

FERMILAB EXPERIMENTS IN PERSPECTIVE

Three teams of FermiLab experimenters reported at the recent XVII International Conference on High Energy Physics in London, England on the significant and surprising results they have observed in the experimental work they have done at the FermiLab. Representatives of Neutrino Experiment #1A in the Neutrino Area, Lepton Experiment #70 and Particle Search Experiment #100 in the Proton Area, described the phenomena observed in their experiments. The results are interesting not only because they bring to light new processes in the nucleus of the atom, but also because the three experimental groups, working independently, have observed similar new effects as they have used the higher energies now available with the FermiLab accelerator.



...Robert March...

More than 70 papers reporting other experimental results from the FermiLab were given at the London meeting. The occasion of the conference provides an exciting opportunity to view the state of high energy physics as it is unfolding with the use of new machines.

Dr. Robert March, professor of physics at the University of Wisconsin, and the prize-winning author of the book, "Physics for Poets," is a member of a research team carrying on an experiment in the FermiLab Meson Area. He is a frequent visitor to the Laboratory. He has recently written an article about the new results and the perspective in which the new FermiLab experiments can be viewed. The article is reproduced on page two of this VILLAGE CRIER to give the staff at FermiLab and friends a layman's insight into the current state of the art in high energy physics. Dr. March says in his article, "Like most scientific surprises, these new discoveries offer a hope as well as a puzzle. This hope is one long cherished by physicists -- to explain the nature of matter in terms of one kind of substance ruled by one kind of force. The last time anything like this happened in physics was over 100 years ago, and it led to the discovery of radio and TV.

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TO ALL FERMILAB EMPLOYEES

On a trial basis, the FermiLab will provide taxi service for official on-site travel beginning Monday, July 22, 1974. Service will be provided from 8:00 a.m to 11:30 a.m. and from 1:30 p.m. to 5:00 p.m. by a single taxi. The present bus service will continue to be available during the lunch period (11:30 a.m. to 1:30 p.m.).

To arrange for service, call the Dispatcher on Ext. 3831 and give your name, designated pickup point and destination. Pickup and delivery points are at the main entrances to buildings. Service should be requested when you are ready to leave. If the taxi is available at your building, service will be provided to you without your having to contact the Dispatcher. The following provisions apply to the new service:

1. Pickup will usually be made within ten (10) minutes after the Dispatcher receives a request.
2. Point-to-point service as posted will be the general rule; taxi drivers are allowed to wait for three (3) minutes for a passenger - beyond that you should repeat your request.
3. The taxi service is intended only for normal business use, not to meet car pools or for other personal reasons. All trips will be subject to combination and special routing as operations may require.

Your constructive comments or suggestions may be addressed to John Colson, Ext. 3470.

A series of unexpected discoveries over the past six months has shaken one of the most basic rules of the microworld of particles that make up the atom. The rule that has been called into doubt is one that divides the subatomic world into two classes of unrelated particles.

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The latest find in the series comes from the Fermi National Accelerator Laboratory (FermiLab) in Batavia, Illinois. It was presented on July 3rd at an international conference of particle physicists in London, England, by three teams of researchers.

The three research teams, each working independently in separate experiments, have observed electrons and electron-like particles called muons emerging from collisions of fast-moving protons with atomic nuclei. Members of the teams include physicists from Columbia, Harvard and Princeton universities, the universities of Wisconsin and Chicago, as well as members of the FermiLab staff. The reverse of the process they observed - the production of nuclear particles in electron collisions - was observed in December, 1973, by physicists at the Stanford Linear Accelerator Center (SLAC) in Woodside, California.

Transformations of this sort were expected to be very rare, because nuclear particles belong to one class of subatomic particles, known collectively as "hadrons," while electrons and muons belong to a separate class known as "leptons."

The separation of subnuclear particles into two classes has been recognized since the early 1930's. The basis for the distinction is the existence of three seemingly unrelated forces that operate on the nuclear level.

One of these forces is electromagnetism, an old friend that has been studied for over 200 years. It appears in many guises, from the lightning of a thunderstorm, the electricity that powers so many appliances, to radio waves and light. The other two are less well known, for they can be observed only in nuclear experiments. They bear names that testify as to just how little is known about them. One is called the "strong force," because inside nuclei, it is about ten times stronger than electromagnetism. It is this force that holds the nucleus together. The other, called the "weak force," is about a million times more feeble. It is responsible for the disintegration of some radioactive nuclei or unstable subnuclear particles.

Hadrons are particles which are sensitive to all three forces. Leptons are particles which have so far proved immune to the strong force.

Because of this immunity, electromagnetism is the strongest force that can transform leptons to hadrons, or vice-versa. But in the FermiLab experiments, such transformations have been found to happen about once in every thousand collisions, which is about ten times as often as expected if the only force involved is electromagnetism. In the SLAC experiments, the reverse process occurs too often by about the same factor.

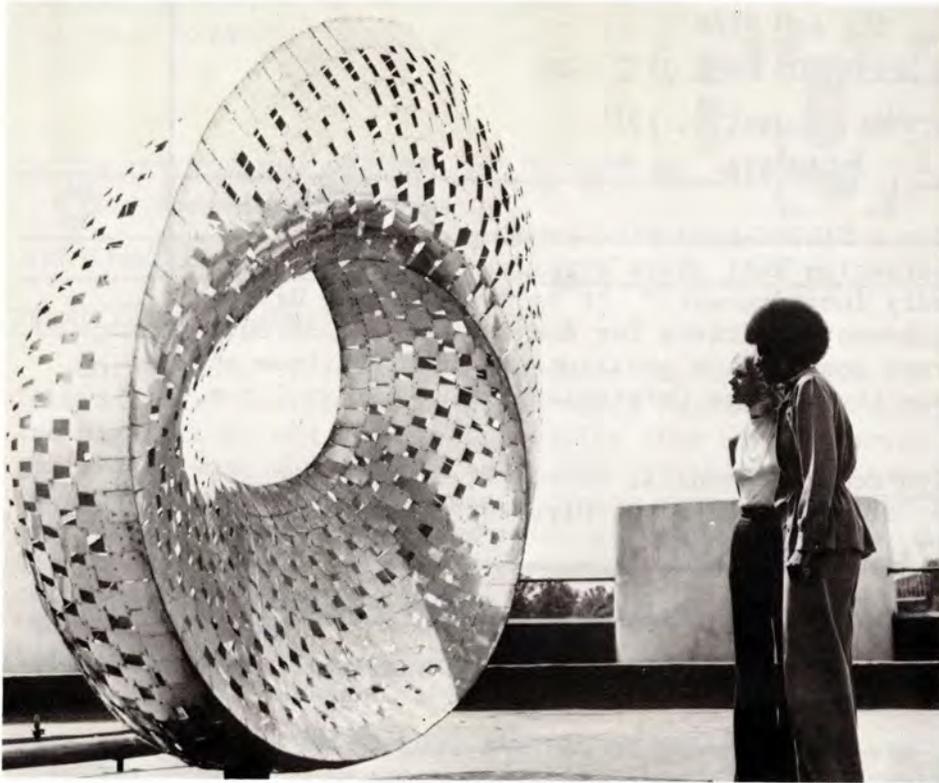
What distinguishes these experiments from earlier ones, in which such transformations were less frequent, is that the particles involved in the new experiments carry far more energy. This gives rise to hopes that, given enough energy, leptons can perhaps respond to the strong force, which in turn suggests that the three basic forces may not be so different, after all, and that all forms of matter are pretty much the same.

The weak and electromagnetic forces have long been known to have a great deal in common, enough to suggest that they may be two different versions of a single force. Uniting two forces into one involves finding a single set of formulas that apply equally well to both. The whole program of experiments in the FermiLab neutrino beams is directed to this task. In the past five years, enough progress has been made to suggest that formulas combining the weak and electromagnetic forces are close at hand. The new experiments suggest that the efforts to find them may have been too modest. Perhaps, what is really called for is single theory that encompasses all three forces.

Would this theory merely be a mathematical trick, or would something practical come of it? It is far too early for anyone to say. But if history is any guide, the practical "fall out" could be enormous. In 1873, a young British physicist named James Clerk Maxwell produced the theory that showed the connections between electricity, magnetism, and light. Though Maxwell won immediate fame through this feat, many physicists felt that his theory really said little that was new about the three phenomena he had united under one banner. But the theory soon led to the discovery of radio waves, and also to Einstein's theory of relativity. Only a generation after he published his theory, long-distance communication had been revolutionized. Now, 100 years later, it appears that a modern version of Maxwell's theory may be able to account for subnuclear forces. It is not surprising that physicists are excited by the prospect of a once-in-a-century breakthrough.

Before any new revolution can happen, however, it must be established beyond the shadow of a doubt that no old theory can explain the new results. Any scientist working at the frontiers of human knowledge is obliged to be a little like Columbus, who did not immediately realize that he had discovered a new world. Instead, he merely claimed to have found a shorter route to India. It took many voyages of discovery before the true facts were known. This is why the continent we live on bears the name "America" rather than "Columbia."

Further experiments must be conducted before physicists can be absolutely sure that the old rules can not be stretched to cover the new results. More accurate measurements of the rate at which the particles are produced are required, as well as careful studies of how the effect changes with the energy of the particles. Only then can physicists be sure they have "landed in a new world."



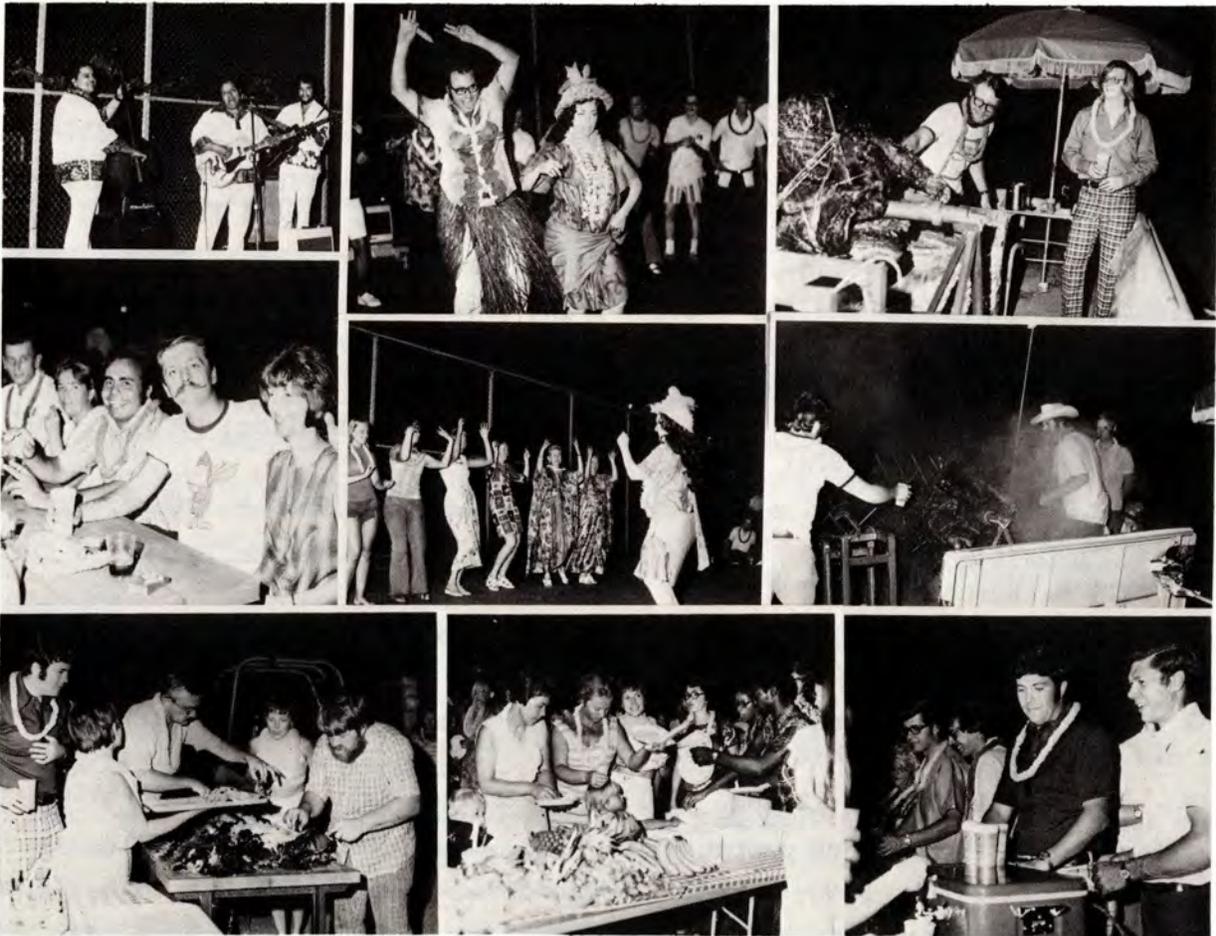
...Standing in the center of the roof-top patio of the FermiLab Auditorium Building is this stainless steel sculpture by Robert R. Wilson, Director of the Laboratory. Dr. Wilson completed the giant Möbius band in the months before the dedication of the Laboratory and presented the sculpture to the Laboratory as a gift. It is built of 3" x 5" stainless steel "cards," spot welded on a stainless steel form. It is almost seven feet in diameter and weighs about 350 pounds. Dr. Wilson has also cast the Möbius band in bronze and made a smaller version in marble.

Dr. Wilson studied sculpture in the United States and in Italy. He has had two showings of his sculpture in Ithaca, New York where he served as director of Cornell University's Laboratory of Nuclear Studies before coming to Batavia, Illinois, to direct the construction of the FermiLab. Dr. Wilson was commissioned to make a large sculpture for the Institute of Advanced Studies at Princeton, N.J. and another for the Festival Theatre in Ithaca.

...Viewing the sculpture in the photo at left are Janet Raboine (L) and Joyce Curry, both of Personnel Services...

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FERMILAB LUAU, JULY, 1974



SEE AND HEAR
PRESERVATION HALL JAZZ BAND
Thursday, August 1, 1974
RAVINIA

Tickets are now on sale for a NALREC-sponsored evening of jazz at Ravinia, Highland Park. Preservation Hall plays original New Orleans Jazz - "the real article, uninhibitedly incandescent." It is Preservation Hall's fifth consecutive Ravinia engagement. Tickets for the evening are \$8.00 each, including a \$6.00 reserved seat in the pavilion and bus fare from the Laboratory. The bus will leave the Village Cafeteria parking lot at 7 p.m. for the 8:30 p.m. concert.

Buy your tickets from Helen Ecker, Technical Services, 5th floor east, Central Laboratory, Ext. 3393, or Nancy Stiening, Directors Office, 2nd floor east, Central Laboratory, Ext. 3031.

CLASSIFIED ADS

"Happy Hour, Wednesday, July 24, Village Barn, 5:15 p.m."

FOR RENT - A 1 bdrm. apt., carpets, drapes, air cond, close to Lab. Available about August 1st. Call Bob Savit, Ext. 3751 or 898-0803 evenings.

FOR SALE - 1974 LTD Brougham, pwr/s/b, air cond., AM/FM stereo w/8 trk. tape player, vinyl roof, metallic brown, take over pmts; parts for 396 engine and a 289 engine and transmission. Call Don Staley, Ext. 3575 or 859-1742.

FOR SALE - 1970 Plymouth Sport Fury, air cond., pwr/s/b, \$1200; TO GIVE AWAY - 4 puppies of mixed breed, medium size. Call Marie Nelson, Ext. 3554 or 898-9472.

FOR SALE - 2 Sears studded snow tires; 1 Sears FM radio w/8 trk. stereo & 2 spkrs.; 1970 Suzuki 250CC motorcycle, \$450; 1974 Dodge Van Sportsman Royal, \$4800. Call Ernie, Ext. 3210.

FOR SALE - 1965 Dodge V-8, new/tires/muf., gd. runner-\$200 or best offer. Call Gregory Lawrence, Ext. 3677.

FOR SALE - Classic 1958 Chevy, 2 door yeoman wagon, excel. Cond., \$750. Call Dave Jones, Ext. 3149 or 695-5972 after 5 p.m.

FOR SALE - Home grown beets, HINES FARM, 1st farm south of Rt. 56 on Eola Rd., 357-3847.

FOR SALE - 1970 'Cuda convertible, white, best offer; SITUATION WANTED - English girl desires au pair position for one or two months, has work permit. Call J. Sauer, Ext. 4125 or 968-5932.

FOR SALE - '71 CL350 Honda, gd. cond., \$500 or best offer. Call Don, Ext. 3886 or 879-2682.

FOR SALE - Baldwin Baby Grand Piano, 54", \$550; a white formica pedestal table w/5 bucket swivel chairs, \$90; bunk beds & mattresses, \$25; chest & desk-\$15; dresser & mirror-\$30; 1972 Honda, SL-70, \$325; an antique Chinese Rose medallion bowl, 13½", \$250. Call A. Streccius, Ext. 3580.

FOR SALE - Electrolux vacuum sweeper, \$25; Coal -- free for the hauling; WANTED - 20" bicycle rims. Call Leon Bartelson, Ext. 3701 or 892-7120.

FOR SALE - Electric G.E. range & db. oven, white, gd. cond, \$35. Call M. Storm, Ext. 4069.

FOR SALE - Bell & Howell movie camera w/zoom lens and super 8 projector, screen & light, used twice, \$125. Call K. Borneman, Ext. 3222 or 879-1844.

FATE UNKNOWN - 12 Dectapes w/labels JAM n and OLDF n. Please forward any information on these tapes to James MacLachlan, Ext. 3689.

FOR SALE - 2 Wilson Steel tennis rackets & covers, one w/male grip, the other, female grip, less than a year old, \$35 each. Call Mary Ann Fazio, Ext. 3324.

TO GIVE AWAY - a 4 mo. old female kitten. Call Peggy Price, Ext. 3252 or 896-6960.

FOR SALE - A 6 mo. old 21" Bradford portable TV, \$100. Call D.R. Getz, 968-6817.

FOR SALE - 1966 Ford Fairlane, \$190; window air conditioners - 15,000 BTU, \$75, 12,000 BTU, \$50. Call George Doddy, Ext. 3642.

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