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HELIUM DISCHARGE-CONDENSATION CHAMBER

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In [1, 2] we proved the possibility of realizing a new discharge-condensation method of recording tracks of charged particles, in which the selected events are recorded in two successive stages based respectively on the discharge and condensation principles.

The discharge-condensation chamber combines to a considerable degree a number of specific features of such elementary-particle detectors as spark and condensation chambers. Besides the high time resolution and the large memory of the selected event, notice should also be taken of such features of the discharge-condensation chamber as complete isotropy, good spatial resolution, large track brightness, and the possibility of using practically any gas as the working medium.

Of particular interest is the development of helium and hydrogen discharge-condensation chambers. Such chambers, owing to their controllability and the possibility of exposure in high-intensity beams, should not be inferior to helium and hydrogen bubble chambers with respect to efficiency of utilization of the working medium as the target.

In the present investigation our purpose was to demonstrate the feasibility of creating a discharge-condensation chamber filled with helium. Figure 1 shows photographs of cosmic-ray particle tracks in a helium discharge-condensation chamber of 30 cm diameter and 8 cm depth. The chamber was filled with pure helium and with saturated ethyl-alcohol vapor to a pressure of 1.2 atm. The expansion ratio was 1.08, and the pulsed light source power was 200 J. The tracks were photographed on film having a sensitivity of 1000 GOST-0.85 units with a delay of 30 msec following the start of the expansion at a relative lens aperture 1:22. The same figure shows an oscillogram of a high-voltage pulse with a peak electric field intensity 14.5 kV/cm applied between a perforated grid and a reticular electrode located inside the working volume of the chamber at the front glass.

Figure 2 shows for comparison photographs of tracks in a neon discharge-condensation chamber and an oscillogram of the corresponding high-voltage pulse. Comparison of these photographs shows that at identical working-mixture pressures, expansions, and photography

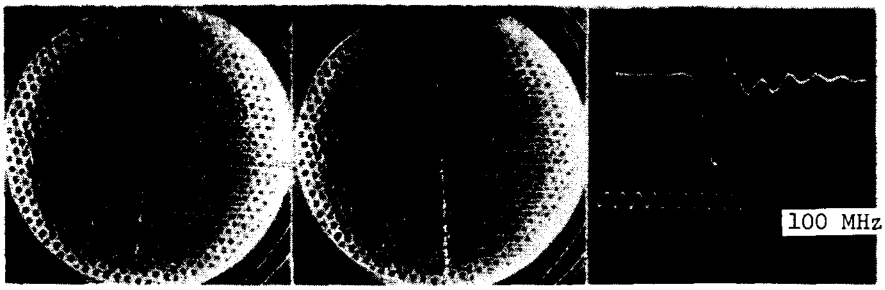

Fig. 1. Photographs of particle tracks in a helium discharge-condensation chamber and oscillogram of the corresponding high-voltage pulse.

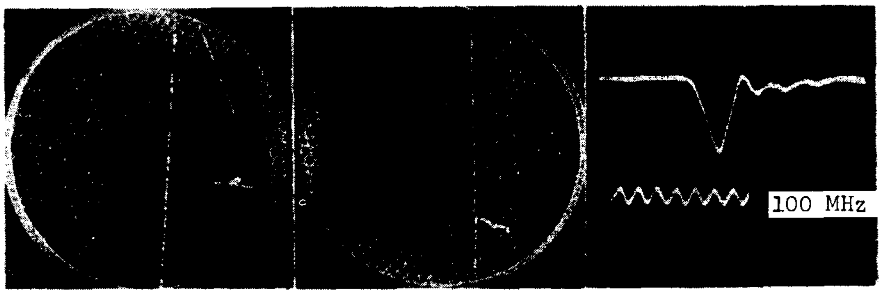

Fig. 2. Photographs of particle tracks in a neon discharge-condensation chamber and oscillogram of the corresponding high-voltage pulse.

conditions, the voltage pulse required to obtain tracks of the same quality is 1.25 times larger in the helium discharge-condensation chamber than in the neon discharge-condensation chamber.

It should be noted that the helium discharge-condensation chamber has a short operating cycle, requiring no additional cleaning expansions, at least for the 5-particle showers observed in our experiments.

By now we have obtained sufficiently extensive data on the characteristics of argon, neon, and helium discharge-condensation chambers and the results are being readied for publication.

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