whereas the organisms in the heated milk grew as diplococci, or formed only very short chains.

These findings made us attempt to estimate the actual number of cocci present, by obtaining an average of the number of cells present in the long chains in the raw milk, and the short chains in the heated milk, and thus calculating the 'total microscopical count'. The results for raw and heated milk revealed the fact that the actual number of cocci present was very similar, which would account for the resazurin and methylene blue reduction times in the raw and heated milk being the same, in spite of the apparent greater number of organisms in the heated milk as estimated by the colony count test.

From these results it would appear that there may not be any growth-inhibitory factor present in raw milk for *Str. lactis*, and that the finding of Hobbs[1] of the greater number of organisms present in the heated milk was due to the organisms growing as diplococci or very short chains in the heated milk, and in consequence producing a very much greater number of colonies.

C. S. MORRIS
M. A. EDWARDS

National Agricultural Advisory Centre,
Staplake, Starcross,
Devon.
June 23.

[1] Hobbs, B. C., *J. Dairy Res.*, **10**, 49 (1939).

Angular Correlation Effects with Annihilation Radiation

IF the two gamma-quanta emitted on the annihilation of a slowly moving positron-electron pair both undergo a Compton scattering, in view of the fact that they are polarized in perpendicular directions, it is reasonable to expect that the scatter distributions will be correlated in azimuthal angle. Fig. 1 shows the expected state of affairs. It has recently been proposed by R. C. Hanna to detect this effect, using counters to observe coincidences of the scattered quanta. With the view of assisting the design of the experiment, we have calculated the magnitude of the effect to be expected. We find that the differential double cross-section is given by

$$\tfrac{1}{16} r_0^4 \, d\Omega_1 d\Omega \left[\frac{\{(1-\cos\theta_1)^3+2\}\{(1-\cos\theta_2)^3+2\}}{(2-\cos\theta_1)^3\,(2-\cos\theta_2)^3} - \frac{\sin^2\theta_1\,\sin^2\theta_2}{(2-\cos\theta_1)^2\,(2-\cos\theta_2)^2}\cos 2(\varphi_1-\varphi_2)\right]$$

where r_0 is the classical electron radius, and $d\Omega_1$, $d\Omega_2$ are elements of solid angle for quanta 1 and 2 respectively.

From this formula one sees that the expected coincidence-rate is greatest for perpendicular and least for co-planar azimuths. Assuming that both counters are placed to observe quanta scattered through the same angle ($\theta_1 = \theta_2$), the ratio of these

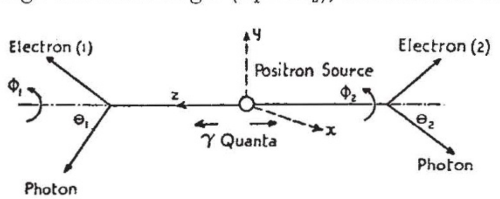

Fig. 1

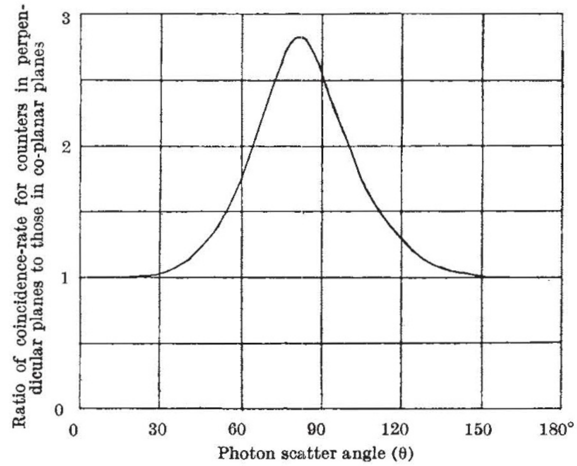

Fig. 2

coincidence-rates has been calculated and in Fig. 2 is shown plotted against the angle of scatter of the gamma-quanta. It is noticeable that a marked effect is to be expected for a scatter angle of about 90°.

A similar experiment could be performed using photo-electrons ejected by the gamma-quanta. If both electrons are ejected from the K-shell (or any s-state), it may be shown that the dependence of their angular distribution on azimuth is proportional to $\sin^2(\varphi_1 - \varphi_2)$, which again is greatest for perpendicular azimuths and is actually zero for coplanar azimuths. If, however, one or both the electrons are ejected from states of higher angular momentum, the correlation is much reduced. It is commonly estimated[1] that some 80 per cent of the photo-electrons are ejected from the K-shell; some 65 per cent of coincidences will therefore correspond to both electrons originating in the K-shell. One may therefore expect a marked correlation in azimuth for photo-electrons also.

M. H. L. PRYCE
J. C. WARD

Clarendon Laboratory,
Oxford.
June 18.

[1] Heitler, "Quantum Theory of Radiation", 127 (Oxford, 1936).

Evidence Against Spontaneous Emission of Neutrons by Uranium X

IN a series of measurements on the absorption of γ-rays of uranium X, Marieta da Silveira[1] found some irregularities. They were finally ascribed to the emission of neutrons by uranium X_{II}, which would lead to uranium Z. Evidence against this will be given in this communication, together with a possible explanation of the anomalies.

If the scheme of decay suggested by Miss da Silveira[1] were correct, uranium X, in equilibrium with 1 kgm. uranium, would give 26×10^3 neutrons per second, whereas 1 mgm. radium plus beryllium gives 20×10^3 neutrons/sec. We have carried out some measurements on the artificial radioactivity induced by the radiation of uranium X in silver. Using an experimental arrangement already described[2], no radioactivity was found, whereas 90 mgm. radium plus beryllium causes an activity of 200 discharges/sec. in the counter-tube, under identical