

lished. The work continues, however, and they hope to publish something later in the year.

Feinberg and Goldhaber had suggested that if an electron in the K shell of an atom of iodine were to decay, then, even if the decay products could not be readily recorded (assuming the neutrino-antineutrino interaction), nevertheless the effect, of the atom's readjustment to the loss would be detectable in the form of characteristic gammas and Auger electrons. Goldhaber and der Mateosian looked for iodine K x rays and electron-decay gammas in a NaI (Tl) crystal. They accumulated a background spectrum for 6.5 hours in a shielded 4×5 in. crystal and assigned to electron decay all events within about 7 keV of a barium K x-ray calibration peak of 32.8 keV, the energy of x rays that would be associated with atomic readjustment due to loss of an electron. They deduced a limit on the electron lifetime in excess of 10^{18} years.

Moe and Reines also used a NaI (Tl) crystal and searched for 33-keV gammas and the gammas from gamma-neutrino decay of electrons. The latter, they calculated, should have an energy of 255 keV. They used a 3×3 -in. crystal, which was large enough to reabsorb 59% of all 255-keV photons born within it. The crystal sat between two pieces of Lucite; a photomultiplier tube was attached to the outside end of each piece of Lucite. The whole assembly was partially surrounded by triple-distilled mercury and encased in a Lucite tube. Scrupulous precautions were taken against radioactive contamination. The crystal assembly components were scrubbed with detergent and handled with clean rubber gloves. (Fingerprints from supposedly clean hands, it has been reported, can contribute 20 counts/min to background.) The whole was enclosed in iron shielding and set up 585 m underground in a mine of the Morton Salt Company.

The system was run at medium energy for 362 hours and at high energy for 25.4 hours. The resulting spectra, after subtraction of background, did not show any peaks at the two desired energies. Moe and

Reines made calculations based on the statistical fluctuations, which might have obscured the spectrum expected from electron decay, and concluded that the electron lifetime is greater than 2×10^{21} years for processes without photons among the decay products and greater than 4×10^{22} years for the gamma-neutrino process.

But the question still remains. If electrons do indeed decay, Feinberg and Goldhaber point out that a microscopic interaction many times weaker than the currently denominated "weak" interaction would have to be invoked to account for the process. The problem is also of cosmological significance if the lifetime is really not much greater than 4×10^{22} years. The disappearance of enough electrons (unaccompanied by proton disappearance) to cause a charge imbalance of two parts in 10^{18} can account for the expansion of the universe [R. A. Littleton and Herman Bondi, *Proc. Roy. Soc. (London)* **A252**, 313 (1959)].

Intermediate boson

A nucleon-nucleon experiment that sought but did not find the intermediate vector boson was reported at the January meeting of the American Physical Society. The experiment was performed at the Zero Gradient Synchrotron at Argonne National Laboratory by M. L. Good, R. Hartung, M. W. Peters and A. Subramian of the University of Wisconsin and R. C. Lamb, R. A. Lundy, T. B. Novey and D. D. Yovanovitch of Argonne.

Since the intermediate boson is postulated to be the particle that transmits the weak-interaction force, earlier attempts to find it centered on bombardments of matter by beams of neutrinos. Negative results of these experiments showed that the boson, if it exists, must be a very heavy particle. Multi-BeV protons in collision with a solid target possess the energy to produce heavy particles, and the Argonne experiment was designed in the hope that the intermediate boson might be one of the many varieties manufactured. Particles directly created in such an interaction move off in directions very close to that of the original proton beam. If the inter-

mediate boson were one of them, it would decay after a short time, producing muons as well as other particles. These muons would come off in directions oblique to the original beam, and so the actual experiment searched for muons at high angles to the beam. The muons that appeared, however, could all be explained as pion decay products, and the experimenters concluded that if the intermediate boson exists, it is too heavy to be made by 12-BeV protons.

Short notes

The research and advanced development division of the AVCO Corporation has received a one-year contract to measure, for the first time, the behavior of ions in the atmosphere at altitudes between 10 and 80 km. The US Army Ballistic Research Laboratories will support the work with \$150 000. Measurements will be made with instrumentation attached to a descending parachute. Hans Dolezalek will direct the work.

Massachusetts Institute of Technology's Lincoln Laboratories will use a new solar simulator for study of material degradation effects. The instrument, designed and manufactured by Aerospace Controls Corporation, will provide a light intensity of $1\frac{1}{2}$ solar constants (solar intensity at the earth is about one half solar constant). It employs a 30 000-watt xenon arc. According to the manufacturer, previous set-ups of this intensity required at least 10 5000-watt lamps.

The AVCO-Everett Research Laboratory is engaged in a program to demonstrate the feasibility of producing repeated, short-duration impulses of high-energy electric power with a magnetohydrodynamic generator. The project is an outgrowth of previous work that developed a self-excited, steady-state, rocket-driven MHD generator. That generator, called "Mark V", has achieved a dc output of 31.3 million watts gross and 23.6 net. The difference represents excitation energy for the generator's magnetic field. Mark V will be modified for the new experiment.