assumed to be transverse. The sum in formula (2) converges rapidly and we can confine ourselves to allowance for the nearest neighbors in its calculation. As a result we obtain for the relaxation time T_1 the expression

$$\left(\frac{1}{T_1}\right)_{\mathrm{opt}} \simeq 6.8\cdot 10^4 \frac{Z^2 e^4 Q^2}{\mu^2 s^3 v_0^{4/3}} \frac{2J+3}{J^2(2J-1)} T^3 . \tag{3}$$

Comparing with the contribution of the acoustic oscillations [2], we obtain for the time ratio

$$\frac{(1/T_1)_{\mathrm{opt}}}{(1/T_1)_{\mathrm{ac}}} = 0.9\left(\frac{M}{\mu}\right)^2\left(\frac{a}{s}\right)^3\left(\frac{\theta}{T}\right)^4 \tag{4}$$

Here M is the mass of the cell and a is the square of the speed of sound.

Thus, the relaxation time due to the scattering of the optical phonons is proportional to $(\theta/T)^3$. This temperature dependence can probably be observed by measuring the relaxation time of the spin of the tellurium nucleus in a SnTe crystal in the temperature interval from 20 to 70°K. All three factors in the right-hand side of (4) are large and for the case of SnTe at T ∿ 20°K the ratio (4) is of the order of 10^5.

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CRYSTALLINE FILAMENTARY PARTICLE COUNTER

A.F. Pisarev, V.F. Pisarev, and G.S. Revenko
Joint Institute for Nuclear Research
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We report here the development and investigation of a new particle detector - a crystalline filamentary counter.

The problem of producing such a counter with a dense working medium has recently been one of the most pressing ones in experimental physics of high-energy particles. A number of workers [1, 2, 3] have attempted to solve this problem with counters filled with liquid media. It was observed, however, that such counters are subject to various operating instabilities.

One of the present authors has therefore formulated a new program for the development of particle detectors [4], based on total replacement of the liquid by a molecularly ordered structure, viz., crystalline matter in which conducting filaments are frozen. This is just the counter investigated in the present study. The counter had a brass cylindrical cathode of 6 mm diameter and a tungsten filament of 10 μ diameter coated with a thin film of gold. The working volume of the counter could be observed visually through end windows. We used in the experiments crystalline argon and xenon. The crystals were obtained by first condensing the gas in the counter at a temperature above the triple point, and then cooling the liquid slowly to the crystallization point freezing it gradually.

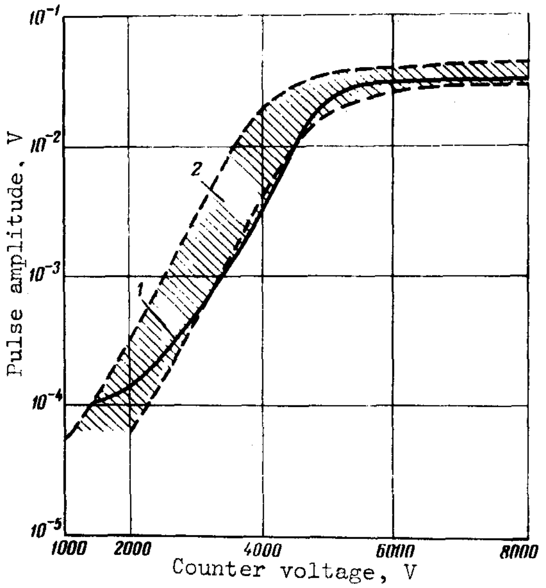

Fig. 1

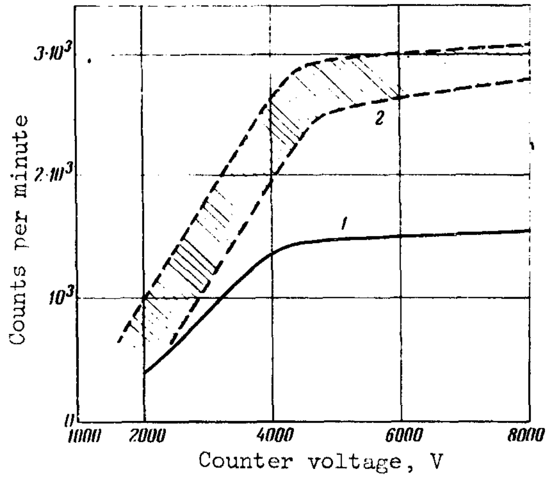

Fig. 2

Fig. 1. 1) Amplitude characteristics of argon counter. 2) Range of amplitude characteristics of xenon counter.

Fig. 2. 1) Counting characteristics of argon counter: 2) Range of counting characteristics of xenon counter.

In these experiments we investigated the amplitude and counting characteristics of the counter when exposed to γ quanta from Co^{60}. The main results of the investigations with crystals having good transparency are shown in Figs. 1 and 2. It is seen that the argon counter has one amplitude and counting characteristic, whereas the characteristics of the xenon counter lie in a certain range of values. In each experiment with xenon we obtained perfectly defined counting and amplitude characteristics, but these characteristics differed in part from experiment to experiment (from freezing to freezing). The aggregate of these characteristics obtained in many experiments made up the indicated range of values.

It is seen from the amplitude characteristics that the counter has three typical sections: ionization - up to 2 kV, proportional - up to 5.2 kV, and saturation - above 5.2 kV. In the proportional region, the gain is $\sim$150. The counting characteristic has a plateau with a slight slope extending up to 3 kV.

In the case of crystals with imperfect structure (insufficient transparency), it was observed that they were charged by the positive space charge, which was then easily eliminated by applying to the counter for a short time a field of opposite polarity and of small amplitude.

In perfect crystals (crystals with good transparency), mobility of the carriers was observed, amounting to 10^{-1} and 10^{-1} - 10^{-2} $cm^2V^{-1}sec^{-1}$ for argon and xenon, respectively.

Our investigations can serve as a basis for the construction of proportional filamentary chambers of large dimensions, in which the filaments are rigidly fixed in space because they are frozen in a crystal.

The large specific ionization of the particles in the crystals makes it possible to place the filaments close to one another in the chamber, and this ensures high temporal and spatial resolution, greatly exceeding the resolution of gas-filled filament chambers.

In conclusion, we are sincerely grateful to V.P. Dzhelepov, B.M. Pontecorvo, G.I. Selivanov, L.M. Soroko, and V.I. Nikanorov for support of this investigation.

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EXPERIMENT ON MAGNETOSONIC HEATING OF IONS IN THE TOKAMAK TO-1

N.V. Ivanov, I.A. Kovan, L.I. Kozlov, E.V. Los', V.S. Svishchev, and N.N. Shvindt

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As shown in [1], when resonant magnetosonic oscillations of the plasma filament in the Tokamak are excited, there are two possibilities for continuous transfer of high-frequency energy to the plasma. One is based on the buildup of the natural oscillations of the filament with the aid of a broad-band amplifier whose feedback loop is closed by the plasma [2]. The use of feedback makes it possible to maintain in the plasma oscillations of a definite type when the plasma concentration is varied and the natural frequency is tuned in time. Another possibility, which is considered in the present paper, presupposes the use of a generator of fixed frequency, corresponding to the quasicontinuous section of the natural-oscillation spectrum of the plasma filament. In this case, the generator frequency should be several times larger than the frequency of the lowest oscillation mode.

To heat the plasma we used in our experiment a self-excited oscillator based on the GI-4A tube. The oscillator operated in a pulsed mode at 50 MHz, delivering up to 5 kW to the plasma. The voltage pulse on the tube anode had an exponentially decreasing shape with a time constant of 25 msec. The HF energy from the oscillator was fed through a coaxial cable to a loop-type exciter introduced into the chamber of the apparatus through a lateral stub. The loop surrounding the plasma filament was 32 cm in diameter and was made of stainless steel. Unlike the HF lead used in [3], the loop was not insulated from the plasma with a dielectric. To decrease the plasma concentration near the exciter, the loop was placed between two molybdenum diaphragms with openings of 25 cm diameter, spaced 20 cm apart.

The main characteristics of the discharge in hydrogen at 8×10^{-4} Torr initial gas pressure and at 8.5 kOe longitudinal magnetic field intensity on the chamber axis are shown in Fig. 1. The HF generator was turned on during a macroscopically stable stage of the discharge, when the plasma concentration, according to the readings of a 4-mm interferometer, exceeded 10^{13} cm^{-3}. At such a concentration, the frequency of the HF oscillations corresponded to the dense section of the spectrum, and this led to a continuous loading of the oscillator. The amplitude of the fields excited in the plasma was several Oersted under these conditions, and the Q of the individual resonant maxima amounted to