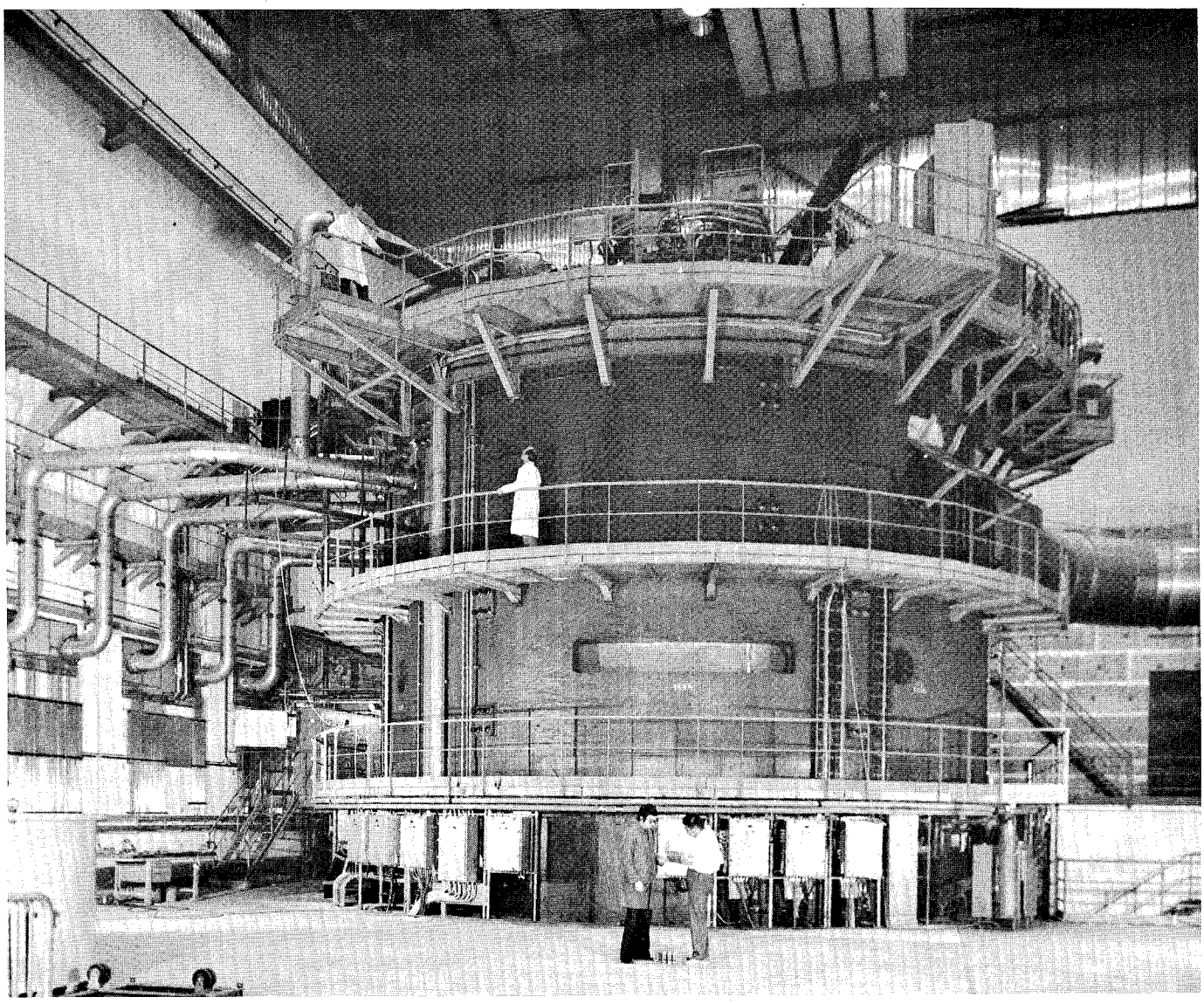
SLAC BEAM LINE

The Law of the Perversity of Nature (The Uncertainty Principle):
You cannot successfully determine beforehand which side of the bread to butter.

Volume 6, Number 6 *June 1975*



CONTENTS

In his article, "The Bubble Chamber," in the February 1955 issue of *Scientific American*, Professor Donald Glaser ended the description of his invention by mentioning "the largest bubble chamber built so far, measuring 6 by 3 by 2 inches." Now, some 20 years later, this most productive of elementary-particle detectors has evolved into a family of precise instruments, both large and small. The photo above shows the BEBC (Big European Bubble Chamber) at CERN. A large superconducting magnet produces a 35 kilogauss field within the 3.7-meter-diameter volume of the chamber, which can be filled with hydrogen, deuterium or neon. (Photo CERN.)

Weisskopf on the Frontiers and Limits of Science

[*From May 16, 1975 issue of* Science.]

Victor Weisskopf is a physicist's physicist and something of a Rennaissance man. Both of these talents were displayed in a recent talk in which he celebrated the scientific world view and yet raised a humanistic note of caution as to the limits of its applicability. Weisskopf predicted, in effect, that science may eventually explain all observable phenomena and yet remain incomplete, and he criticised exclusively rational views of human experience by comparing them to medieval religous excesses.

Weisskopf's career has spanned two continents, including graduate study in Europe under Wolfgang Pauli and wartime work on the U.S. atomic bomb project. He has been director of the European Center for Nuclear Research (CERN) near Geneva, Switzerland, one of two Americans to have held the post, and was on the faculty of the Massachusetts Institute of Technology from 1945 until his retirement last fall. By avocation he is a pianist of near-professional competence, and he has a broad interest in many aspects of literature, philosophy, and international relations. The address he gave to the American Academy of Arts and Sciences [V. F. Weisskopf, *Bull. Am. Acad. Arts Sci.* 27, 15 (March 1975)] reflects his growing concern that science has lost its human anchor, that both its critics and many of its practitioners have lost sight of the relationship in which science properly stands to human affairs.

Man, Weisskopf notes, has been curious about the world since the beginning of culture, but it was only about 500 years ago that a more focused and limited version of that curiosity began to result in what we now call science. According to Weisskopf, it was the renunciation of immediate contact with absolute truth and the investigation of particular phenomena that created a framework for understanding the natural world. The growing discovery that nature is indeed comprehensible led to a world view--what Weisskopf calls "the scientific myth of the universe" --that in its twentieth century version depends heavily on a description of matter derived from quantum mechanics. Thus matter is composed of atoms, and atomic phenomena--encompassing chemistry, biology, geology, and most naturally occurring phenomena on earth--are essentially electric in character. These phenomena exemplify for Weisskopf the internal frontier of science, in which the basic principles (the coulomb force and the quantum mechanical selection rules) are believed known but understanding is limited by the complexity of the phenomena. The external frontier, on the other hand, includes subnuclear physics and astronomy, where the fundamental principles are still unknown.

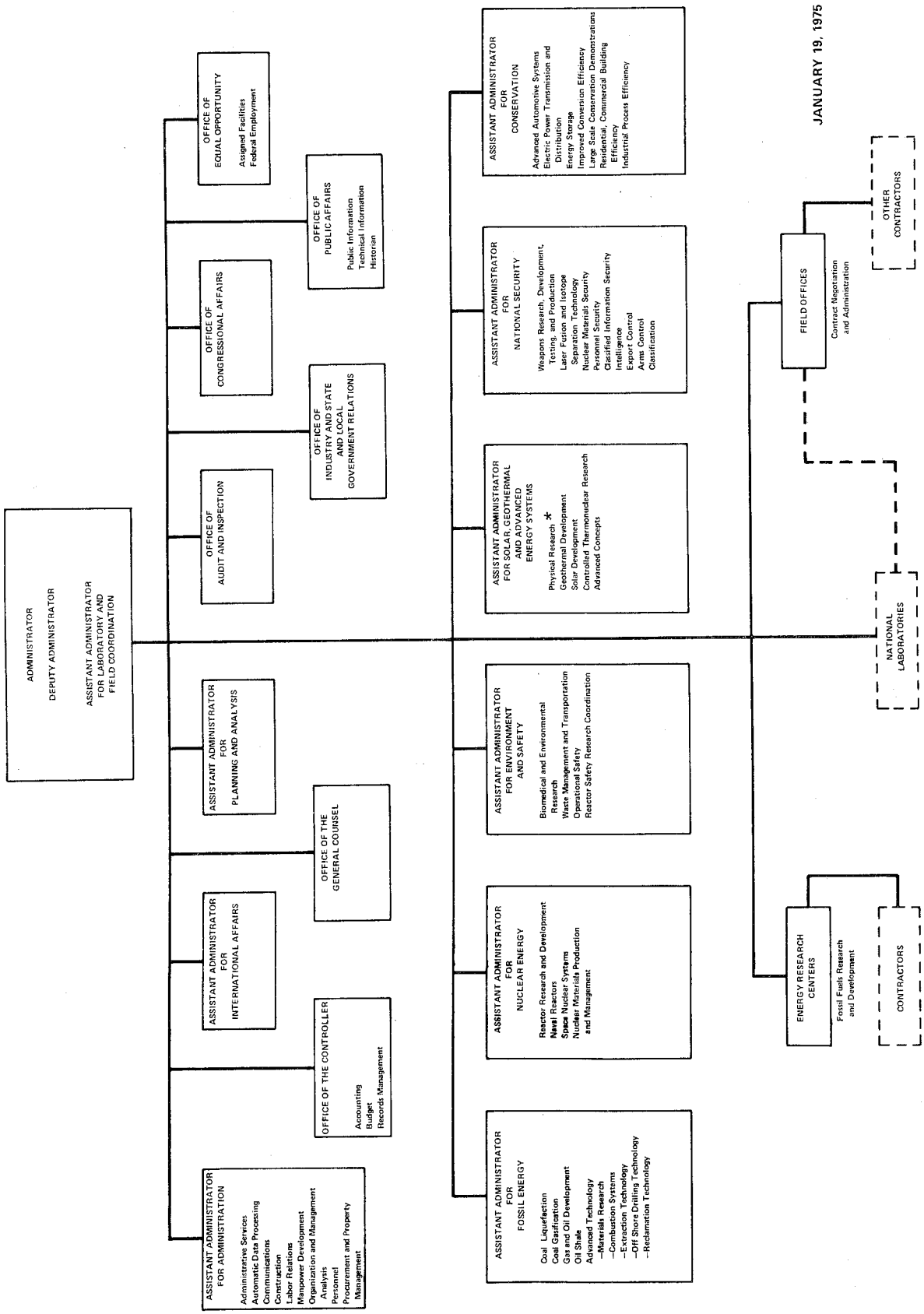
Weisskopf is hugely optimistic that the frontiers of scientific knowledge will continue to recede. He believes that "it is reasonable to predict that man will eventually understand all of nature scientifically"--all observable phenomena. But he qualifies this sweeping claim by asserting that scientific insights will not cover every aspect of human experience. For example, "one can understand a sunset or the stars in the night sky in a scientific way, but there is something about experiencing these phenomena that lies outside science." Quoting Wittgenstein and the Swiss philosopher Fierz, Weisskopf goes on to develop the point that science does not always illuminate the most important aspects of human experience, that there are limits to the scientific world view. Indeed, he believes that overemphasis on the scientific way of thinking can be dangerous in that it leads to neglect of other modes of experience, and he draws an analogy to religion in the Middle Ages. "The religous and scientific emphases have each released creative forces, but as one-sided approaches, both have also produced serious abuses. In the Middle Ages, one can point to the Crusades and to the complete neglect of corporal suffering; in our time there has been overrationality with respect to definitions of the quality of life and political decisions and an excessive concern with the production of material goods."

It is to this overemphasis of the scientific approach and the corresponding neglect of modes of experience captured in art, music, and literature that Weisskopf assigns the blame for much of the current prejudice against science and technology and for the rise of such pseudosciences as astrology and ESP--"perverse" forms that are, he claims, the result of natural urges suppressed because "the scientific approach is considered the only 'serious' way of dealing with human experience."

It is an uncompromisingly humanist manifesto, and one that carries all the more force coming from a scientist of Weisskopf's stature. In an interview, Weisskopf said that he does not wish to be considered a spokesman for Carlos Castenada, Theodore Roszak, or other antirationalist critics of science. But he did acknowledge that a connection exists between the narrowness and specialization of graduate training and research practices in the sciences today and the problems they, and he, have addressed. "Specialization has made of the rational method a profession and not an avocation," was how he put it. Many "professional" scientists may wish to disagree with Weisskopf's diagnosis, but they might do well not to dismiss it out of hand.

--Allen L. Hammond

FUNCTIONAL ASSIGNMENTS IN ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION



*This is where SLAC fits into ERDA.

When The Swallows Come Back To Compistrano

May 14, 1975

To: Fred Hall
From: Charles Dickens
Subject: Joint Tenancy of New Computer Bldg.

I observed last Saturday that there are tenants already starting their accomodations in the new Computer Building . . . . In fact, I believe they are poachers and haven't even signed a rental contract or a lease. They have built lean-to's on two sides of the building and are starting to raise a family! Before all this progress goes too far, don't you think we ought to serve them with eviction papers?

There are several families of swallows building their homes on the south and east wall . . . perhaps they could be dissuaded from this activity by inviting the Fire Department to [aim] their water hoses in the proper direction. This would certainly be better now than waiting until the building was ready for spray painting and then all the new baby birds would be harmed.

What do you think?

* *

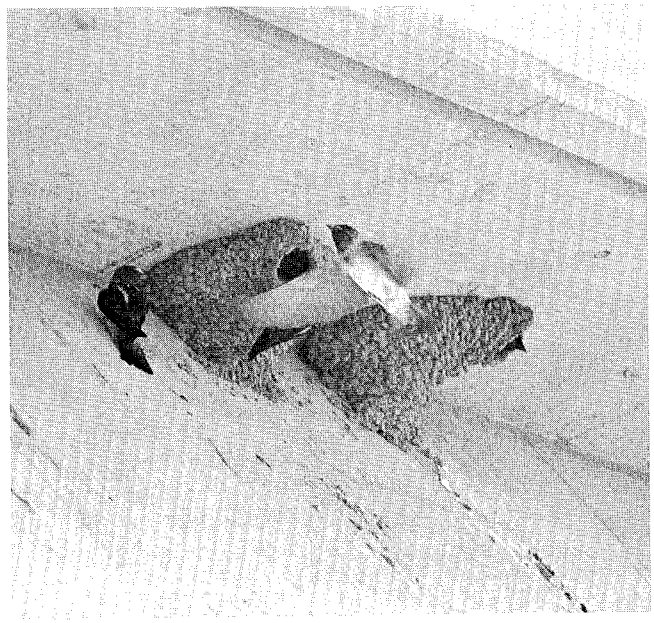
May 20, 1975

To: Chuck Dickens
From: Fred Hall
Subject: Joint Tenancy of New Computer Bldg. (Barn Swallows)

It is true that birds generally love your new building. Large numbers of barn swallows have joyously swarmed aboard, particularly into architectural recesses just above each east wall and each south wall third-story window. . . . Here they will raise a family despite bangs of nails driven into concrete, shrieks of power-driven screws penetrating sheetrock and metal studding, screech of saws cutting through metal members of fenestration, loud clangs . . . etc.

Beyond barn swallows a pair of birds built a nest between opposed studs in a third-floor toilet partition. I have reason to hope that sheetrocking preceded egg-laying in that instance. Each evening . . . lunch-bucket droppings are scavenged by blue jays who "hide" from humans in above-ceiling crannies while their big blue tails hang out. . . . For awhile longer, birds will be allowed fourth-floor privileges and then it too will be sealed against feathery intruders. . . .

Back to barn swallows: since SCIP and SLAC Comp activities will be housed on SLAC land, I discussed this political problem with R. B. Neal, who favored temperance. I then spoke with Pief in re your memo. He quickly handed back this hot potato. I then looked you up and advised that [this painting] could be deferred until after this year's crop of swallows has hatched. I was delighted to learn you belong to the Audubon Society and approve of this essentially humane game plan.



Gene Cisneros took this photo of two of the many swallow's nests, and two of the inhabitants, high up on the south wall of the new Computation Building at SLAC. After consulting his Bird Guide, Dave Coward came to the tentative conclusion that the birds are cliff swallows--making the most of this particular concrete cliff.

Looking ahead, I expect human occupants of third floor will enjoy annual mating, nest-building, egg-laying of barn swallows attended by a myriad of bird droppings to consternation of SLAC janitorial service. It has been suggested . . . that we attach weatherproof material to inner points of triangular architectural recess above windows to create a continuous barn swallow nest-sized recess above each east and south window. This would allow each pair of barn swallows to build one transverse partition between themselves and next-door neighbors, rather than a complete nest. Also, it would contain several seasons of droppings at a time. . . . I think Hoover Architects should be congratulated for having created an SCC building exterior which is so uniquely for the birds.

* *

(continued)

May 27, 1975

Howard J. White Company, Inc.
750 Welch Road
Palo Alto, CA 94304
Attn: Don Peabody
Subject: Barn Swallows

Gentlemen:

Please direct men grinding and chipping concrete in preparation for finish rubbing and sacking to trim bottom lines of 3-inch flat at bottom of architectural recess above each east and south window as discussed. . . . All trades are to work around swallow nests. I understand painter will paint exterior walls during last three weeks in June. In order to ease his problem and retain general architectural appearance, please direct him to paint vertical triangular side walls, soffits and sloping back walls of architectural fourth-floor recesses Homespun Brown to match swallow nests. . . .

Very truly yours,
Fred F. Hall
Mgr. of Plant Eng.

* *

27 May 1975

Mr. Fred Hall
Stanford Linear Accelerator
Post Office Box 4349
Stanford, California 94305

Re: SLAC Computation Center

Dear Fred:

If you had obeyed the simple straightforward laws of the land applicable to we common folk and prepared an EIR, none of this would have happened. There wouldn't be a building there today to cause this sticky situation to have developed.

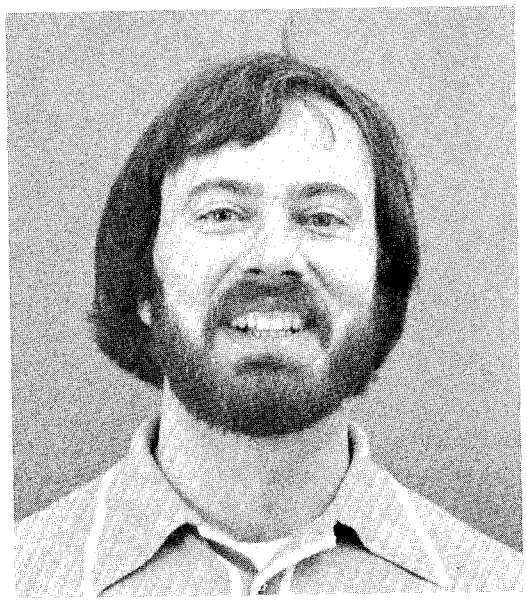
I believe a hard hat issue to all staff and visitors will clear you past OSHA with minimal fines only occurring as the regulations change.

In the meantime I suggest you just swallow hard and treat any suggestion that our building looks like a barn as a bird-brained idea.

And remember, Fred, a bird in the building is worth two in the staff garden.

Sincerely,
ALBERT A. HOOVER & ASSOCIATES
Gordon B. McAdam.

"The rabbi spoke three times; the first talk was brilliant: clear and simple. I understood every word. The second was even better: deep and subtle. I didn't understand much, but the rabbi understood all of it. The third talk was a great and unforgettable experience. I understood nothing, and the rabbi himself didn't understand much either."



FRED FEHRER LEAVING SLAC

SLAC's longest tenured Tour guide has taken on a new job--that of materials' scientist in Johannesburg, South Africa. Good old Fred Fehrer, who started giving tours at SLAC back in 1968, has now become Dr. Frederick Fehrer of the Chamber of Mines of South Africa.

Fred graduated from Tufts University in 1965 and immediately enrolled in graduate school at Stanford. He received his Master's Degree in 1968, and in that same year began his work at SLAC. During the following six years, while working on his Ph.D., Fred has led more than 500 tours of SLAC.

One of the tours that Fred remembers best was a special tour, arranged at the last minute, for a foreign visitor to Stanford from South Africa. In the course of their discussion on the tour, the visitor learned of Fred's background, and at tour's end he told Fred, "If you ever need a job, be sure to look me up."

Although loathe to leave SLAC, Fred eventually decided to take the visitor up on his offer, with the result that he will soon be toiling in a different mine.

But Fred expects to be back. His South African work is covered by a three-year contract, after which time he plans to buy a sailboat and return to California by sailing half way 'round the world.

We'll have a contingent stationed on the Golden Gate Bridge to welcome him home.

--Doug Dupen

To explain all nature is too difficult a task for any one man or even for any one age. 'Tis much better to do a little with certainty, and leave the rest for others that come after you, than to explain all things.

--Isaac Newton

PHYSICISTS STILL NOT SURE IF NEW PARTICLES HAVE "CHARM"

[Note: The following article is reprinted from the May 4, 1975, edition of the *New York Times*. In the article science writer Walter Sullivan reviews some of the particle data presented at the late April meeting of the American Physical Society in Washington, D.C. Since both fact and speculation about the new psi particles tend to move on rapidly, we hope to have ready for a *Beam Line* issue in July or August a rather complete update on what has been learned about psi's and how that data fits with basic theory.]

By WALTER SULLIVAN

After almost six months of hectic research in which the world's largest experimental devices have been used to study some of the tiniest constituents of matter, the nature of the new class of particles discovered last November has become more perplexing than ever.

The possibility remains that the particles indicate the existence of a subtle property of matter known as charm. A few particles have been fleetingly observed that may be "charmed." But other experiments designed to test the charm hypotheses have failed to find particles predicted by the theory.

The status of this search was described last week by physicists from European and American laboratories at the spring meeting of the American Physical Society.

As stated in the current issue of the CERN COURIER, issued by the European Organization for Nuclear Research near Geneva, the discoveries of recent months "have opened up completely new interpretations about the fundamental components of nature and their behavior."

LARGEST IN EUROPE

The organization's research center outside Geneva is the site of Western Europe's largest atom smasher. Virtually all research on the new particles depends on the very large smashers, or particle accelerators, including the four-mile ring of the Fermi National Accelerator Laboratory at Batavia, Ill., the world's largest.

Charm is a hypothetical property of atomic particles that would be conserved when those particles interact with other heavy particles, much as an electric charge is conserved. In charge conservation, for example, if the net electric charge of particles entering into a reaction is minus one, the net charge of those that emerge from the reaction must also be minus one.

The existence of the property called charm was suggested in 1964 by Drs. James D. Bjorken, now at Stanford University, and Sheldon L. Glashow, now at Harvard University. They saw it as an explanation for certain patterns of particle interactions. When the new particles were discovered in November they were hailed as the first evidence for "charmonium."

QUARKS AND ANTIQUARKS

The particles of charmonium would be formed from the mating of two subparticles known as quarks. Because one was a so-called antiquark, the properties of charm would be neutralized within charmonium and not evident to outside observation.

Since physicists like to assign odd names to theoretical concepts, two researchers at the Fermi Laboratory have facetiously proposed "panda," rather than "charm" for this property. They are M. B. Einhorn and C. Quigg. . . . The new particle would then be called "pandamonium" which, as noted in the CERN COURIER, "is a fair reflection of its impact on the world of high-energy physics."

The first of the new particles was discovered almost simultaneously at Brookhaven National Laboratory near Upton on Long Island, and at the Stanford Linear Accelerator in Palo Alto, Calif. Brookhaven named it the J particle. The California group calls it the psi particle. The latter team then found a second, slightly heavier particle that decays into the first one.

Both are uncharged electrically but the charm hypothesis predicted a whole family of particles, including some with electric charge (both positive and negative) and the outward manifestations of charm.

BEAM OF PROTONS FIRED

Dr. Samuel C. C. Ting of the Massachusetts Institute of Technology led a group at Brookhaven that made the original discovery there. An intense beam of high-energy protons (hydrogen nuclei) was fired into a tank of liquid hydrogen to produce proton-proton collisions.

Last week he reported that a continuation of such experiments had not revealed the predicted sister particles, although the data have not been entirely processed.

A completely different type of Brookhaven experiment has, however, produced a single event in which a seemingly charmed particle was formed. A beam of neutrinos was fired into a tank filled with liquid hydrogen to see what happened when the neutrinos interact with protons.

Neutrinos are elusive particles that have no observable mass and no electric charge. They therefore interact with protons only when they come extremely close to them. In this series only 100 neutrinos were detected in 62,000 photographs and the analysis of one suggested that a particle behaving as though "charmed" had briefly been formed.

EXISTENCE CONFIRMED

Its mass would be roughly 2.426 billion electron volts (abbreviated GeV). The mass or weight of such particles is normally expressed in terms of the energy that would be released if they were entirely converted to energy. The masses of the particles discovered in November are 3.1 and 3.7 GeV. Their existence was quickly confirmed here and abroad.

Researchers at the [CERN] organization's base in Switzerland, firing neutrinos into Gargamelle, a bubble chamber filled with heavy liquid, have also observed an event which, as stated by CERN COURIER, is "a strong candidate for the production of a charmed particle."

However, other experiments there, at the Fermi laboratory and at Stanford have not observed phenomena predicted by the charm theory.

For example, it had been expected that the heavier psi particle would decay through a succession of energy levels, giving off characteristic gamma rays at each stage.

UNSUCCESSFUL EFFORT

At last week's meeting, Dr. Robert Hofstadter, a Nobel laureate in physics, reported on unsuccessful efforts at Stanford to observe these gamma ray emissions. Just as the characteristic colors, or spectral lines, emitted by atoms as they change their energy states, reflect their internal structure, one would expect to find analagous emissions from the psi particles, he said.

Thus, Dr. Hofstadter said, the theories advanced so far "do not seem consistent with what we are finding." He expressed confidence, however, that spectral lines of some sort would eventually be detected.

Dr. I. Peruzzi of the Italian nuclear center at Frascati reported that in experiments, like those at Stanford, where beams of electrons and positrons collide head on, no evidence was found for any particles in the range from 1.1 to 3.0 GeV.

Dr. Roy Weinstein of Northeastern University in Boston told of efforts at the Fermi Laboratory to detect particles with a mass of about 2 GeV, produced in pairs and thus producing a "bump" in the data at about 4 GeV. A small bump of this sort has, in fact, been observed, he reported.

PARTICLE OBSERVED

Evidence for a particle with a less sharply defined mass has been seen at 4.2 GeV in the Stanford electron-positron collisions, according to Dr. Charles C. Morehouse.

Dr. David Cline of the University of Wisconsin reported the discovery of what is tentatively being called the Y particle that seems completely different from the psi or J particles. It was observed at the Fermi Laboratory in a small percentage of the high energy neutrino collisions decaying in a manner never before observed (into two muons and a neutrino). Its mass would lie between 2 and 4 GeV and its interactions would be controlled by the "weak" force responsible for radioactivity.

The psi or J particles are believed to answer to the "strong" force that binds the atomic nucleus. They seem to be "cousins" of light waves in that they are the transmitters of a force--in this case the "strong" force. Light waves transmit the electromagnetic force.

Because of this relationship it was suspected that the new particles would be produced by aiming extremely energetic light waves (gamma rays) at a solid target. This has been done at Stanford, the Fermi Laboratory, Cornell University, and in West Germany. The results support the view that the new particles are related to the nuclear force.

PUZZLING DISCOVERIES

A variety of puzzling discoveries were reported. Dr. Ting found it "very strange" that J particle production at 20 GeV is only one-tenth what it is at 30 GeV. The Northeastern group reported that production by a beam of particles known as pions was five times higher than by a proton beam. "No theoretical explanations exist," they said.

Dr. Michael J. Tannenbaum of Rockefeller University in New York told of a strange phenomenon first observed in the Soviet Union and subsequently at CERN, where he was a visiting experimenter, and elsewhere. The proton beams that collide head on at CERN produce, in effect, the highest energy collisions in any laboratory. The psi or J particles are seen as well as electron-positron pairs that shoot off at right angles to the colliding beams.

However, once in roughly every 10,000 events only one electron flies off, violating one of the basic laws of physics: that heavy particle collisions cannot produce single light particles such as the electron.

"Something really interesting seems to be occurring," he said. "We are now confronted with all these mysteries to solve," he told a standing-room only audience, " and I think it is a wonderful time."

1975 LEPTON - PHOTON SYMPOSIUM
AUGUST 21-27, STANFORD UNIVERSITY

This summer, from August 21 through 27, SLAC will host the seventh in a series of biannual *International Symposia on Lepton and Photon Interactions at High Energies*. The series began in Boston in 1963, and in 1967, soon after the SLAC accelerator began operating, the third of the Symposia was also held here. This conference is jointly sponsored by the International Union of Pure and Applied Physics, the U.S. Energy Research and Development Administration, the National Science Foundation, and Stanford University.

The Symposium will be held on the Stanford campus in Kresge Auditorium, which is a part of the new Law School complex. More than 500 physicists from all parts of the world have indicated their intention to attend. The scientific program (see below) will consist of about 35 invited papers, roughly half of which will report recent experimental results, with the balance divided between theoretical topics and general experimental reviews. Papers contributed to the Symposium by delegates will be forwarded to the invited speakers, as appropriate, for reference or partial inclusion in their talks. The Symposium Proceedings will include the invited papers and subsequent discussions in full, and also abstracts of contributed papers.

The Symposium Secretary is Ruth Thor Nelson of SLAC, who along with Susan Fleming is carrying most of the load of correspondence and the necessary extensive preparations. Joe Ballam is the Chairman of the Organizing Committee, while Elliott Bloom and Sam Berman are the Arrangements and Program Chairmen, respectively. Ruth's experience and that of Doug Dupen is proving invaluable in anticipating and coping with the many logistical problems.

As the program shown below indicates, there will be a strong emphasis this year on the recenty discovered psi or J particles, which have now been produced and studied in many different laboratories and by a variety of experimental techniques. Even before the new particles came along, the experimental results from the past year or two had raised a number of puzzling but suggestive problems. Now the general sense of the field of elementary-particle research seems to be one of very strong excitement, with important clues now in hand, and perhaps also with even more important answers within our grasp.

THURSDAY, AUGUST 21	FRIDAY, AUGUST 22	SATURDAY, AUGUST 23	24	MONDAY, AUGUST 25	TUESDAY, AUGUST 26	WEDNESDAY, AUGUST 27
R. Schwitters *G. Feldman* *G. Abrams* e^+e^- RESULTS FROM SPEAR	*L. Lederman* REVIEW OF LEPTON PRODUCTION IN HADRON COLLISIONS	*A. Silverman* REVIEW OF HIGH-ENERGY PHOTOPRODUCTION		*B. Barish* HIGH-ENERGY INELASTIC INTERACTIONS AT FERMILAB	*L. Mo* MU INELASTIC AT FERMILAB	*R. Hofstadter* RESULTS FROM e^+e^- QED EXPERIMENTS
	PHOTOPRODUCTION OF NEW PARTICLES: FERMILAB - *W. Lee* SLAC - *R. Prepost*	*H. M. Fischer* REVIEW OF LOW-ENERGY PHOTOPRODUCTION	1975 LEPTON-PHOTON SYMPOSIUM AT STANFORD	*C. Rubbia* NEUTRAL CURRENTS AND ANOMALOUS MU PRODUCTION AT FERMILAB	*R. Taylor* REVIEW OF e-p INELASTIC	*F. H. Combley* NEW CERN g-2 EXPERIMENT
B. Wiik e^+e^- RESULTS FROM DORIS	*S. C. C. Ting* PRODUCTION OF NEW PARTICLES BY PROTONS	*A. Donnachie* COMPARISON OF THEORY AND EXPERIMENT IN PHOTOPRODUCTION		NEUTRINO RESULTS: BNL 7-FOOT - *N. Samios* GARGAMELLE - *J. Morfin*	*C. Llewelyn-Smith* COMPARISON OF MODELS OF INELASTIC LEPTON INTERACTIONS	*L. Di Lella* REVIEW OF LARGE $P_\perp$ PHENOMENA IN HADRON COLLISIONS
C. Bemporad REVIEW OF e^+e^- RESULTS AT $\leq$ 3 GeV	PRODUCTION OF NEW PARTICLES: BY NEUTRONS - *T. O'Halloran* BY OTHER PARTICLES - *(To be announced)*			*D. H. Perkins* REVIEW OF OTHER INELASTIC NEUTRINO EXPERIMENTS	*R. Mozley* μ-NUCLEON EXCLUSIVE AT SLAC *K. Hanson* e-NUCLEON EXCLUSIVE AT CORNELL	*R. Dashen* THEORY OF QUARK CONFINEMENT
F. Gilman THEORY OF e^+e^- ANNIHILATION INTO HADRONS	*H. Harari* THEORETICAL IMPLICATIONS OF THE NEW PARTICLES			*L. Wolfenstein* NEUTRAL CURRENTS AND ANOMALOUS LEPTONIC INTERACTIONS	*G. Wolf* REVIEW OF EXCLUSIVE LEPTON INTERACTIONS	*J. Bjorken* SYMPOSIUM SUMMARY AND PROGNOSIS
				B. Lee GAUGE THEORIES	*A. M. Polyakov* THEORY OF SCALE INVARIANCE AT SMALL DISTANCES	

SCIENTIFIC AMERICAN ARTICLES

Note: See last item on this list.

We've recently been leafing through a bunch of old issues of the *Scientific American* looking for articles about accelerators and high-energy physics--and more generally about the properties and behavior of matter. In so doing we've been impressed again with the consistently high quality of the articles in this journal. This stuff is a gold mine for anyone who wants to get a popular description of important scientific research. The scientists who actually do the research are not always very good at explaining it in simple terms, but the *Scientific American's* editors seem to do a remarkably good job of tugging and hauling on the material (and probably on the writers) to get the final versions into readable shape.

On this and the following page we've listed a number of *SA* articles from the period 1949 through early 1975 that seem to be relevant, in one way or another, to SLAC's work. The SLAC Library has bound volumes of *SA* that extend back to July 1958. There is also a Cumulative Index available that covers the period from 1948 to 1971. For anyone who wishes to get reprint copies of articles, most of those listed below, and many others, are available at 30¢ a copy from the following source:

Scientific American Offprints
W. H. Freeman and Company
660 Market Street
San Francisco, CA 94104

There are some specific ordering instructions, so it would be a good idea to write to Freeman and ask for a copy of the *Scientific American Offprints Ordering Form*, which also includes a complete listing of all the titles that are available.

--BK

	1949	
Mar	Kirkpatrick	THE X-RAY MICROSCOPE
Nov		DEMOCRITUS ON THE ATOM
	1950	
Apr	Seaborg Perlman	THE SYNTHETIC ELEMENTS I
Apr	Einstein	ON THE GENERALIZED THEORY
Apr	Hoffman	SHAKESPEARE THE PHYSICIST
May		ARISTOTLE'S PHYSICS
Jul	Korff	COUNTERS
	1951	
Feb	Smith	THE BEVATRON
Mar	Mayer	STRUCTURE OF THE NUCLEUS
Jul		ATOMIC MICROSCOPE
Oct	Morrison	THE NEUTRON
	1952	
Mar	Darrow	THE QUANTUM THEORY
Aug	Pierce	MICROWAVES
	1953	
Apr	Dyson	FIELD THEORY
Aug	Hughes	THE NUCLEAR REACTOR AS A RESEARCH INSTRUMENT
Sep	Bethe	WHAT HOLD THE NUCLEUS TOGETHER?
Sep	Rossi	WHERE DO COSMIC RAYS COME FROM?
Sep		FUNDAMENTAL QUESTIONS IN SCIENCE
Nov	Collins	SCINTILLATION COUNTERS
	1954	
Sep	Dyson	WHAT IS HEAT?
Nov	Panofsky	THE LINEAR ACCELERATOR
Dec	Corben DeBenedetti	THE ULTIMATE ATOM
	1955	
Feb	Glaser	THE BUBBLE CHAMBER
	1956	
Jan	Morrison	THE NEUTRINO
May	Yagoda	THE TRACKS OF NUCLEAR PARTICLES
Jun	Segre Weigand	THE ANTIPROTON
Jul	Hofstadter	THE ATOMIC NUCLEUS
Sep	DeBenedetti	MESONIC ATOMS
Sep	Fowler	THE ORIGIN OF THE ELEMENTS
Dec	Seaborg Perlman	THE SYNTHETIC ELEMENTS II
	1957	
Jan	Marshak	PIONS
Feb	Sciama	INERTIA
Mar	Ginzton	THE KLYSTRON
Apr	Morrison	THE OVERTHROW OF PARITY
Jun	Muller	ATOMS VISUALIZED
Jul	Gell Mann Rosenbaum	ELEMENTARY PARTICLES
Nov	Matthias	SUPERCONDUCTIVITY
	1958	
Jan	Gamow	PRINCIPLE OF UNCERTAINTY
Mar	Wilson	PARTICLE ACCELERATORS
Apr	Burbidge Hoyle	ANTIMATTER
Sep	Dyson	INNOVATION IN PHYSICS

	1959	
Jan	Peierls	MODELS OF THE NUCLEUS
Mar	Treiman	THE WEAK INTERACTIONS
May	Wannier	THE NATURE OF SOLIDS
Jul	Gamow	THE EXCLUSION PRINCIPLE
Sep		IONIZING RADIATION
	1960	
Mar	Marshak	THE NUCLEAR FORCE
Jul	Katz	THE BIOLOGY OF HEAVY WATER
Jul	Rothman	THINGS THAT GO FASTER THAN LIGHT
	1961	
Mar	Gamow	GRAVITY
Jul	Penman	THE MUON
Nov	Ginzton Kirk	THE TWO-MILE ACCELERATOR
	1962	
Mar	Steinherz Redhead	ULTAHIGH VACUUM
Aug	O'Neill	THE SPARK CHAMBER
	1963	
Jan	Hill	RESONANCE PARTICLES
Mar	Lederman	THE TWO-NEUTRINO EXPERIMENT
May	Dirac	THE EVOLUTION OF THE PHYSICIST'S PICTURE OF NATURE
Oct	Feinberg Goldhaber	CONSERVATION LAWS OF PHYSICS
Dec	Ford	MAGNETIC MONOPOLES
	1964	
Feb	Chew Gell Mann Rosenfeld	STRONGLY INTERACTING PARTICLES
Apr	Giordmaine	THE INTERACTION OF LIGHT WITH LIGHT
May	Selig, Malm Claassen	THE CHEMISTRY OF THE NOBLE GASES
	1965	
May	Frisch	MOLECULAR BEAMS
Dec	Wigner	THE VIOLATIONS OF SYMMETRY IN PHYSICS
	1966	
May	Shapiro	POLARIZED ACCELERATOR TARGETS
Nov	O'Neill	PARTICLE STORAGE RINGS
	1967	
May	Feinberg	ORDINARY MATTER
Sep	Reiss	THE CHEMICAL PROPERTIES OF MATERIALS
Sep	Ehrenreich	THE ELECTRICAL PROPERTIES OF MATERIALS
Sep	Cottrell	THE NATURE OF METALS
Oct	Yount	THE STREAMER CHAMBER
Dec	Barger	HIGH ENERGY SCATTERING
	1968	
Jan	Crane	THE g-FACTOR OF THE ELECTRON
May	Weisskopf	THE THREE SPECTROSCOPIES
Sep	Weisskopf	HOW LIGHT INTERACTS WITH MATTER
	1969	
Aug	Baranger Sorensen	THE SIZE AND SHAPE OF ATOMIC NUCLEI
	1970	
Feb	Feinberg	PARTICLES THAT GO FASTER THAN LIGHT
May	Holliday	EARLY VIEWS OF THE FORCES BETWEEN ATOMS
	1971	
Jun	Panofsky Kendall	THE STRUCTURE OF THE PROTON AND NEUTRON
Jul	Murphy Yount	PHOTONS AS HADRONS
Sep	Dyson	ENERGY IN THE UNIVERSE
	1972	
Jan	Everhart Hayes	THE SCANNING ELECTRON MICROSCOPE
Apr	Keefe	COLLECTIVE-EFFECT ACCELERATORS
May	Penrose	BLACK HOLES
Oct	Zafiratos	THE TEXTURE OF THE NUCLEAR SURFACE
Nov	Weigand	EXOTIC ATOMS
	1973	
Aug	Barish	EXPERIMENTS WITH NEUTRINO BEAMS
Oct	Litke Wilson	ELECTRON-POSITRON COLLISIONS
Nov	Amaldi	PROTON INTERACTIONS AT HIGH ENERGIES
	1974	
Jan	Schramm	THE AGE OF THE ELEMENTS
Feb	Wilson	THE BATAVIA ACCELERATOR
Jul	Weinberg	UNIFIED THEORIES OF ELEMENTARY PARTICLE INTERACTIONS
Nov	Will	GRAVITATION THEORY
Dec	Cline, Mann Rubbia	THE DETECTION OF NEUTRAL WEAK CURRENTS
	1975	
Feb	Schwartz	DUAL-RESONANCE MODELS OF ELEMENTARY PARTICLES
Jun	Drell	ELECTRON-POSITRON ANNIHILATION & THE NEW PARTICLES

NOTE

SLAC PERSONNEL OPEN FROM 7 AM TO 6 PM

"Extended hours" has long been the policy of SLAC's Personnel and Public Information Department. As a reminder, the Department is open from 7:00 in the morning through any and all lunch hours and until 6:00 in the evening. No need to take time off from work, if this is a difficulty, in order to pose a question or a problem.

The kinds of things you might want to discuss with members of the Department's genial staff might include the following:

Medical claims
Salary questions
Job openings
Affirmative action
Tours for visiting relatives
Training opportunities
Tax exemption modifications
Changes of address
Grievances
Tuition refunds
Brochures about SLAC
Pension plan enrollment
Classification questions
Transfer opportunities
Movies and visual aids
House or apartment rentals
Conference room reservations
Visa problems
Maps to and of SLAC
Summer employment
Personnel statistics
Personal problems
Directory listings
Complaints
Recreation programs
Campus information
Old records
General gripes
Etcetera

The Department is located in the southwest corner of the A&E Building and, once again, is open for business anytime between 7:00 AM and 6:00 PM.

--Doug Dupen

A recent and novel use of the telephone has been the reporting of the Michigan-Ohio State football game Two bare wires were stretched across the field, and a trolley arranged to run on them. To this trolley was attached a portable telephone set, which was used by the reporter, who followed the progress of the ball along the field. This circuit was connected to the Ann Arbor, Mich., exchange, and through it to the University of Michigan. In this way the progress of the game was followed at Ann Arbor almost as closely as it was on the field where it was played.

--*Scientific American*, March 1907

--*Photo by Joe Faust*

Ken Johnson is shown examining some of the burned cables that were removed, along with a section of the metal cable tray, from the West experimental pit at SPEAR.

CAPTION CONTEST

The photo and caption shown above appeared in the "SPEAR Repairs" story in the May 1975 *Beam Line*. There must have been something about the photo that provoked many of the local wise guys to come popping out of the woodwork with smart remarks. At any rate, we've been receiving a steady stream of suggestions for a better caption, including the following:

1. I told 'em and I told 'em!
2. I predict a good vintage year.
3. Mama mia! Dat's good spaghetti!
4. Why me?
5. Rapunzel! Rapunzel! Let down your hair!
6. Feel that material!
7. Nothing but red whips? Don't they make licorice anymore?
8. So I just plugged in one more little extension cord, so what?
9. Ain't that a can of worms.
10. Let's see now, A-257 goes either to L-433 or . . .

In the expectation that someone out there can do better than *that*, we offer some blank spaces to be filled in and returned to Bin 80. The winning entry will get a glorious weekend in Philadelphia. Second place will get two weekends in Philadelphia.

11. _____

12. _____

13. _____

_____

Dear Doctor,

Publish or perish? Today, more scientists than ever before are faced with this problem. This letter brings you an opportunity not only to publish but to appear as a co-author of many important articles bearing on research problems in a variety of scientific disciplines. Naturally, we want to help you, but in order to do this you have to help us.

Below are the names of eight well-known scientists. Include them as co-authors in your next publication.

Then make eight copies of this letter with the names amended as follows. Strike out the name of the first-mentioned scientist and advance the positions of the remaining names by one space upwards. Then include your name at the bottom of the list.

Send the eight copies to eight well-known scientists of your acquantance. Try to maintain as far as possible the high standard of scientific excellence represented on the present list.

If you send eight copies off within a few weeks and publish, as you usually do, within a few months, you should by the end of the year be the co-author of approximately 160,000,000 first-class papers. Not bad going--Eh!

Nature, May 5, 1972

SLAC Beam Line (Bin 80)
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Stanford University
P.O.Box 4349
Stanford, California 94305

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SLAC BOWLING LEAGUE ENDS SEASON

The SLAC mixed-four bowling league climaxed its 1974/75 season with a banquet on May 14 at Los Gatos Lodge. SLAC participants arrived in full regalia to enjoy an hour of conversation and cocktails, followed by a sumptuous dinner.

The mellow glow brought on dining, wining and congeniality was intensified when league President, Harvey Hukari, distributed the prize money to the team captains. Vice-President Mario Smalls then presented the awards and trophies to the league's "best." The *Smashers* won the first-place trophy, and congratulations are in order for the team's members: John Mark, Kathy Asher, Wes Asher and Howard Martin. The second-place team was the *Split Kickers*, with team members Dick Bierce, Rod Curry, Joan Hirigoyen and Paul Lee. The individual awards were presented to the following persons:

High Handicap Game
Women - Peg Brunk
Men - Dick Bierce

High Handicap Series
Women - Leslie Brunk
Men - Frank Karas

High Average
Women - Leslie Brunk
Men - Gordon Ratliff

Most Improved Bowler
Women - Pat Houghtaling
Men - Ed Logg

League Secretary Shirley Livingood made a special presentation to Frank Karas for his overall effort on behalf of the SLAC Mixed League for the 1974/75 season as well in years past. Frank has always done more than his share in carrying out the League's work.

Centerpiece decorations at the banquet were attractive African Violets, which were given as door prizes, with Anne Starks drawing the winner's names from a hat.

If anyone at SLAC is interested in joining the SLAC Mixed League for next season, please contact one of the elected officers:

President Mario Smalls x2784
Vice Pres. Frank Karas x2420
Sec.-Treas. Shirley Livengood x2338

The 1975/76 season will begin sometime in the fall, with bowling scheduled for 6:00 PM on Wednesday evenings. We hope to see you then for a bigger and better new season.

--Shirley Livengood

Beam Line Dist.													
	0-2	6-14	11-19	21-6	26-22	34-4	52-7	60-20	65-35	70-5	75-17	82-12	87-8	92-3
	1-15	7-2	12-8	22-13	27-3	40-65	53-42	61-21	66-16	71-56	78-24	83-9	88-27	94-12
	2-8	8-4	14-4	23-12	30-41	45-7	54-30	62-47	67-12	72-3	79-85	84-20	89-20	95-37
	3-6	9-3	15-4	24-7	31-7	50-25	55-31	63-19	68-10	73-13	80-8	85-20	90-3	96-15
	4-5	10-9	20-20	25-3	33-17	51-30	56-10	64-15	69-23	74-8	81-50	86-11	91-6	97-88