LETTERS TO THE EDITORS

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Photo-electric Measurements of the Density of Tracks in Nuclear Emulsions

GRAIN-COUNTING is an important method for the study of charged particles in photographic emulsions. The method is well suited for the Ilford *C* 2 emulsion and others of a similar kind, but does not work for heavily ionizing particles in electron-sensitive emulsions, for example, the Ilford *G* 5. We have measured the density of the tracks in such cases by a photo-electric method.

A slit was mounted in the eyepiece of a microscope and the divergent light passing through the slit was allowed to fall on the cathode of a photo-multiplier tube (*RCA* 1 *P* 21). A portion of the track was adjusted symmetrically in the slit and the resulting photo current measured in terms of the current without track. Figs. 1 and 2 give the results of such measurements for 55 tracks from *G* 5 plates exposed during a balloon flight to an approximate altitude of 20 km. The length of the slit corresponds to 30 μ of track-length.

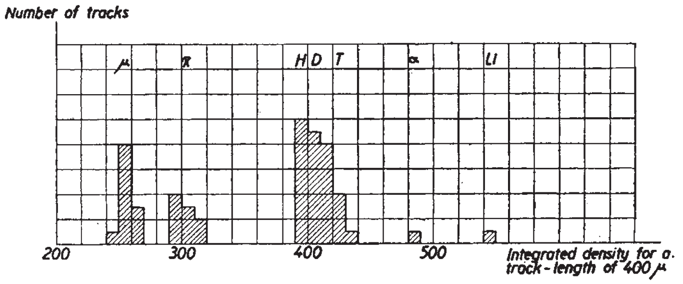

Fig. 1. Histogram of integrated densities for a track-length of 400 μ of 55 tracks in Ilford *G* 5 emulsion

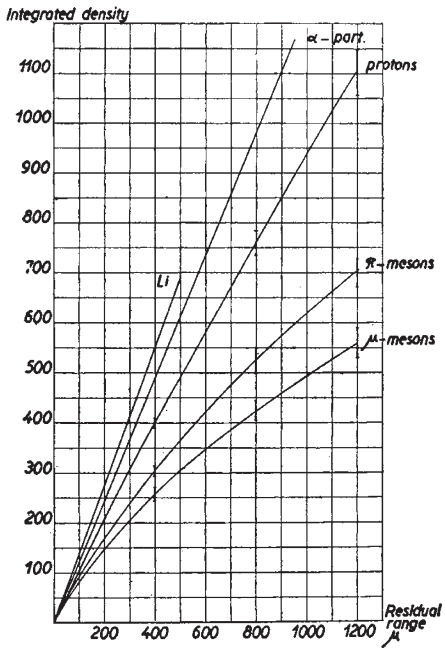

Fig. 2. Integrated density in arbitrary units against residual range for tracks in Ilford *G* 5 emulsion

The diagrams show that it is possible to distinguish with certainty between π- and μ-mesons. The limits of error indicated in the diagrams cover all measured values. The method is also well suited for tracks from heavy particles.

A detailed account of the method and of results obtained will be given elsewhere.

STEN VON FRIESEN
KRISTER KRISTIANSSON

Physics Department,
University of Lund.
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Production of Uniform Droplets

A SIMPLE apparatus has been evolved which will generate lines, or streams, of droplets. All those in one stream are of the same size and follow the same trajectory, but differ from those in another stream. Primary and subsidiary droplets are formed, and, by adjustment, diameters ranging from 10 μ to 300 μ may be obtained. The production of the droplet system is regular, and may be watched in slow motion if illuminated by a stroboscopic light source.

The basis of the apparatus is a vibrating hollow reed supplied with liquid. A length of ordinary glass tubing 3/16 in. or ¼ in. outside diameter is drawn to a fine capillary of about 0·025 in. outside diameter and up to 8 in. long. On to this reed is waxed a short piece of 1 or 1·5 mm. steel hypodermic tubing an inch or two from the shoulder, to act as an armature. A mounting is now necessary to clamp the butt of the capillary firmly and to support a small electromagnet, aligned with the armature, and energized by an alternating current. The mains supply via a transformer is suitable for this.

With liquid supplied to the butt of the hollow reed (only a small head is needed), and the electromagnet switched on, the capillary is tuned to resonance with the applied frequency by shortening it in steps of about 1/16 in. The tip of the reed will then sweep a path varying from a straight line to a circle depending apparently on the cross-sectional form of the capillary and its alignment with the magnet. Thus by arranging for the position of the magnet to be adjustable, and by twisting the reed in its clamp, a wide variation may be obtained.

Streams of droplets are thrown off at various points on the path of the reed tip, usually at points of maximum acceleration.

A cylinder provided with an aperture, and surrounding the vibrating tip, enables a single stream of drops to be selected. The axis of the capillary may be at any angle provided the tip is below the butt.

A series of photographs was taken over a period of 15 min. showing the stages in the formation of one droplet system, and representing a continuous time of 3·3 sec.$^{-3}$. Initially it was attempted to obtain pictures using the stroboscopic illumination only, but the long exposures made necessary by the low-power neon lamp did not give perfectly clear results. (A 10-sec. exposure means the superimposition of 1,000 droplets.) The final series of photographs, of which the accompanying illustration is one, was obtained using a 56-Joule, 1-microsecond flash tube. The triggering of this tube, to coincide with desired stage