a is the lattice constant and ϵ_0 is the limiting energy]. If at a temperature T_2 the electron-impurity collisions predominate over the electron-phonon collisions, namely $l_{ef}(T_2) \gg l_{imp}$, then the resistance remains constant from then on and remains very small (up to the value of the residual resistance of an unbounded specimen, where $l_{eff} \sim l_{imp}$). Finally, at a temperature $T_3(l_{ef}(T_3) \sim l_{imp})$, the usual growth in resistance begins: $R \sim T^5$ ($l_{ef} \sim a(\epsilon_0/\Theta)(\Theta/T)^5$, where Θ is the Debye temperature). For a minimum of the resistance to occur, it is obviously necessary that at a temperature T_1 the value $l_V = (l_{imp}^{-1} + l_{ef}^{-1})^{-1} > r$, from which follows $a(\epsilon_0/\Theta)^{8/3} < r < l_{imp}$. Thus, the specimen should not be too thin (for a typical metal, $r \gtrsim 10^{-2}$ cm).

It is clear that the results obtained (and, in particular, the minimum of the resistance), are qualitatively valid for specimens of arbitrary shape. For example, for a plate of thickness d we have in the limiting case (1) $l_{eff} \cong d^2/l_{ee}$. An analogous situation should also occur in an unbounded conductor in the presence of macroscopic distortions (say, dislocations); in this case the role of d in the inequalities given above will be assumed by the average distance between the distortions. These considerations apparently do not apply to impurities, since the average distances between the impurity atoms is $\lesssim 10^{-5}$ even in the purest specimens.

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A TWO-ELECTRODE SPARK CHAMBER WITH A LARGE DISCHARGE GAP IN A MAGNETIC FIELD

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SPARK chambers with large discharge gaps have been described by many workers.[1-8] Others[9-11] have reported the results of investigations of multilayer spark chambers in a magnetic field.

The present note reports the preliminary results of a study of the possibility of recording the trajectories of charged particles in a spark chamber with a large discharge gap, placed in a magnetic field. Figure 1 shows an external view of the chamber, placed in the gap of an electromagnet at the high-altitude cosmic-ray station Nor-Amberd of the Physics Institute of the State Commission on Atomic Energy. The side surfaces of the chamber were made of polished organic glass (Perspex) of 30 mm thickness. The Duralumin electrodes of 20 mm thickness were clamped by means of flanges with rubber spacers. The working dimensions of the chamber were 20 × 40 × 21 cm. The chamber was evacuated to a pressure of 3×10^{-2} mm Hg and then filled with neon to a pressure of 1.5 atm.

To avoid edge effects the chamber was fitted with outer "wings" which made it possible to obtain 100% working efficiency throughout the whole volume of the chamber.

Good records were obtained of the trajectories of particles coming at an angle of 40°. Moreover, it was found that particles entering from the sides of the chamber, with parts of their trajectories outside its working volume, were also recorded. Showers were recorded with high efficiency; however, detailed studies of the efficiency of recording showers have not been carried out.

Figure 2 shows the essentials of the triggering circuit of the spark chamber (S.C.). The coincidence circuit with a delay time of 0.25—0.3 μsec was triggered by a high-voltage discharger of Marks type (M) which generated a high-voltage pulse of 10^{-7} sec duration and 60—80 kV amplitude.

The tests were carried out in a magnetic field of 5×10^3 G intensity. Photographs of the trajectories of charged cosmic-ray particles in a magnetic field are given in Fig. 3.

As indicated by the photographs, the curvature of a trajectory in the magnetic field is well reproduced by a streamer channel without visible distortions. Measurements showed that the curvature of μ-meson tracks of a certain range, photographed with this chamber, was in good agreement with the expected value. According to our estimates in such chambers we can obtain good accuracy in determining particle momenta up to tens of BeV/c. We are carrying out detailed investigations of this problem.

The possibility of measuring the momenta of charged particles in a spark chamber of the type described considerably extends the range of applications of such chambers.

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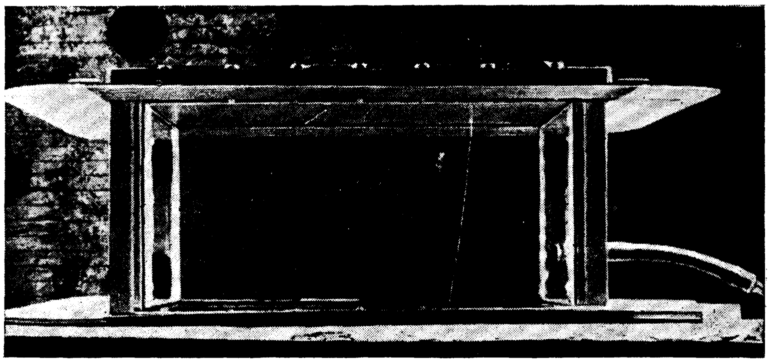

FIG. 1

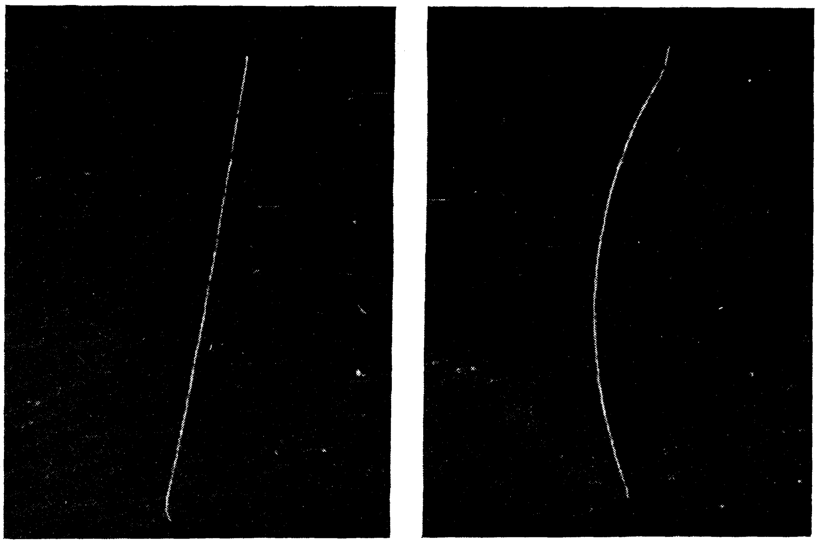

FIG. 3

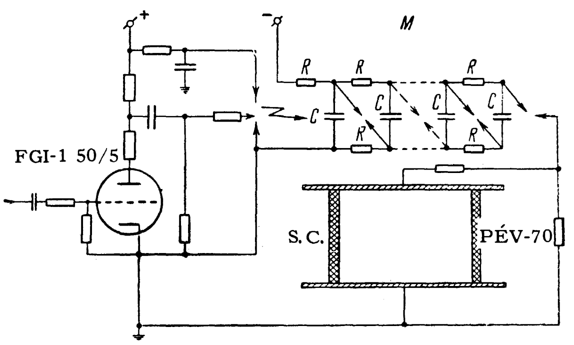

FIG. 2

and R. V. Badalyan for their participation in the setting up and carrying out of the tests, and to R. O. Sharkhotunyan for taking part in the discussion of the results.

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