The Fermi Proton Effect

E. Fermi and his co-workers[1] have recently discovered the remarkable effect of proton containing substances in *increasing* the yield of artificial radioelements during neutron bombardment. We had an opportunity to study this effect and some of our results are communicated below.

A silver cup was irradiated for 15 minutes with neutrons, from a Be-tube with 200 mC Rn, (1) in air, (2) filled to the rim with pure water and (3) filled and surrounded with water. The increase in activity depends to a great extent on the geometry of irradiation. The dimensions in case 3 are shown in Fig. 1.

The emitted electrons were counted by means of a He-filled Geiger-Müller tube and a thyratron operated counter. The results are plotted on logarithmic paper, as given in Fig. 2.

Filling the cup with water increases the silver activity three-fold and by surrounding it with water the activity is still further increased by a factor of 3–4. This increase is also produced in about the same degree by *n*-pentane (n-C_5H_{12}), while the effect of carbon tetrachloride (CCl_4) and carbon disulfide (CS_2) is practically negligible.

The addition of 5 percent uranyl nitrate to the water reduces the effect of pure water, as does boric acid.[1] The introduction of an Al-cylinder of 0.03 mm wall thickness between source and cup has practically no effect.

This Fermi phenomenon was also observed with iodine and aluminum cylinders. One should expect the same effect with neutrons produced by artificially accelerated ions.

In agreement with Fermi and as expressed by one of us in discussions previously, we believe that as the neutrons loose their energy by collisions they are more and more easily captured by nuclei with the production of stable or radioactive isotopes. The protons of the water absorb the energy of the neutrons by elastic collisions and the probability of capture of neutrons by protons (deutons will be investigated) is evidently small, since a large quantity of neutrons are reflected backwards (see case 3).

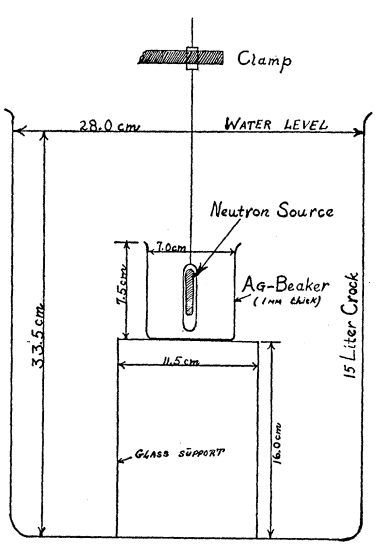

Fig. 1. Method of irradiating.

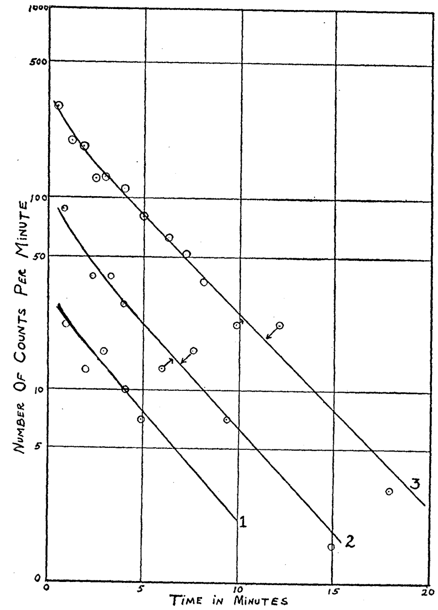

Fig. 2. Variation of the activity produced by bombarding silver with neutrons. (1) *AG*-beaker in air; (2) *AG*-beaker with water inside; (3) *AG*-beaker filled with and surrounded by water.

It would be interesting to determine the neutron capture probability of different elements or isotopes placed between the source and the silver (or any other suitable material) and as indicated by the activity of the latter.

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[1] E. Fermi, E. Amaldi, B. Pontecorvo, F. Rasetti and E. Segré, La Ricerca Scientifica **2**, No. 7–8, No. 9–10 (1934).

North-South Asymmetry of the Cosmic Radiation in Mexico

During a recent survey of cosmic-ray angular distributions, northern and southern intensities were compared at six different zenith angles in the plane of the local magnetic meridian. Measurements were made at two elevations in geomagnetic latitude 29°. The first station, referred to by the name Copilco, was on a ranch near Mexico City at an elevation of 2280 m. The second station was a camp on the summit of Nevado de Toluca, a volcano in the State of Mexico, elevation 4300 m.

The apparatus used was a new multidirectional coincidence counter which simultaneously recorded the intensi-