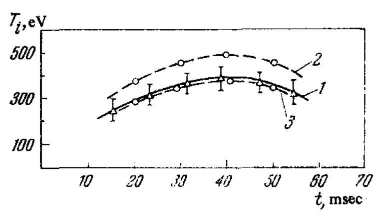
servations. It is possible to explain the second-class periods of the pulsars, either by foregoing the hypothesis wherein the pulsar pulsates as a whole, or by finding other equations of state for the neutron stars.

L. A. Artsimovich. Heating of Ions in "Tokamak" Machines.

Results are reported of experiments on heating of ions in a toroidal plasma pinch with the "Tokamak" machine. It was shown earlier that by choosing the necessary ratios of the longitudinal and transverse magnetic fields it is possible to obtain a stabilized plasma pinch with a lifetime on the order of 5×10^{-2} sec. The heating of the electrons is due to the Joule loss of the current in the plasma. It is shown that heating of the ions in the plasma at relatively high concentrations ($\sim 3 \times 10^{13}$ cm^{-3}) occurs mainly as a result of Coulomb collisions with hot electrons, whereas at lower plasma density the heating of the ions calls for the presence of specific plasma processes connected with development of instabilities.

One of the most important experimental problems with the "Tokamak" is the determination of the ion temperature T_i. For many years T_i was determined from the energy spectrum of the neutral atoms emerging from the plasma pinch. Such atoms result from charge exchange of the plasma ions with the atoms of the neutral gas, and contain information concerning the energy of the plasma ions. This method was developed at the Physico-technical Institute of the USSR Academy of Sciences (Leningrad). For an independent estimate of T_i at an ion temperature exceeding 300 eV, use was also made of registration of the neutron emission from the volume of the toroidal chamber as a result of the D-D reaction. Although the intensity of the neutron emission is small ($\sim 10^6$ neutrons per pulse), the sensitivity of the apparatus makes it possible to measure T_i for $\sim 30-40$ msec.

The $T_i(t)$ curves obtained from an analysis of the spectrum of the neutral atoms (curve 1) and the intensity of the neutron radiation (curves 2 and 3, assuming different forms of the $T_i(t)$ distribution inside the



plasma pinch) are shown in the figure, from which we see that measurements of $T_i(t)$ by two independent methods give satisfactory agreement. The ion temperature turns out to lie within 300—400 eV for the entire measurement interval.

A. A. Galeev and R. Z. Sagdeev. Paradoxes of Classical Diffusion of Plasma in Toroidal Magnetic Traps.[1,2]

The authors consider of the increase of classical plasma diffusion, due to the presence of particles locked in the region of a weak toroidal magnetic field. It is assumed that the larger classical diffusion[1] compared with that in straight systems) has already been observed in the simplest traps having axial symmetry ("Tokamak"). Therefore particular attention is paid to the distinguishing features of this effect in traps that do not have actual symmetry. By way of a concrete example, a model of a triple-loop stellarator with small toroid ratio is considered. The magnetic field near the magnetic axis z (which is aligned with the minor axis of the torus) is of the form

$$B_z = B_0\{1-\epsilon_h\cos[3(\vartheta-\alpha z)]-\epsilon_t\cos\vartheta\} \quad (\epsilon_t \ll \epsilon_h \ll 1). \tag{1}$$

It is noted that in an axially-symmetrical magnetic field ($\epsilon_h \equiv 0$) the trajectories of the "trapped" and transiting particles differ in their topology, but each changes over continuously into the other (Fig. 1). Consequently, a small change of the particle velocity along the field can transform the particle from a "trapped" one into a particle that passes through, but changes the inclination of the particle to the magnetic surface also by a small amount.

On the other hand, particles that are "trapped" in the region of a weak helical field in a stellarator ("banana") are capable of moving under the influence of the toroidal drift by a finite amount, while those that pass through follow the magnetic surface strictly (Fig. 2 shows the trajectory of a "trapped" particle which goes over into the region of the weak toroidal field into a particle that passes through; the figure is borrowed from the article of A. Komin et al. ("Atomnaya

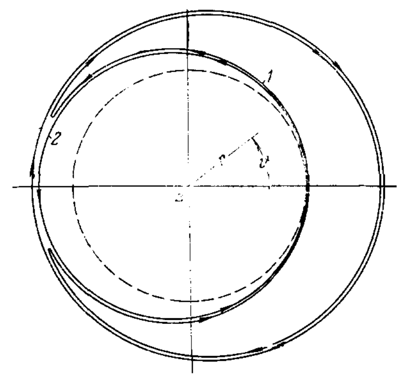


FIG. 1. Trajectories of "trapped" (1) and transiting (2, 2′) particles in a magnetic field with axial symmetry.

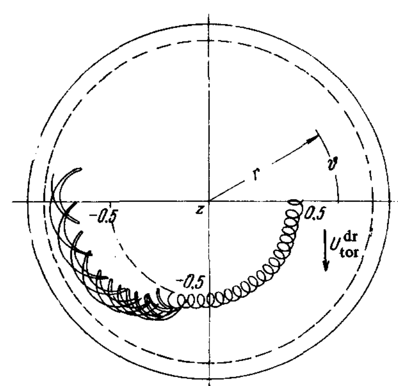


FIG. 2. Trajectory of a particle changed from a "trapped" one into a transiting one by the inhomogenities of the helical field.