the Bulletin Board

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NEW TYPE OF NEUTRINO DISCOVERED IN COLUMBIA-BROOKHAVEN EXPERIMENT AT AGS

DR. VICTOR P. BOND SUCCEEDS DR. LEE E. FARR

VICTOR P. BOND

LEE E. FARR

Dr. Maurice Goldhaber has recently announced the appointment of Dr. Victor P. Bond as Chairman of the Medical Department, to succeed Dr. L.E. Farr.

Dr. Bond joined the Brookhaven staff in 1953 as Physician in the Medical Department, becoming a Senior Scientist in 1958. Dr. Bond received a M.D. in 1945 and a Ph.D. in biophysics in 1951, both at the University of California. Dr. Bond came to BNL from the U.S. Navy Radiological Defense Laboratory in California where he was Head of the Experimental Pathology Branch.

Dr. Bond's research at Brookhaven has been primarily in the fields of radiation effects in mammals and in the kinetics of cell proliferation. In 1956, he represented the medical sciences on a study team, initiated by the Department of State and organized by Brookhaven National Laboratory, to survey many of the Asian nations, with a view to the establishment of a regional cooperative nuclear research and training center in the Far East.

Dr. Lee E. Farr has resigned as Chairman of the Brookhaven Medical Department, which he has headed since 1949, to assume the newly created Chair of Nuclear Medicine at the M.D. Anderson Hospital and Tumor Institute, University of Texas, Houston, Texas.

Before accepting his appointment at Brookhaven, Dr. Farr was Director of Research and Physician-in-Chief of the Alfred I. duPont Institute of the Nemours Foundation in Wilmington, Delaware. He received B.S. and M.D. degrees from Yale University, and post-graduate training at New Haven Hospital. From 1934 until 1940, he was with the Rockefeller Institute and in 1940 he received one of the two Mead Johnson awards of the American Academy of Pediatrics for research on children with nephrosis. His experimental work has dealt with the studies of the nature of Bright's disease and, in particular, metabolism of protein and amino acids. Dr. Farr's main fields of research are now concerned with nuclear medicine.

A group of scientists from Columbia University and BNL, working at the AGS, has discovered that there exist in nature two different types of neutrinos. The only apparent difference between them is that one will produce negative mumesons (muons), where the other produces electrons. For each of these two types of neutrinos there is a corresponding type of anti-neutrino.

The research team that has demonstrated this dichotomy among the neutrinos includes Professors L. Lederman, M. Schwartz, and J. Steinberger of Columbia; Dr. G. Danby of Brookhaven; and J.M. Gaillard, C. Goulianos and N. Mistry of Columbia.

The neutrino, whose existence was first proposed by W. Pauli and E. Fermi some thirty years ago, has proved to be a most elusive particle. Having a rest mass of zero and no electrical charge, it has been extremely difficult to detect. Its existence was originally proposed to account for an apparent violation of the laws of energy conservation in the spontaneous beta-decay of some nuclei, in which an electron or a positron is emitted. The total energy observed after decay did not equal the energy present before decay. A careful study of these decays indicated that the conservation laws would be observed if a particle of zero rest mass was emitted in the decay, along with the electron or positron.

The particle emitted along with the electron was named the anti-neutrino, while the particle emitted with the positron was named the neutrino. It has since been shown that the neutrino and anti-neutrino are different particles, and that their assignment to positron and electron always holds in beta-decay. The reason for the elusiveness of these two particles lies in the nature of their interactions with other elementary particles. They participate only in what are termed the weak interactions. For example, a neutrino from a typical beta-decay could pass on the average through 10^{14} miles of iron before interacting. Thus, its detection is a formidable problem, and it was not until 1955

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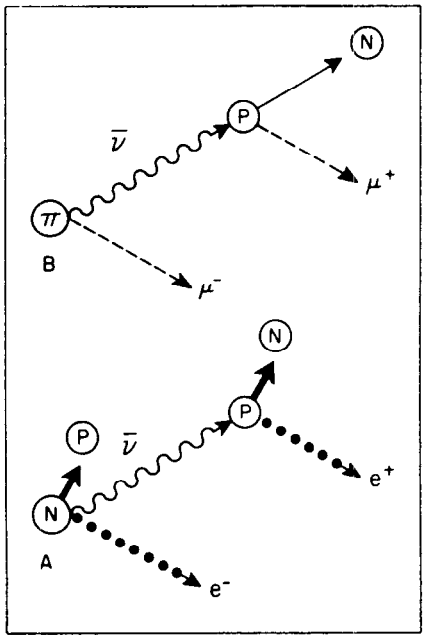
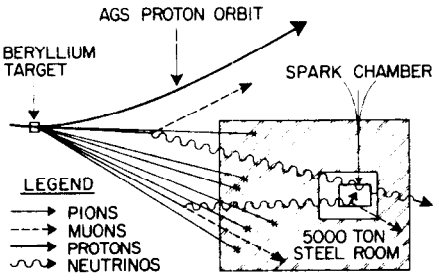
NEUTRINO—(Continued)





Above: Schematic of the experimental arrangement at the AGS. A small fraction of the pions radiating from the bombarded target decay into muons and neutrinos. The neutrinos penetrate the 42-foot steel shield.

Left: Schematic diagram indicating the birth of an anti-neutrino together with an electron in the decay of the neutron (A), and the birth of the anti-neutrino together with a mu-meson (B). The experiment shows that the electron-type neutrino prouduces only electrons (positively charged), and the mu-meson type neutrino produces only mu-mesons in the collisions with protons.

that a Los Alamos group was first able to observe the effects of such an interaction. In this instance, the interactions of anti-neutrinos coming from the sponaneous decay of radioactive nuclei produced in a reactor were detected.

Some fifteen years ago, the pi-meson (pion) was first observed, and was found to decay spontaneously into a muon and another unseen particle. Careful study of the decay of the positive pion led to the discovery that the unseen particle accompanying the positive muon had all the properties of the neutrino. Similarly, the unseen particle accompanying the negative muon in the decay of the negative pion had all the properties of the anti-neutrino. Consequently, it was assumed that these particles were the same as those present in beta-decay. In fact, one of the important characteristics of the weak interactions is the presence of a neutrino whenever a muon or an electron is involved in such an interaction.

If, however, the muon and electron were both connected with the same type of neutrino, then one might expect in some cases that a muon would decay spontaneously into an electron and a gamma ray, although normally it decays into an electron, a neutrino, and an anti-neutrino. This alternative decay mode was expected to occur once for about every ten thousand normal decays. However, experiments involving about 100 million normal decays revealed no such result. G. Feinberg and others explained this phenomenon by suggesting that the neutrinos coupled to muons are not of the same type as the neutrinos that are coupled to electrons.

To test this hypothesis, an experiment was proposed in which a sample of neutrinos or anti-neutrinos coupled to muons, such as those from the normal decay of pions, would be allowed to impinge on a target. If they were the same as those involved in beta-decay, they would produce as many electrons as they produced muons. If not the same, then they could produce muons only.

The Columbia-Brookhaven group has just completed such an experiment. This experiment was made feasible by the fact that high energy neutrinos interact more strongly than those of low energy. For example, a 1-Bev neutrino will pass through an average of only 10^8 miles of iron before interacting. Thus, if 10^7 neutrinos per second passed through a ten-ton detector, there should be one neutrino interaction per day.

In the experiment at Brookhaven, pions produced by the AGS were allowed to travel about seventy feet before striking a shielding wall. About 10 per cent of these pions decay during this interval. The shielding wall is 42 feet thick and consists of about 5,000 tons of iron, in the form of old battleship plates. This wall is sufficiently thick to stop all particles except the neutrinos, which pass through with ease. On the further side of the shielding wall, in a room well shielded from outside radiation, is installed a ten-ton spark chamber. This device will show a trail of sparks along the path of a charged particle traveling within it. The interaction of a neutrino would be indicated by the trail of either a muon or an electron starting within the chamber. The aim of the experiment was to detect these neutrino-induced tracks, which should occur several times per day, and to determine how often they were due to electrons as against how often to muons.

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Arrivals and Departures

WELCOME TO BNL

BIOLOGY
William S. Hillman Ext. 2259
MEDICAL
Donald H. Clifford 301-83
Max W. Hess 301
PHYSICS
Jerry K. Andritz 686
Roger A. Galvin
James R. Sanford 2663
Thomas J. Ypsilantis 2616

LEAVING BNL

BIOLOGY
Eric C. Gaetjens
COSMOTRON
Patricia Benkenstein
MEDICAL
Abbas Alaghemand
William Clode
Frank Dunn
David Price
NUCLEAR ENGINEERING
Grace Schwaner
PHYSICS
Maurice J. Cotter
James Niederer
Judith N. Reidl
PLANT MAINTENANCE
Paul Temme
SUPPLY & MATERIEL
Albert Ralph

TENNIS TOURNAMENT

Entries for the 1962 BNL Tennis Tournament have been coming in for the past week. They will be accepted to Thursday, July 12. The entry fee is $.50 per participant. Applications are available at the Recreation Office.

FOLK DANCING

There will be folk dancing every Monday evening at 8:00 p.m. at the Recreation Hall.

TICKETS

Westbury Music Fair tickets are still being sold at the Recreation Office, 3 Center Street between 12:00 and 2 p.m., Monday, Wednesday and Friday. **Discounts** are available for the Sunday, Tuesday, Wednesday and **Saturday 5:00 p.m.** performances. **Full price** for Thursday, Friday and **Saturday 9:30 p.m.** Reservations must be made at least four days in advance to insure getting the date and price range desired.

Discount coupons are also available for the Mineola Playhouse and Jones Beach Marine Theatre's "Paradise Island."

BERA FILM SERIES

"GOLDEN DEMON"

MON., JULY 9 8:30 P.M. LECTURE HALL

The film is based on the novel "Golden Demon" by Koyo Okaki, a story of middle-class life in Japan at the turn of the century. The theme is a tale of young love made sordid by money, the "golden demon", and the tragic consequences. The novel has attained the status of a modern classic in Japan. Its fame is such that the names Miya and Kanichi are household words meaning separated lovers, and the "17th of January," when the lovers were parted, signifies any tragic anniversary.

BRIDGE

Harold Schwarz starred in the most exciting hand of the Individual Tournament. The contract was 3NT.

N. (Czapski)
S. 10 9 2
H. A 3
D. 10 7
C. A J 10 9 7 3

W (Wagner)	**E** (Schermer)
S. K Q J 7 6	S. 5 3
H. K J 10 5	H. 8 6 4
D. J 8 6 5	D. 9 4 3
C. ——	C. Q 8 6 5 2

S (Schwarz)
S. A 8 4
H. Q 9 7 2
D. A K Q 2
C. K 4

Harold properly ducked the spade king opening. At this point, Sandy Wagner made the killing (or so it would seem) switch by leading his king of hearts. Declarer won and passed the jack of clubs. After getting the bad news of the 5-0 club break, and after mumbling some remark indicating uncertainty of his left-hand opponent's parentage, Harold passed a heart, ducked the spade queen return, and then won the spade continuation. He cashed the heart queen and the three top diamonds. Dummy now held just the A, 10, 9 of clubs and Bob Schermer, the Q, 8, 6. Declarer overtook his king of clubs with the ace, and endplayed Bob by leading the 10 to the queen. The forced club return to dummy's 9 was the game-going trick.

Attention Summer Students. The next game is July 5, at 7:45 p.m., in the Recreation Hall. Everyone is invited.

ANNOUNCEMENT

The optician will not be at Building T-100 on August 16 and 20.

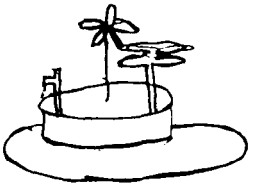
OPERATION GET-TOGETHER NO. 5 IS COMING

Tickets are now on sale for OPERATION GET-TOGETHER NO. 5. Remember Saturday, July 28, 1:00 p.m. to 9:00 p.m., is the day. Everyone has been working hard to plan a day that will provide a wonderful time for all. Don't tell anyone we told you, but here is a sneak preview of just a few of the attractions we have planned for you.

CLOWN ACT

One of the greatest professional clown acts will perform for your pleasure. There will be two big shows during the day. The kids will love it when the clowns roam the picnic area for a personal hello.

WHAT'S IN A HAT?



Come to the picnic wearing the craziest hat you can think of. You many walk off with the exciting first prize in the Crazy Hat Contest. The crazier, the better. Applicants are to report to the bandstand at 4:30 p.m. on the day of the picnic for judging.

DAY CRAWLERS

If you are a baby in the crawling stage (or have one or can get one by July 28) you are eligible for BNL's first annual Diaper Derby. This exciting race will be held at approximately 3:15 p.m., and all babies who can crawl are eligible. Start rehearsing junior now and may the best tot win!

WAY OUT

Here's one for everyone to try. At 6:00 p.m. on the day of the picnic, judging will start for the Out of This World Contest. So see what you can dream up, the madder, the better. Come wearing whatever you think is "out of this world." See how ridiculous **you** can get. Exercise your imagination and, who knows, you may even win the fabulous first prize.

And, of course, there will be many other contests, games and prizes. There's music and dancing to five bands, shows, cartoons, rides, sports, and plenty of delicious food and beer. And don't forget the Miss BNL contest. Enter your candidate **now.**

THANK YOU, BERA

Thank you, BERA, for sponsoring OPERATION GET-TOGETHER again this year; and thank you, BERA Executive Board, for leading the volunteer workers. Let's all pitch in and help. If your department is called upon, please lend a helping hand. Any department that would like to volunteer its services to help at the picnic, please call D. David, Ext. 686, or G. Sabine, Ext. 391.

APPLICATION FOR MISS BNL 1962

Name of Applicant.....

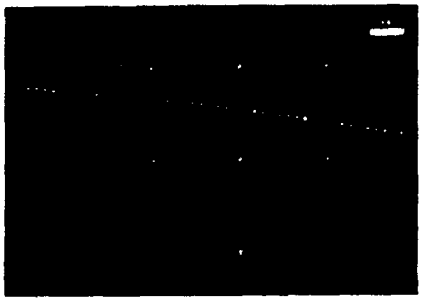
Department.....

Sponsor (if any).....

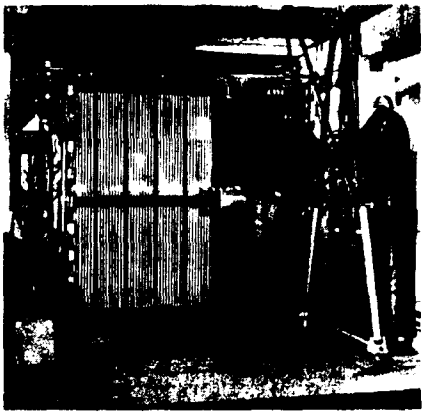
Title of Applicant.....

Signature of Applicant.....

NEUTRINO—Cont'd.



Photograph of a neutrino collision in the 10-ton aluminum spark chamber. The spark tracks show a long straight mu-meson created by an incident neutrino. Another track is also seen to point towards the origin of the event. This is thought to be a gamma-ray.



Spark chamber assembly in the shielded room before being closed in.

Since early this year, 100 trillion neutrinos have passed through the spark chamber. Fifty of these neutrinos have interacted in the chamber, to produce energetic events. Of these fifty interactions, twenty-four show only a single energetic muon being produced, while the remainder show muons being produced along with other particles. In no case was a single energetic electron produced.

Thus, it has been demonstrated conclusively that the neutrinos resulting from the decay of pions are different from those produced in beta-decay. It is therefore no longer adequate to speak of the neutrino; it must be designated as either a muon-type neutrino or an electron-type neutrino.

CLASSIFIED ADS

FOR SALE

1960 COMET - 4 dr. station wagon, r&h, std. shift, reasonable. L. Baker, Ext. 591

1955 CHEVROLET - Belair, r&h. $295. AT 6-9519.

1955 PLYMOUTH - New motor job last January, good cond. $250. firm. Joyce Smith, Ext. 578 or AN 5-7586 after 6:00 p.m.

1962 RAMBLER - Blue, American convertible, perfect cond., 4,000 miles. Purchased one month ago for $2700. Best offer over $2100. EA 4-0179-W.

1948 DODGE - Good cond., must be seen to be appreciated. Best offer over $75. J. Faust, Ext. 2474 or 2255.

1952 ENGLISH FORD - Good operating cond., leather interior, r&h, windshield washer, 4 good tires. Asking $160. Mike Rothbart, Ext. 680 or 2208.

1953 PLYMOUTH - Coupe, good running cond., needs muffler, $65. Ext. 2597 or HR 3-5025. H. Hildebrand.

1953 OLDSMOBILE - Best offer. Ext. 2351 or SH 4-5046 after 6:00 p.m. A. Campo.

1959 OPEL - Low mileage, snow tires. L. Barlow, Ext. 301-3.

1949 BUICK - Will give good trans., very reasonable. Eleanor, Ext. 2192, or JU 8-3925.

1956 CHEVROLET - 6 cyl., 2 door, good cond. Owner leaving country. Must sell this week. Priced to go at $375. Lenny, Ext. 2149.

1958 OPEL - Excl. cond., low mileage. Owner leaving country, must sell. $595. J. Oosting, Ext. 2543 or AT 6-0408.

HOUSE - 7 rooms on wooded ½ acre in Shoridge Hills. Large livingroom, 3 bedrooms, 1½ baths, stone fireplace, playroom, dishwasher and many extras. Private baech rights. $18,500. SH 4-9877 evenings.

HOUSE - English Tudor, 10 rooms, 3½ baths, 2 car garage, studio apt. 103 ft. river frontage, view of bay. Blue Point. N. Elliott, EM 3-9548.

HOUSE - 5 rooms, 2 baths, finished cellar. Gas, hot water heat, 3 track combination screens and storm windows. Wall to wall carpeting. Attached 1 car garage, landscaped plot 100'x207'. Walking distance to schools, village and RR. Owner leaving state. E. Elliott, GR 5-5549 after 5:30 p.m.

HOUSE - Lovely white Colonial home on .8 acre rolling wooded property in village of Shoreham ½ block from private beach. Living room with fireplace, dining room, den 3 bedrooms, 1 full bath, 2 lavatories, porches, full basement with 5 rooms, washer dryer, dishwasher, refrigerator, Low taxes, $26,500. SHoreham 4-3667 after 6:00 p.m.

HOUSE - Commack. 3 bedroom ranch. 1½ bath, extra large kitchen, ½ acre fenced plot, patio and other extras. 4¾ GI mortgage. FO 8-8702.

OUTBOARD ENGINE - 1959 Lark elec. start, 35 hp long shaft, incl. controls and battery. Used one season, in fine cond. $275. JU 5-8322.

CABIN CRUISER - 28'x8'6". 92 hp Ace. Afloat and ready to go. $1500. C. Reed, Ext. 2182.

OUTBOARD MOTOR - Evinrude, 1½ hp, light weight. Good cond. $25. Ext. 2381.

SOCCER

A soccer game will be held on Thursday, July 12, at Field Two, following the softball game. After this week, the games will be held on Wednesday nights, same time and place.

CAMERA - Kodak Retina, $42. Nikon camera body, $62.50. Norwood exposure meter, $11.50, microfilm proj. lens (65mm f6.3) $12. Tripod for light duty, $1. Ed Zeidler, Ext. 339.

SEWING MACHINE - Wilcox, chain stitch, $15. Love seat with matching chair - perfect cond. $10. Mounted animals, assorted $3-5. Ext. 326 or AT 1-8253.

ELECTRIC LAWNMOWER - Scott rotary. 24" cut, excell. cond. $40. HR 3-3036.

FOR RENT

HOUSE - Rocky Point, 15 min. from Lab., 3 bedroom ranch, unfurnished, all elec. kitchen with built in dishwasher. Refrigerator and washing machine included. Largercorner fireplace with pleanty of firewood available, rights to private beach. Available Aug. 1. J. Reidl, SH 4-2822.

APARTMENT - In private home, new, 2 rooms, bath, all elec. kitchen. Private entrance, all utilities included. AT 6-8596 after 6:00 p.m.

APARTMENT - 5 rooms in Patchogue. $100 mo. incl. heat. Available September 1, 1962. GR 5-7651.

HOUSE - Furnished, in Center Moriches, 3 bedrooms, 1½ baths, fenced in garden, beach inlet 5 min. walk away. $110 per month. R. Nissen, Ext. 425 or AT 4-1568.

FURNISHED APARTMENT - All utilities, five minutes from shopping area. Business couple. HR 3-3043.

APARTMENT - 4½ rooms, 2 bedrooms, in Patchogue Garden Apartments. Available July 1. Rent: $128 mo. Sublease for one year or more. A. Schwarzschild, Ext. 797 or GR 5-1964.

APARTMENT - Newly furnished, 2 rooms, tiled bath, complete elec. kitchen. Private entrance, utilities included, East Patchogue. AT 6-8596 after 6:00 p.m.

ROOMS - 2 rooms and bath for rent July 1. Bellport. AT 6-1068 between 6:00 and 7:00 p.m.

FOUND

SUNGLASSES - Grey frame. Personnel Services, Ext. 2107.

MONEY - In apartment area laundry. Personnel Services, Ext. 2107.

BLACK FOUNTAIN PEN - Personnel Services, Ext. 2106.

BRACELET - Vari-colored stones and gold, in gym after dance. Marie Follenius. Ext. 301-107.

CAR KEYS - With religious medal. Personnel Services, Ext. 2107.

PEN - 3-way, silver pen-pencil wearever. Found in Research Library, Ext. 2294.

BRACELET - Found in gym after Hawaiian dance. Ext. 301-107.