minds of man will walk unaided  
thru the stars.

The road of science, where knowledge is  
the tool, not the god, of men.  
Where any thing deemed needful can be  
rightly done.  
The limits of light and time will be  
controlled by man  
And men will travel in sturdy craft, those  
thin lines that link all the stars.

These two main roads, each composed of  
many highways and byways,  
Cross and recross many times on the  
way ahead.  
Till that one day, when Time is Right,  
and all paths again become one,  
When man stands tall in space, and  
greet his Brothers from the Stars.

This is the vision I give to man, as it has  
been shown to me.  
This is the hope I have for man, that men  
will go forth free.  
This is the dream I pray for man, let  
mankind never tire,  
This is the faith I have in man, his  
roads go ever higher.

## SLAC Amateur Photographers

(Amateur" means "one who loves")  
Candid shots around the site — anything  
you think might capture that "special  
shot", whether it's animal, mineral,  
vegetable or human — bring your hobby  
to light — come on over to Beam Line  
office (A&E 233) & keep us in touch  
with your snaps around SLAC!

# LBL, SLAC Designing Colliding Beam Accelerator

(Ed. note: Reprinted courtesy of LBL's Magnet)

And after NAL and the "mile-wide" accelerators — what next?

It seems only yesterday that physicists around the world were debating proposals and counter-proposals for a generation of giant accelerators, a mile in diameter and 200 GeV or higher in energy. Today, machines of that generation (America's NAL, Europe's CERN II) are already operational or well advanced in design, and physicists are again looking ahead toward the generation of accelerators that will determine the course of high-energy physics in the 1980's and beyond.

## Joint study

One of the most promising of the new forward-looking proposals is currently under investigation by a joint study group from LBL and SLAC. The concept is known as PEP — Position-Electron-Proton colliding-beam accelerator. As its name implies, PEP would be something new in particle accelerators — a machine capable of accelerating and storing beams of three of the most important subnuclear particles in the same "housing."

## Flexibility

In the past, accelerators have been primarily "proton machines" (like the Bevatron or NAL) or "electron machines" (like SLAC). More recently, an increasingly important role has been played by colliding-beam storage rings, either for electron-positron collisions (like SPEAR at SLAC) or for proton-proton collisions (like the Intersecting Storage Rings at CERN). By combining both kinds of storage ring in one housing, the PEP machine would give experimenters a large increase in available energy as well as an unprecedented flexibility. Collisions between electrons and positrons, electrons and protons, and positrons and protons would all be available. Proton-proton collisions could be accomplished by a change of machine configuration.

The kind of physics that could be done with such a machine seems enormously exciting. For example, in the field of electron-proton interactions, a PEP machine would greatly extend the scope of traditional experiments (in-elastic electron scattering, photoproduction, etc.) and would also open up the relatively-unexplored field of weak interactions to practical experimentation. One such experiment might be the search for the so-called "intermediate boson," or "W" particle,

which some theoreticians believe plays an important role in the weak force. In the field of electron-positron collisions, PEP would be capable of investigating particle production with a pure and beautifully simple photon probe at energies comparable to the highest-energy conventional accelerators now under construction. In electron-proton interactions the available energies would exceed those available at the conventional accelerators.

The machine would consist of two large intersecting rings, with electrons and/or positrons stored in one ring and protons in another. The two rings would be of about the same size and occupy the same housing, intersecting each other in a number of "interaction regions." All particles in each ring would be concentrated into one or more short bunches which encounter each other only in interaction regions.

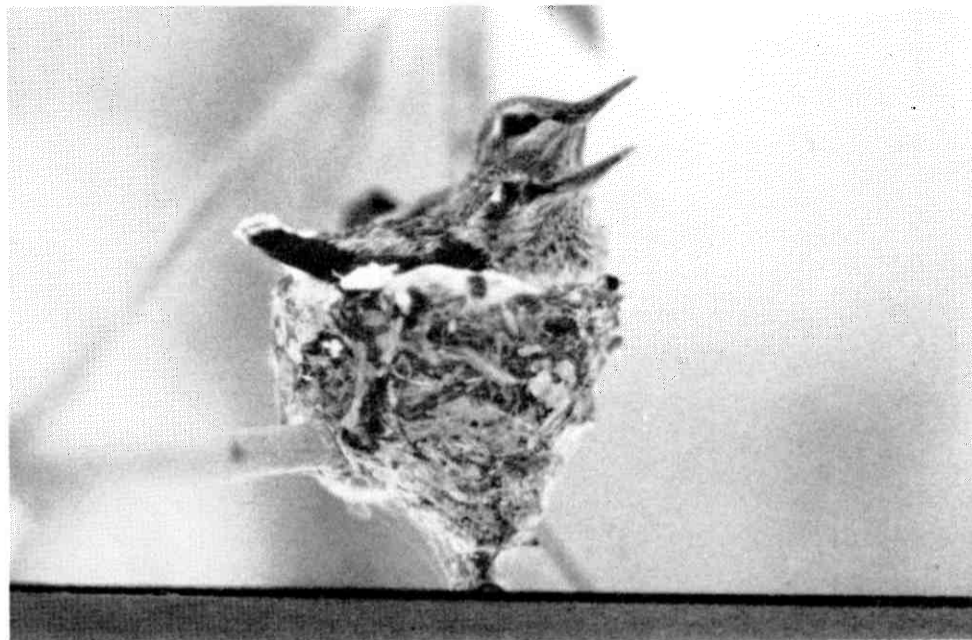
## High energies

The energies that seem feasible with such a design are extremely attractive: about 15 GeV for electrons and positrons and 72 GeV for protons. Since PEP is a colliding-beam design, this corresponds to a center-of-mass energy for electron-proton collisions of 65 GeV, which is the same as that which would be available if a 2000 GeV beam from a conventional accelerator strikes a stationary hydrogen target. (There is, however, no economically feasible way of reaching these energies with a conventional accelerator). The 30 GeV center-of-mass energy available in electron-positron collisions matches that available in proton-proton collisions from a 500 GeV proton machine of conventional design.

The PEP project represents the most important collaborative effort to date between the two principal West Coast high-energy physics centers — LBL and SLAC. Some physicists at both sites speculate that the collaboration could lead, eventually, to the establishment of a major new West Coast regional accelerator facility, with direction and scientific-effort coming from local institutions. A PEP conference held at UCLA March 24-25 attracted interested scientists from many West Coast universities and research centers.

## Gaining momentum

The PEP idea has roots that lead far back, both at SLAC and at LBL. Here at SLAC, discussions and studies of electron-positron colliding beams machines have been going on for a number of years in connection with SPEAR. SPEAR is intended to accelerate electrons and positrons to an energy of about 3 GeV. LBL, on the other hand, has been the local center of expertise for proton machines ever since the design of the Bevatron 20 years ago. More recently, that expertise has been brought to bear on the design of the 200 GeV accelerator and on research concerning new techniques of acceleration. The PEP collaboration began when LBL's Andrew Sessler, Dieter Mohl, and Claudio Pellegrini and SLAC's Burt Richter, John Rees, and Mel Schwartz worked together on a preliminary study of the idea, which Rees presented at the 1971 Accelerator Conference in Geneva last fall. Since then, the project has been gaining momentum from week to week. In October, LBL's Geoffrey Chew called a meeting of physicists interested in the project. More than 30 showed up, representing both LBL and SLAC, and organized themselves into three informal study groups to explore the kind of physics that might be done with such a machine. In December, an Accelerator Design Group, jointly chaired by Lloyd



These two little fellows (?) were recently the subject of much attention in the Central Lab courtyard. The mother hummingbird must have known their presence was a welcome view for SLAC of the beginning life cycle of one of nature's most elusive and delicate birds.

## Credit Union Counseling in English and Spanish

Most SLAC employees are aware of the primary services of credit unions such as savings amounts and consumer type loans. However, the Stanford Federal Credit Union does offer other important services that may be of benefit to SLAC credit union members.

These programs are in the area of financial counseling. Those that could benefit from these programs are members having financial problems including difficulty in meeting monthly payments, inability to systematically save for emergencies, or difficulty in money management. Normally, additional borrowing is not the solution, as this generally creates a new payment or increases the existing ones.

There are two basic programs available: the Budget Assistance Program and the Bill-Payer Program. Under the Budget Assistance Program the husband and wife meet with a financial counselor in order to formulate and implement a workable detail budget. Subsequent meetings are then scheduled to review

progress and to obtain further counseling as needed. Budget books and all other material are provided by the credit union to assist the member.

The Bill Payer Program is mainly for members who are over-extended and are having difficulty making monthly payments. The basis of this program is that through payroll deduction a pre-determined sum is deducted and distributed by the credit union to the various creditors. In most cases the credit union negotiates with the member's creditors in order to pay the maximum amount possible and still not place extreme hardship on the member. Most creditors are receptive to this plan because it provides them with assurance of receiving some money each month as long as the plan is in effect.

For further information on these financial counseling services, and on Spanish-speaking assistance and personal income tax preparation, call Al Ramirez at the Stanford Federal Credit Union on extension 4887.

## New Last Resort for Credit at SLAC

To help employees with financial difficulties, SLAC has set up the SLAC Emergency Loan Credit Committee (SELCC). The primary function of the SELCC is to work with the Stanford Credit Union when a SLAC employee is unable to obtain a loan from the Credit Union.

An employee may have been denied a loan, for instance, because he already has too much debt by Credit Union guidelines, he may not have been employed long enough to qualify for a loan, or he may have an unsatisfactory credit rating.

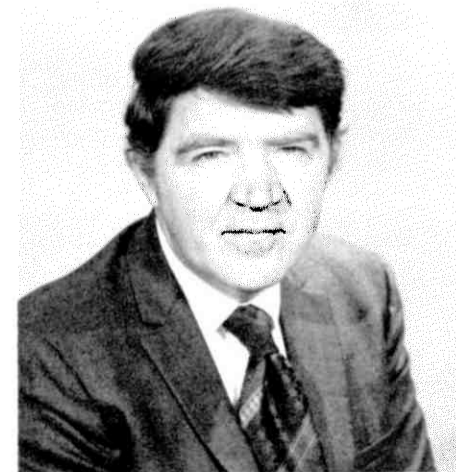
Whenever such is the case, the SELCC can pledge funds as collateral for a loan to the employee. In addition, the SELCC will make available financial counseling to the employee applying for the loan.

Anyone with this type of financial problem who has been denied a loan by the Credit Union can submit a request for help to the SELCC by either contacting the Employee Relations Section of the SLAC Personnel Office or one of the SELCC committee members. The loan, if approved, will be arranged with the Credit Union subject to their rules for time of repayment, interest charges, etc.

The SELCC is composed of one member from each of the operating divisions of SLAC selected by that division's director, and one member

selected by the MWCC. The present members are:

Bob Gex, Administrative Services Division  
Ray Valenzuela, Business Services Division  
Bette Reed, Research Division  
Louise Stanley, Technical Division  
Jim Ketcher, Minority and Women's Committee



Donald E. Reardon, long associated with the Atomic Energy Commission's program to supply nuclear auxiliary power to this nation's space exploration programs, has been named Deputy Manager of the Commission's San Francisco Operations Office.

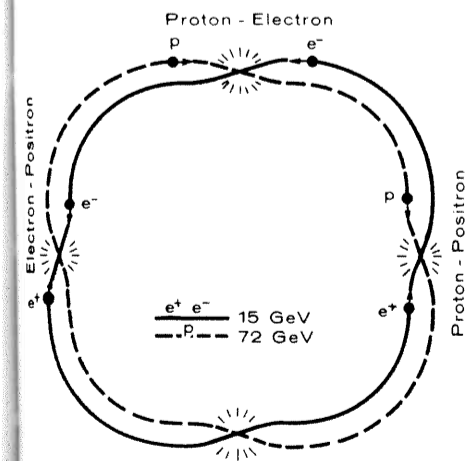


Diagram of possible PEP design shows four interaction points and the probable energy for each ring. The machine's three types of interactions are displayed, though only one of these interaction types can occur at any time. For electron-positron collisions, two bunches, one of each type of particle, circulate in the same ring in opposite directions. Protons are loaded into the other ring when proton-electron or proton-positron interactions are desired. The machine would provide high collision energy and reaction rate.

(Continued on Page 4)



A group of SLAC women meeting with the MWC committee to explore the changing patterns of women's lives in modern society.

## Director Responds to JMC Report

In the last issue of the Beam Line, the summary and recommendations of the Job Mobility Committee report on their staff survey were printed. In this issue we print the Director's response and comments on that report, as communicated to the JMC by Acting Director Richard B. Neal:

"In his absence, I should like to convey Dr. Panofsky's and my appreciation to the members of the Job Mobility Committee for all the work they have accomplished for SLAC in the short period of seven months. During this period, JMC has successfully elicited comments and suggestions for developing methods for increasing job mobility within SLAC. Special appreciation is directed to the members of the special sub-committee who analyzed and reported the results of their survey of SLAC, portions of which were published in the recent Beam Line.

That JMC report included recommendations to 1) provide increased education and training opportunities to all SLAC employees and to 2) effect a stirring of the job pool at SLAC.

Many of the detailed recommendations of this report have already been implemented. For example, last month the Director expanded the function of the Minority Affairs Committee to include in its function the special concerns faced by women workers at SLAC. More women are being encouraged to apply for career-enhancing positions available at SLAC. Also, the Training section of the Personnel Department is expanding the number of junior college courses to be offered at SLAC beginning in the Fall. And, towards broader dissemination of information on educational opportunities, the Training Office has initiated the regular publication and distribution of lists of courses available at SLAC and in the surrounding area; the first edition appeared just last month. At least one course is being offered at SLAC this summer by the U.C. Extension Division.

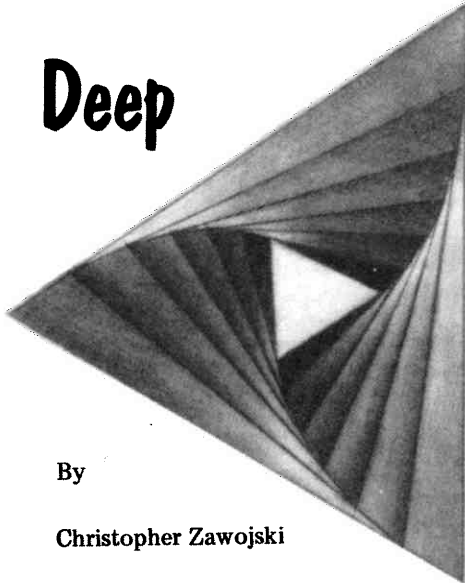
SLAC has continued to expand and broaden the publicizing of its job

opportunities to employees. More job announcement posters have been acquired and put up around the site to help in getting the information around. The Personnel Department has actively expanded its recruitment activity within the staff as an effort to promote transfer and promotion as a means of filling jobs. Further efforts in this regard are still under consideration and more attention will be directed to these efforts.

Other recommendations of the JMC Survey Report are still under study for future implementation.

I should like to thank the members of this committee and all the SLAC employees who took the time to respond to the survey questionnaire for their efforts in helping SLAC deal with these important problems."

## Deep



By

Christopher Zawojski

Think  
just think about thought  
and how you sometimes search  
the inner limits of your mind  
and find only more spaces  
deeper caverns and darker places  
on and on  
until you fear the unknown  
and return to the consciousness  
and security  
of the dimensional world about you  
a place you think you understand.

Only  
it too is just a part  
an infinitesimal segment  
of an unattainable answer  
to the mysteries of existence.

Thinking, you see  
is in itself incredible  
means of escape  
the incentive of evolution  
and our individualism.

## San Francisco Exhibit

The San Francisco Palace of Fine Arts (in the Marina) is exhibiting "Art in Science" monochromatic airbrush paintings done by Walter Zawojski for SLAC.

## SERA Election

On Wednesday, June 28, at noon, SERA will hold a semi-annual election in the Orange Room of the Central Lab. A nominating committee manned by Al Ashley, Jim Ketcher, and George Owens have arranged a slate of candidates:

John Ashton, Electronics  
Marco Buenrostro, Crafts  
Jerry Jobe, Personnel

Come to the Orange Room on Wednesday and help elect one of these deserving people to the office of Director of SERA for the next 18 months. The meeting is open to all, but only members may vote.

### Summer Courses

Summer session at DeAnza and Foothill Colleges is June 26 to Aug. 18, catalogs now available. Call or write: DeAnza College, 21250 Stevens Creek, Cupertino 95014 (408) 257-5550; Foothill College, 12345 El Monte, Los Altos Hills 94022 (415) 948-8590.

### Summer vacation?

—No service charge on travelers checks or money orders if you are a member of the Stanford Federal Credit Union.

### Phone Books

New SLAC phone books and bin lists are now available in A&E room 233.

### Garden Club

SLAC'S potato bug populace is bound to thrive, with Garden Club membership now eighty-five.

## Unspoken Word

by Kimo Welch

As children, thinking quick and intense thoughts,  
Yet without their blessing of sweet distraction,  
A dog stirs at your feet with the thought of rest,  
But with a stroke of your hand finds some satisfaction.

The clock on the shelf ticks on, and even it finds—  
It, of wood, and glass and metal parts in tension—  
A song; clearing its throat of the hour in chimes.

But alas, to be as smoke in a room with no draft,  
Swirling, undefined, without shape or purpose,  
Not even the indignation of falling as chaff;  
Foul intellect which in this, comfort would find.  
With what honesty does a soul weep "dignity in suffering"?  
None, but self-preservation at least, an intact mind.

Thoughts come to mind, warmth, beauty and tenderness in intent;  
But the divergent currents of self dilute them, reaching my lips shallow and spent.  
This life has me captured in a vulgar embrace,  
dissolving sensitivity's virility in the flaming heat of ambition,  
insecurity and greed.  
To sing without truth's brilliance and range,  
to see without vision,  
to feel without perceiving need.  
Where, oh word, for your breath on my face?

## Pep Accelerator

(Continued from Page 3)

Smith of LBL and John Rees of SLAC, was formed to do preliminary design studies of the PEP concept. Each laboratory will spend about \$100,000 this calendar year in support of the study.

### Timetable

The long-range time-table for exploration of the PEP concept reads about as follows: 1972—conceptual design and physics studies; 1973—begin detailed engineering studies and writing of proposals; 1974—submit official proposal to the AEC, asking authorization for construction to begin in FY 1976. With such a timetable, a PEP accelerator could be operating about 1980.

## THE BEAMLIN

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