TRACK SPARK CHAMBER

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WE have investigated the operation of a spark chamber with the particle trajectories roughly parallel to the planes of the electrodes. The tracks were photographed, using a stereoscopic camera, through the electrodes themselves. These consisted of metallic grids (Fig. 1) to achieve transparency. As a result of the experiment, we found an interesting possibility, brought about by the characteristic form of the discharge in the spark chamber, of reconstructing the charged particle tracks in space.

When the particles move roughly perpendicularly to the electrical field, the discharge is such that luminous centers are produced along the particle trajectories, from which discharge filaments propagate towards the electrodes. Since the intensity of the luminous centers is greater than that of the discharge filaments, we obtain in the photographs essentially a picture of the luminous centers with a halo due to the discharge filaments. The

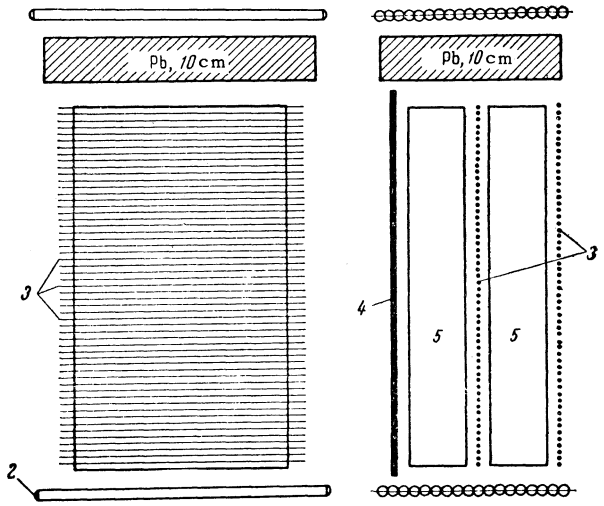

FIG. 1: Diagram of the setup: 2 – Geiger counters, 3 – grid electrodes (5 mm mesh), 4 – duraluminum electrode, 5 – glass vessels 50 x 30 x 10 cm, filled with neon.

brilliance of the filaments decreases when several particles pass through the chamber and we obtain in the photographs the images of the luminous centers only. A stereoscopical scanning of the pictures revealed that the tracks, consisting of a chain of luminous points, do not differ in appearance from the cloud chamber tracks (Fig. 2), the only difference being that the size of the luminous centers (~ 1 mm) is greater than that of the drops in a cloud chamber.

A preliminary processing of the tracks by meas-

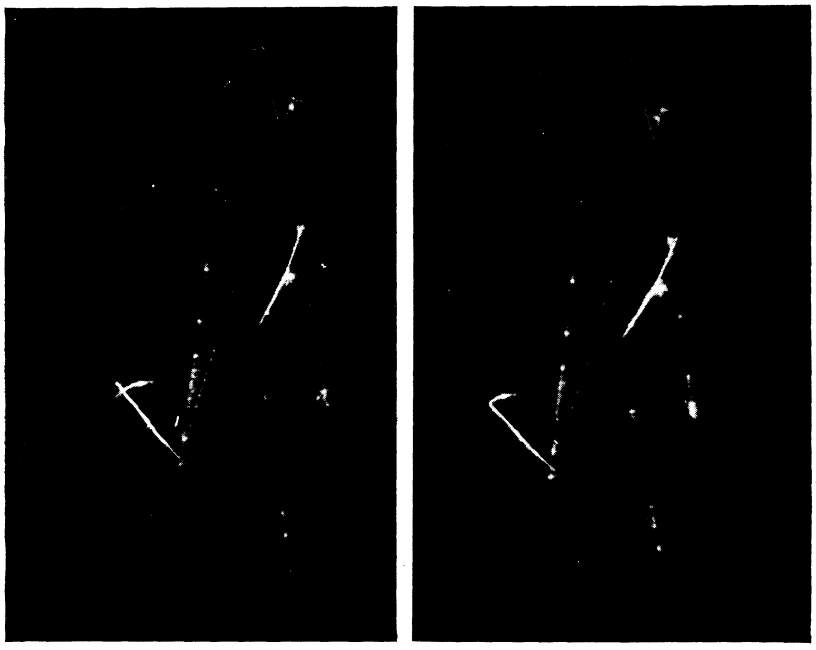

FIG. 2

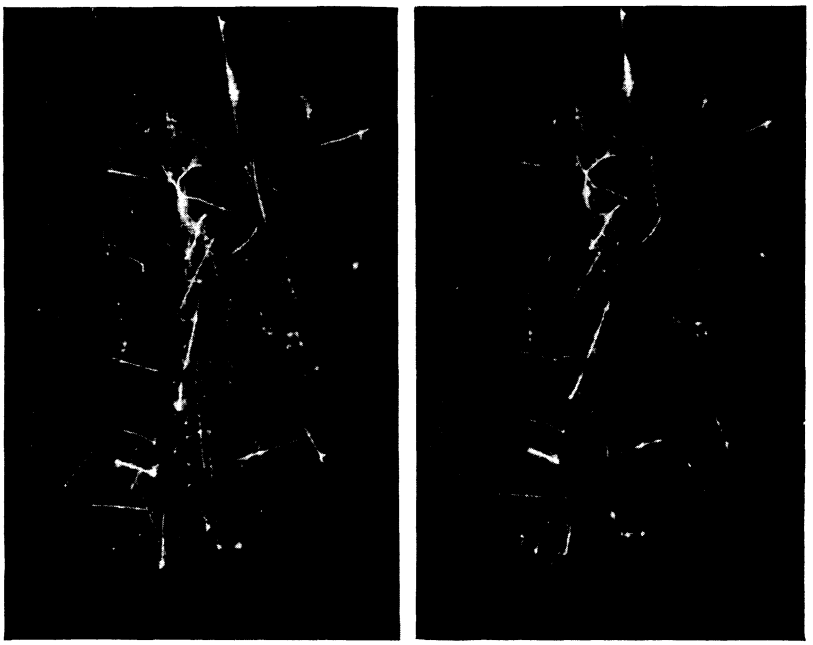

FIG. 3

uring the parallax showed that in our geometry (stereoscopic base equal 10.6 cm, distance of the camera to the object equal 120 cm, and magnification 10x), the z coordinates of the luminous centers can be determined accurate to several millimeters.

The new method of spark chamber operation enables us therefore to reconstruct the charged particle tracks in space, and also to detect showers (Fig. 3), making the spark chamber a true track detector comparable with such classical instrumoments as the cloud chamber.

In conclusion the authors express their deep gratitude to É. L. Andronikashvili for stimulating the present work and his constant interest in it.

Note added in proof (August 20, 1963). During the course of further work we were able to make the single and shower tracks identical by specially shaping the high-voltage supply pulse.

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ANOMALOUS BEHAVIOR OF SPECIFIC HEAT OF CRYSTALS WITH HEAVY IMPURITY ATOMS

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THE authors have previously [1] called attention to the fact that the oscillation spectrum (i.e., the spectral density of the mean square of the displacement) of an isolated heavy impurity atom with $m'/m \gg 1$ (m' and m are the masses of the impurity atoms and the ideal-lattice atom) has a sharply pronounced resonance character, being localized near the frequency

$$x_0 \equiv \omega_0^2/\omega_{max}^2 = 1/|\varepsilon|\langle x^{-1}\rangle. \quad (1)$$

Here $x = \omega^2_{max}$, $\epsilon = 1 - m'/m$, $\langle\ \rangle$ denotes averaging over the phonon spectrum of the initial ideal lattice (matrix), and ω_{max} is the upper limit of this spectrum. It is precisely this circumstance that has made it possible to obtain a limiting expression for the probability of the Mössbauer effect on a heavy impurity nucleus (see also [2]). An analogous result was obtained later in [3,4].

It turns out that such localization of the spectral density of the oscillations brings about a noticeable increase (compared with the ideal lattice) in the specific heat at low temperatures,