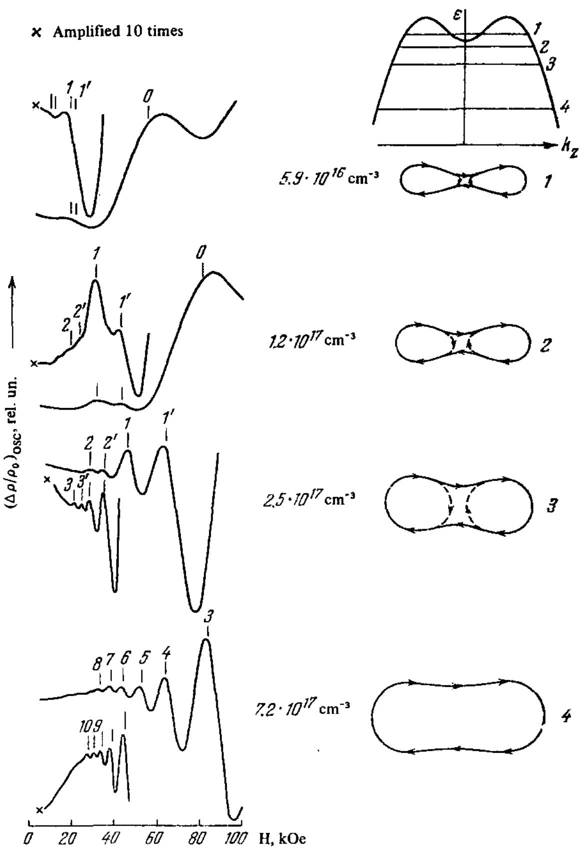

serve a magnetoresistance maximum corresponding to the zero Landau level.

The figure shows the experimental results of the investigation of the SH oscillations in a magnetic field up to 100 kOe at liquid-helium temperature, on samples with different hole concentrations near p_{cr}.

The results indicate that realization of magnetic breakdown leads to simultaneous appearance in the oscillations of harmonics corresponding to two types of possible carrier trajectories, and the contribution of each of the trajectories to the quantum SH oscillations changes with increasing concentration, i.e., with changing breakdown probability.

The quantization formulas given in Azbel's paper[4], and also the quasiclassical quantization rules, which can be used at energies sufficiently far from the critical value, make it possible to plot the position of the Landau levels against the magnetic field for the dispersion law (1). Such a calculation is in satisfactory agreement with the presented experimental data.

The investigated angular dependence of the position of the zero maximum of the oscillations on the angle between the direction of the magnetic field H and the axis C_3 confirms the interpretation wherein the observed phenomenon is regarded as intraband magnetic breakdown.

The results presented in the paper were published in[1,2,5].

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M. S. Rabinovich. Stellarator Program

The stellarator program was and remains one of the main programs of controlled thermonuclear fusion (CTF). The principle of plasma containment is the same in the stellarator as in the Tokamak. Plasma containment is determined by the magnetic surfaces with sufficiently large angle of rotation of the force lines (i), shear $\theta = (r^2/R)di/dr$, where r and R are the minor and major radii of the torus, and the well of the magnetic field averaged along the force line $\langle H\rangle = \{\lim_{l\to\infty}(1/l)\int dl/H\}$. The shortcomings of the stellarator are the absence of axial symmetry, the diffuculties in producing the magnetic field and, consequently, and the lower efficiency of magnetic-field energy utilization. Its advantage lies in the possibility of controlling the field parameters, attaining large angles i, and producing stationary installations, and in the great variety of configurations. The first stage in the stellarator program is the production of the necessary magnetic fields and of methods of measuring and correcting the magnetic surfaces. This necessary stage of research has already been performed. An attempt to bypass this stage has caused failure of the stellarator program of the Princeton Plasma Physics Laboratory, where the stellarator idea itself was originated in 1952 (L. Spitzer). At the present time, ideal magnetic surfaces with angle $i = 6\pi$ (Physics Institute, USSR Academy of Sciences), large shear $\theta = 0.1$ (Physico-technical Institute, Ukrainian Academy of Sciences and Culham, England).

The second stage of the stellarator program is an investigation of plasma containment. The main results of this stage are as follows:

1) In the kinetic regime (mean free path larger than the perimeter of the apparatus), at temperatures $T_e = 5-10$ eV and $T_i = 20-40$ eV, and a plasma density $n < 10^{11}$ cm^{-3}, the particle lifetime is proportional to the angle of rotation of the force lines, and at a shear of $\theta \gtrsim 0.05$ it differs by a factor of 5 from the "classical" values determined by pair collisions.

2) At certin resonant values of the angle i, when the force line is closed after a small number of turns, $i/2\pi = p/q$, where p and q are small integers, a sharp decrease of the plasma lifetime is observed, apparently resulting from the formation of convective cells.

3) In the hydrodynamic regime, classical lifetimes were obtained in a cold plasma (Garsching, West Germany). In this case, however, the Bohm time is smaller than the classical only by one order of magnitude. The "Uragan" apparatus (Physico-technical Institute of the Ukrainian Academy of Sciences) pro-

duced particle lifetimes equal to approximately 30 Bohm times and an energy lifetime equal to four Bohm times in a dense hot plasma. These results break all records. At the present time, no other experimental or theoretical data capable of compromising the stellarator program have been observed. However, owing to the complicated construction of the stellarators, the development of the program proceeds slowly, mainly via small model installations.

The main tasks of the stellarator program in the nearest future is as follows:

1) Investigations of containment of a plasma with density 10^{12}—10^{13} cm at a temperature $T_e \sim 1$ keV and at transverse plasma dimensions 20 cm. To this end, apparently, special installations will be constructed in the near future (USSR, West Germany, England).

2) Investigation of the role of the convective cells in plasma loss and development of methods of combatting them.

3) Development of new methods of injection and heating of plasma, including high-frequency and laser methods. Elucidation of the role of injection in the appearance of convective cells and anomalous plasma drift.

4) Search and selection of optimal systems, which apparently will occupy an intermediate position between installations with double-helix and triple-helix windings, stellarators, and torsotrons.

5) The use of various high-frequency systems of stabilizing the instability in stellarators, including feedback systems.

6) Continuation of the development of technical problems of effective utilization of magnetic fields, the use of cryogenic windings, and placement of windings in the vacuum chamber. The development of hypothetical reactors based on stellarators.

O. N. Krokhin. Use of Lasers for Plasma Heating

High-power pulsed laser make it possible to obtain high rates of energy release in a dense plasma, and can therefore be used for effective heating of plasma to thermonuclear temperatures. The most unpleasant factor when attempts are made to use lasers for thermonuclear fusion is the low efficiency of laser devices, on the order of 0.2—0.3%. This circumstance makes it practically impossible to obtain a positive yield by direct heating of a certain plasma region with a light pulse (unless, of course, the laser efficiency is increased in the future). The only method of obtaining energy gain is therefore, apparently, to use the regime of "thermonuclear burning" of the medium, in which the laser serves to produce suitable initial conditions. In other words, this means that since the optical energy is expensive, it is necessary to study, during the first stage, the possibility of obtaining sufficiently large energy gains in a plasma heated by laser radiation.

Calculations show that at least two procedures are promising: the use of the regime of inertial "self-containment" and cumulative effects. In the former case the criterion $nt = 10^{14}$ can be satisfied at a plasma temperature 8—10 keV, which is attained at a laser-pulse energy $\sim 10^5$ J/mm^2 on the surface of solid deuterium—tritium, and at a pulse duration 10^{-9} sec. This regime can apparently not result in an appreciable energy gain, but can probably be improved using a special experimental geometry that allows the plasma to be kept from expanding during a much longer time than the "self-containment" time.

The main results were published in Vestnik AN SSSR No. 6, 1970 (article "Use of Lasers for Thermonuclear Fusion") by N. G. Basov and O. N. Krokhin).

Translated by J. G. Adashko