

The Village Critic



fermi national accelerator laboratory

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EXPERIMENTAL GROUP ANNOUNCES NEUTRINO RESEARCH FINDING



...Fermilab Neutrino Experimental Area scores important research measurement...

A group of experimenters working at Fermilab announced recently that they have achieved the first direct measurement of the velocity of neutrinos. The experiment -- #254 -- was carried out on the Fermilab Neutrino experimental line.

The experimenters include J. Alspector and G. R. Kalbfleisch of the Brookhaven National Laboratory; Neil Baggett and Earle C. Fowler of Purdue University; B. C. Barish, A. Bodek, D. Buchholz, F. J. Sciulli, E. J. Siskind and L. Stutte of the California Institute of Technology; H. E. Fisk, G. Krafczyk and D. L. Nease of Fermilab, and Orrin D. Fackler of Rockefeller University. Fermilab staff members Jim Griffin, Leon Beverly, and Ray Stefanski have also contributed to the experiment.

E-#254 uses the 150-ton detector originally built for Experiment #21-A, one of the first experiments to be built at Fermilab. It is located in the "Wonder Building" adjacent to the Muon Area building, halfway down the Neutrino line.

In the Neutrino area protons coming from the accelerator strike a small metal target, creating secondary particles, pions and kaons, which are then focusing down a tube 1,200 feet long. In that tube other particles are produced, including muons and neutrinos. The particles then fly through an 1,800-ft. steel and dirt shield which removes nearly all of the particles except the neutrinos.

The experiment measures the length of time required for the neutrinos to speed from the target tube to detectors in the Wonder building at the end of the earth shield.

Dr. Earle Fowler, spokesman for the experiment, points out that until recently the longest flight path for such particles available in the United States was at the Brookhaven National Laboratory, about 200 feet. At Fermilab the flight path is equivalent to a quarter of a mile.

"Since you measure velocity by the time required to go from point A to point B, and

(Continued on Page 2)

NEUTRINO RESEARCH FINDING (Continued)

since electronic instruments have a practical limit for the shortest elapsed time that can be measured, the longer the path of the particle, the more the precise the measurement," Fowler observed. The experiment achieved an accuracy of five parts in ten thousand.

The experiment verifies that neutrinos move at the speed of light -- 186,000 miles a second. It is possible that more precise measurements in the future may show that the velocity of neutrinos is different from the speed of light.

The neutrino is a particle with little or no mass and without electrical charge. It interacts so weakly with matter that it can penetrate material about 1,000 times the thickness of the earth before an interaction occurs. The high energy available with the Fermilab accelerator produces neutrinos at unprecedented rates, permitting experiments such as this to study systematically the properties of this elusive particle for the first time.

Outside Fermilab, devices to study neutrinos have included such apparatus as the tank of perchloroethylene located 4,850 feet underground in the Homestake Gold Mine at Lead, South Dakota. Scientists observed there neutrinos passing through the earth that have originated deep inside the sun. Interactions on the order of less than a dozen a year were considered successful. At Fermilab the production of 1,000 neutrino events per week is not uncommon.

Neutrino velocity is only one aspect of the overall objectives of E-254. The group is studying many other elements of neutrino experiments including dimuon production. Gene Fisk explains, "This measurement leads to no surprises and was the expected result. On the other hand, with the energies achievable at Fermilab there might be something new and exciting. For example, if some of our data were due to interactions of a new very heavy neutrino-like particle, we would have observed a different time of flight spectrum.

"For us there is at least one practical application of the time of flight measurement which is related to studies of neutral current interactions. In our old neutral current data there are background interactions due to cosmic rays. Since the cosmic ray time spectrum is unrelated to the bunch structure of particles in the accelerator, it will be possible to directly remove cosmic ray events on the basis of their time of flight."

What is the importance of making such a precise measurement? "The history of physics," Fowler commented, "is that if there's something you haven't checked as precisely as possible, you'd better check it. If it has been determined that the mass of a neutrino is exactly zero, and that of a photon -- a particle of light -- is zero, and you find their velocities differ, then it means something's wrong...either the neutrino has a little mass or the theory is not exactly right.

"As it turned out -- as things stand now -- the mass of neutrinos is zero and Einstein's theory of special relativity is right. We will still need to pursue this farther, but in this test both the idea of the massless neutrino and Einstein's theory passed with flying colors."

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SCHEDULE CHANGE FOR WILSON ROAD GATE

Effective April 19, 1976 the schedule for the gate at the West Wilson Road entrance to the Laboratory will be as follows:

Monday - Friday: 6 a.m. to 8 p.m.

The gate will be closed all day Saturday and all day Sunday. Monday through Friday the gate will be closed for those hours not listed above. This policy will be in effect until further notice.

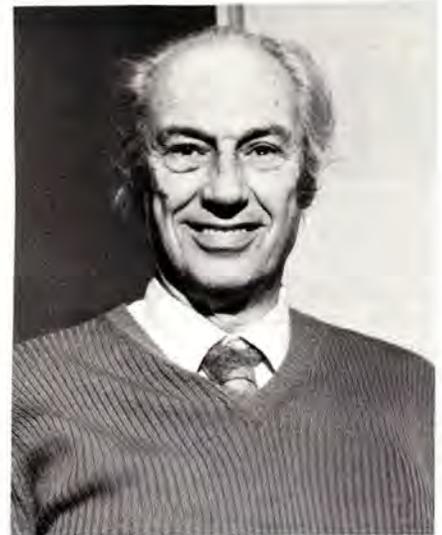
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...Detectors in Wonder Building (curved roof) record neutrino velocity...

ARTHUR ROBERTS HONORED FOR PIONEERING RESEARCH

Fermilab physicist Arthur Roberts has been honored by the New England Chapter of The Society of Nuclear Medicine for the role he played in the development of radioactive iodine for medical diagnostics. Dr. Roberts was a research associate at the Massachusetts Institute of Technology and, along with Bley D. Evans, participated in the pioneering research initiated by the late Dr. Saul Hertz in the late 30's and early 40's which established the usefulness of radioactive iodine in research in thyroid metabolism and the treatment of thyroid disease. Isolating the iodine isotope in their pioneering study, they found that when administered to rabbits the iodine could be detected in the thyroid gland just a few minutes later. Foreseeing this to be an important application of the results of their basic research they sought and obtained funds to build the cyclotron at MIT, completed in 1941 under the direction of M. Stanley Livingston for the production of the radioactive iodine.

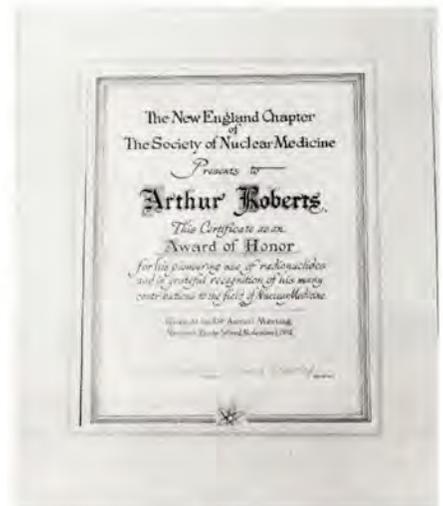


...Arthur Roberts...

As a consequence of this pioneering work and later follow-up studies, radioactive iodine is now routinely used as a tracer in the diagnosis of thyroid disorders. In larger quantities it is used to deliver radiation to the thyroid for the treatment of several types of thyroid disease, including cancer of the thyroid.

In 1942 Dr. Roberts moved to the MIT Radiation Laboratory where he worked on the development of microwave radar.

Important research is one of two lanes in Arthur Roberts' traffic pattern. At the same time that he studied for his master's degree in physics at Columbia University, he was a student at the Manhattan School of Music, majoring in piano, receiving degrees from both schools simultaneously in 1933. At this crossroad he chose physics, "when I realized that if I chose music, I would have to give up physics, but the music could go along with the physics," he points out. His Ph.D. in physics from New York University followed.



...Award of Honor...

Capturing a fellow Manhattan music student as his wife, Arthur (and now Janice, too) pursued their musical bent in Cambridge during the MIT years. In addition to his isotope work, Arthur taught at the New England Conservatory of Music and wrote his first two musicals.

In the years that followed, the Roberts, their research and their music moved from MIT to the State University of Iowa, to the University of Rochester, to the Argonne National Laboratory and the University of Chicago, and to Fermilab in 1967. Arthur's "Overture for the Dedication of a Nuclear Reactor," was performed by the Rochester Philharmonic. At the University of Chicago he also became interested in computer-produced music.

Recently, Dr. Roberts has been involved in another piece of unusual research, this time a study of the possibility of using the ocean as a giant detector of neutrinos. He told a Fermilab seminar recently that devices located five kilometers down in the ocean may prove useful as detectors for neutrinos with energies ten to a hundred times higher than that of Fermilab neutrinos. Such a device might also detect supernova explosions in distant galaxies up to ten million light-years away where the neutrinos originated. The possibility of locating such a detector off the coast of Hawaii will be the subject of a workshop at the University of Hawaii next September, which he is leading.

Meanwhile, as one of the stars of "The Physical Revue" performed by physicists and physicist's wives at the April meeting of the American Physical Society in New York, Arthur joshed and spoofed the profession in what a New York Times reviewer called "a medley of staggering variety." He returned home in time to help Janice direct the Hyde Park group in their performance of the Gilbert and Sullivan operetta "The Gondoliers." It was their 17th joint musical production. They both agree that the camaraderie and the excitement of producing a musical keep them coming back for "just one more."

HUCKLEBERRY FINN AT FERMILAB APRIL 30

Chicago's Organic Theater will bring its internationally-acclaimed production -- "The Adventures of Huckleberry Finn" -- to the Auditorium of Fermilab on Friday, April 30, at 8:30 p.m. This is one of two plays chosen for a Bicentennial Tour of Illinois under the sponsorship of the Illinois Arts Council, with the help of the National Endowment for the Arts.

"Huck Finn" was the recipient of two Joseph Jefferson awards -- Best New Play and Best Director. It was the smash hit of the 1975 Chicago theater season, and went on to a triumphant six-week tour of Europe.

The Organic Theater's version of "Huck Finn" is the first completely faithful stage version of the Mark Twain novel of the same name. In fact, it uses only Twain's words for its dialog. Huckleberry Finn, his friend Tom Sawyer, and their mutual slave friend Jim are American classics. Director Stuart Gordon comments, "Twain's story is America, for good and not so good. It is the young facing a scary and prejudiced world. It's a story about growing up in America, about the conditioning of children, about freedom. It presents the same kinds of problems we have now."

The Organic Theater's production relies heavily on the talents of its seven cast members who portray over 300 characters. They embody such things as the flow of the river and the atmosphere of the towns, for there are virtually no sets or props.

A special dinner will be served at 6 p.m. in the Atrium Cafeteria before the performance. The cost of the dinner is \$4.50, including wine. Reservations are necessary. Tickets for the show are \$3.00 for adults; students, senior citizens, \$2.00. Reservations and tickets are available in the Guest Office, CL-1W.

NOTE: The Fermilab Cafeteria will offer regular dinner service from 5-6 p.m. only on Friday, April 30, before the special dinner-theater event.

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COMING EVENTS AT FERMILAB

...NALREC Happy Hour - Thursday, April 22 - 5-7 p.m. in the Village Barn.

...Cookout at the Users Center - Wednesday, April 28 - beginning at 6 p.m. - T-bone steak, salad, French bread - \$4.75 per person. Call S. Rumpel, Ext. 3524, or Jane Theis, Ext. 3126 for reservations.

...Pool passes are now on sale at the Cashier's Desk, CL-4E.

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ATTENTION GOLF TEAM CAPTAINS - If you did not pick up your schedules and rules at the Friday League meeting, you will have to contact Ellery Cook at Ext. 3734. The League needs one more golfer for Thursday night. If you are interested sign up with Ellery, Ext. 3734.

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CONGRATULATIONS... to Chuck (Site Operations) and Lyn Johnson of [REDACTED]

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WANTED - Contestants & audience for Great Amer. Male Beauty Pageant, DuPage & Aurora N.O.W. sponsor, Sat., Apr. 24, 2:30 p.m., Holiday Inn, Roosevelt & Finley Rds., Glen Ellyn. Entry blanks or tickets from Judy Mueller, X3936, Anne Burwell, X3028 or Pam Perkins, X3284.

LAS VEGAS NIGHT - Bingo & other Las Vegas games, Sat., Apr. 24, 7 p.m. to midnight, Batavia V.F.W. Hall-So. Rte. 25, souvenir adm. tickets \$1. Call H. Van Leesten, Ext. 3977.

SUBLEASE - 1 bedroom corner apt., gas, water, draperies, cent. AC, dishwasher, carpeting, The Lakeside, Lisle. Avail. end of June, \$240/mo. Call K. Kaczar, Ext. 3251/3316.



...Jim tells Huck's fortune with a hairball in Twain's "Adventures of Huckleberry Finn"...