By connecting a small copper coil, immersed in a bath of liquid hydrogen, during 0·1 sec. with the terminals of a very big battery, we have been able to produce magnetic fields up to about 250,000 gauss in a cylindrical space of 8 mm. diameter; the duration of one discharge is thus about ten times as long as in Kapitza's experiments. The heat developed causes the evaporation of a quantity of hydrogen, but as the resistance of the copper coil at the temperatures of liquid hydrogen is very small, and the heat of vaporization of liquid hydrogen relatively great, the amount of hydrogen required is not very big, which means that the experiments can be made in an ordinary cryostat.

The electrical equipment at our disposal did not permit us to push this method as far as possible, but the results indicate that with relatively small improvements much stronger fields can be obtained than in these very preliminary experiments.

Similar experiments have been carried out in baths of liquid helium at temperatures below the λ point. Although the development of heat was smaller in this case, the heat of vaporization of helium is also small and the fields produced were therefore not as strong as in liquid hydrogen; but an improved apparatus will certainly also yield much better results.

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Fission Fragment Tracks in Photographic Plates

THE observation of tracks due to fission fragments in photographic emulsions has been reported by a number of authors[1,2]. In the course of similar work with photographic plates, we have obtained abundant and easily recognizable fission fragment tracks in specially concentrated emulsions supplied by Ilford, Ltd. The advantages of these new emulsions for the investigation of nuclear processes have already been described[3].

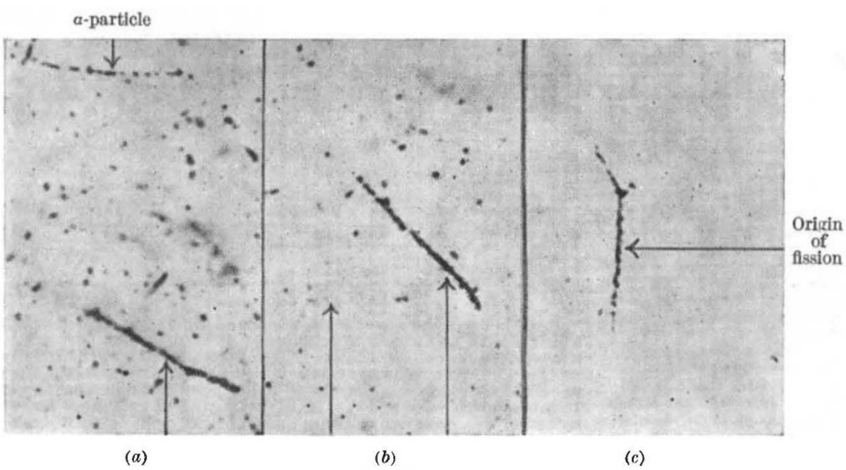

Fig. 1

The concentrated plates were prepared for exposure by immersing them in ammonium uranate dissolved in dilute acetic acid. The plates were then thoroughly dried, enclosed in thin brass boxes and irradiated for three hours with slow neutrons in the Cavendish High Tension Laboratory using a lithium-deuteron neutron source surrounded by paraffin wax.

The plates were examined under the microscope in the usual way and numerous examples of fission tracks were found (see Fig. 1, *a*, *b*, *c*). In most of the plates α-particle tracks from the disintegration of uranium are also visible, but tracks due to the recoils of fast neutrons are almost completely absent. This is due to the desensitizing action of the uranyl ion on the emulsion, which also improves the differentiation between the tracks of various types of nuclear particles. At a strength of 10 gm. uranyl ion per litre, proton tracks are almost completely inhibited, α-particle tracks are weakened, but fission tracks are still prominent. Fig. 1*a* shows the marked difference of grain density between a fission track and an α-particle track at this stage of desensitization, and the considerable background of single grains present. Further increase in the strength of the uranium solution reduces the background considerably, completely prevents the formation of proton tracks, and greatly weakens the traces of α-particles. Fission tracks, however, are still prominent, as shown in Fig. 1*b*, which was taken in a plate immersed in a solution containing 40 gm. uranyl ion per litre. Measurements made of the track-lengths in a plate similar to Fig. 1*a* are plotted in Fig. 2, from which it is clear that the combined range of the two fission fragments exceeds that of the α-particle groups from uranium by a considerable margin, and this feature, together with the higher grain density of fission tracks, makes identification immediate.

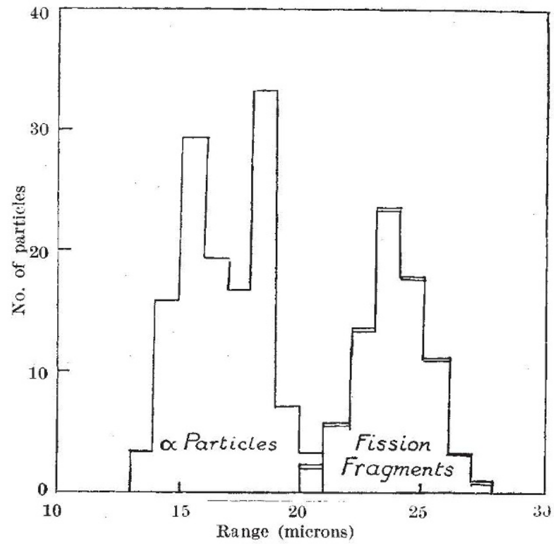

Fig. 2

A similar technique was utilized in the production of fission fragment tracks by fast lithium-deuteron neutrons in thorium. In this case the proton recoil background would normally be exceedingly dense, but this background was eliminated by soaking the plates in a 2 per cent solution of chromic acid and drying before impregnating with thorium acetate.

The fission fragment tracks exhibit several characteristic features which have been observed already[4]. There are frequent light and heavy nuclear recoils, giving forked and branched tracks, an example of which is shown in Fig. 1*c*. The grain density in the tracks decreases with decreasing energy of the fission fragment, unlike the well-known Bragg curves for protons and α-particles. This effect causes the total range to be reduced in highly desensitized plates, because the last portions of the actual range are not recorded. The abundance of fission tracks varies with the strength of the impregnating solution and the conditions of irradiation, but a typical figure of three tracks per sq. mm. per gm. of uranyl ion per litre is readily obtainable. In a highly loaded plate, therefore, it is possible to examine rapidly large numbers of fission events. The method in general has obvious advantages where it is desired to inspect the entire path of the fission tracks or to obtain information about rare fission events.

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July 27.

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Linear 'Curves of Best Fit' and Regression Lines

IN a recent communication, Austen and Pelzer[1] have discussed the problem of fitting a straight line when both the variables v, w are subject to error: their solution first seems to have been derived by Kummell[2] without the restriction that the standard deviations be constant throughout the range; he only assumed the ratio of the standard error of one variable to that of the other was the same for all pairs of readings. Kummell's paper does not seem to be obtainable in England, but this particular result is quoted by Deming[3]. The same solution was given later by K. Pearson and again by Gini, and there is a bibliography of work related to the subject in a paper by Roos[4]. Attention may also be directed to a recent paper by Wald[5].

It is important to distinguish between the line of 'best fit' and the regression lines. The former serves as the estimate of the constant of proportionality holding between *true* values; for example, the slope of the line of best fit of mass against volume is an estimate of the density. The regression lines, however, provide an answer to the problem: How can one variable (mass, say) be estimated from the other (volume, say)? To answer this, one takes a preliminary sample of several pairs of observations under the same conditions as will be encountered later in measuring the volume, and estimates the re-