electrons pass through, a coaxial magnetic field constrains them to remain on the cylinder axis. Time of flight through the cylinder is measured for each electron. From the distribution of flight times, the experimenters determine the force acting on the electrons. To check whether this method really works, uniform fields have been deliberately introduced by sending electric currents vertically through the cylinder walls. Since the distribution changes by the expected magnitude with changes in the applied electric field, the method appears to be valid.

The experimenters reduced electric and magnetic forces in a variety of ways. Magnetic interactions were minimized by selecting electrons in their ground magnetic state. The apparatus was cooled to 4.2 K to reduce background gas pressure, minimize Johnson noise and allow persistent, superconducting magnets to guide the electrons.

Controversy has arisen over what electric forces act on the falling electron. Whatever electric field exists matters enormously; the force from an electron five meters from the test particle is greater than the gravitational pull of the earth. One would expect much larger contact-potential fields within the shielding tube due to fluctuations in contamination and in crystal grain structure. Though these seem not to show up in the experimental data, their absence disturbs some physicists. In addition, there is the question of how large an electric field would be caused in a tube with an ideal surface by the action of gravity on the electrons and nuclei of the metal.

Leonard I. Schiff and M. V. Barnhill[2] some time ago computed this electric field. They showed that if the nuclei can be treated as forming a rigid lattice, gravitational force on the electrons will produce a field in the tube that will just counteract the gravitational force on an electron in the bore—that is, a field of 6×10^{-13} V/cm. They conclude that effects due to nonrigidity of the lattice of nuclei would make only a minor modification in this figure. It is this compensation of gravity that the Stanford experiment appears to verify.

Taking a hint from space physics, though, A. J. Dessler, F. C. Michel, H. E. Rorschach and George T. Trammell[3] of Rice University recomputed the effect of lattice distortion and found an oppositely directed field about ten thousand times as large.

At the Washington meeting Conyers Herring (Bell Labs) argued that you can get a field of the order of that predicted by the Rice group with the Schiff–Barnhill methods if proper account is taken of surface stresses and elastic deformations. Thus the failure of the Witteborn–Fairbank experiment to observe such fields remains a puzzle.

—RHE

References

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Satellite Detects Gamma-Ray Glow from Center of Milky Way

An OSO (Orbiting Solar Observatory)-III experiment has seen cosmic rays with energies above 70 MeV coming from our galaxy. The gamma rays show a bright glow around the galactic equator with the brightest spot near the direction of the galactic center in the constellation of Sagittarius. William Kraushaar, George Clark and Gordon Garmire of MIT, who discussed their work at the dedication of the MIT Center for Space Research on 25 April, noted that their experiment is the first definite observation of a nonuniform gamma-ray brightness in the sky.

Reines Delves Deeper In His Search for Neutrinos

Frederick Reines, now dean of the School of Physical Sciences at the Irvine campus, University of California, has moved his neutrino-detection equipment to a deeper part of a South African salt mine. Three times as sensitive as it was before, it has moved down 47 meters to a depth of 3300 meters. Reines is running experiments at three different installations: the one in South Africa, another in a salt mine near Cleveland and a third near an AEC reactor in South Carolina. The effort is a collaboration among Irvine, Case Western Reserve (with M.F. Crouch and Robert Woods Jr) and the University of the Witwatersrand (with J.P.F. Sellschop). □

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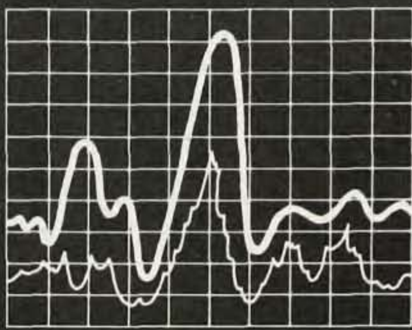

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