Fig. 1. Diagram of the experimental set-up: (1) electron gun; (2) collector; (3) resonator.

The energy of the injected electrons could be varied 1-2 Kev. Magnetic field H_0 between the stoppers was between 200-300 gauss. Experiment showed it was sufficient to have H_m/H_0 = 2-3. Space modulation was achieved by a system of opposing coils. L was 5-7 cm, number of periods n = 5. The modulating magnetic field was 20-30 gauss; the vacuum chamber was 9 cm diam; the distance between the stoppers, 100 cm. The electron gun was producing a tubular electron beam 3.0 cm diam, and the electron current could reach 100 ma. Working pressure in the system was maintained at 2.10^{-6} mm Hg. The authors detected accumulation of electrons by shift in resonant frequency of the measuring space resonator in Fig. 1. A 10^{10} cm^3 electron density was measured at a pressure of 10^{-5} mm

Hg of hydrogen in the chamber. Charges were trapped only when condition (2) was satisfied. Figure 2 shows the relation between space-charge potential and magnitude of the injection current.

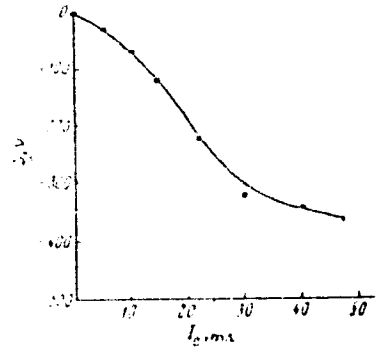

Fig. 2. Relation between potential at a distance of 2.5 cm from axis and magnitude of injected current. P = $2 \cdot 10^{-6}$ mm Hg.

The authors also measured potential along axis of the system by a probing electron beam modulated at 200 c/sec for easier detection, and potential was deduced from the beam energy necessary to get it through the trap to the collector. Results along the axis agree with Fig. 2. The negative space charge accumulated in the trap can be used as a potential well for ions, and Fig. 4 shows decrease of negative potential because of filling of the well by positive ions.

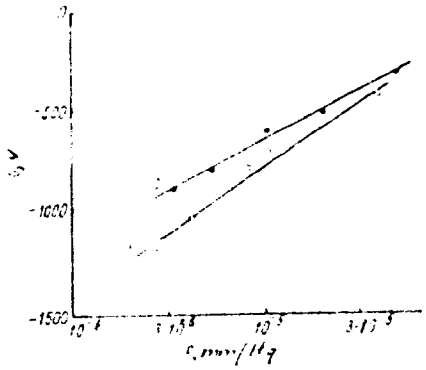

Fig. 4. Decrease of negative potential along axis of the trap with increase in the hydrogen pressure in it, I_0 = 75 ma. (1) U_0 = 1,500 v; (2) U_0 = 2,000 v.

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The electron beam probe was also used to measure radial component of the noncompensated space charge field because of electron plasma. The effect of beam drift in crossed E_r and H_o field was observed by a fluorescent screen placed inside the trap. Figure 5 shows that the radial field component builds to considerable magnitude. It is, however, difficult to explain the trapping mechanism for the particles. The injected electrons should be showed down by the space charge field and should, therefore, come out of phase with the magnetic field of the system. At the same time, experiment showed space modulation of magnetic field continues to play an important role; in absence of that field plasma disappears. The authors conclude that their notions about the trapping mechanism based on analysis of the single-particle motion are completely inadequate and additional investigations are needed before one could explain the influence of a space modulated magnetic field on a partially non-compensated plasma. The presence of crossed electric

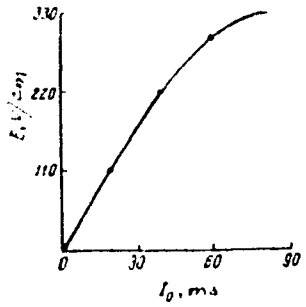

Fig. 5. Average value of radial component of space charge field of plasma in the trap at a distance of 2.5 cm from axis as function of injection current. Field was measured through asymuthal drift of probing beam. $P=3\cdot10^{-6}$ mm Hg.

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SOV/57-30-3-3/15

and magnetic fields seems to create conditions for the generation of particles resulting from the ionization of the gas by the electron beam. These particles may acquire energies in the mentioned fields comparable to those of the injected electrons. Using the system described in the present paper the authors hope it is possible to investigate properties of a partially noncompensated, fairly hot plasma. There are 5 figures; and 4 Soviet references.

ASSOCIATION: Physico-Technical Institut AS UkrSSR, Khar'kov
(Fiziko-tekhnicheskiy institut AN USSR, Khar'kov)

SUBMITTED: October 27, 1959

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9.3150, 24.2120

77832
SOV/57-30-3-5/15

AUTHORS: Sinel'nikov, K. D., Tolok, V. T., Nazarov, N. I., Bakayev, I. I., Babarev, V. A., Brody, Yu. F.

TITLE: Investigations of Ion Cyclotron Resonance in a Dense Plasma

PERIODICAL: Zhurnal tekhnicheskoy fiziki, 1960, Vol 30, Nr 3, pp 283-288 (USSR)

ABSTRACT: The heating up of plasma under ion cyclotron resonance, where the ions acquire directly the energy of the electric field, is a process which one could hope to utilize for attaining high ionic temperatures. Theory developed by Stix (see ref) indicated that at plasma densities of 10^{14} cm^{3} and more, one could generate and thermalize so-called ion cyclotron waves. The authors, therefore, investigated the ion cyclotron resonance in hydrogen plasmas of density 10^{12}-10^{14} cm^{3} under impulse conditions, using a device described on Fig. 1.

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In a Dense Plasma

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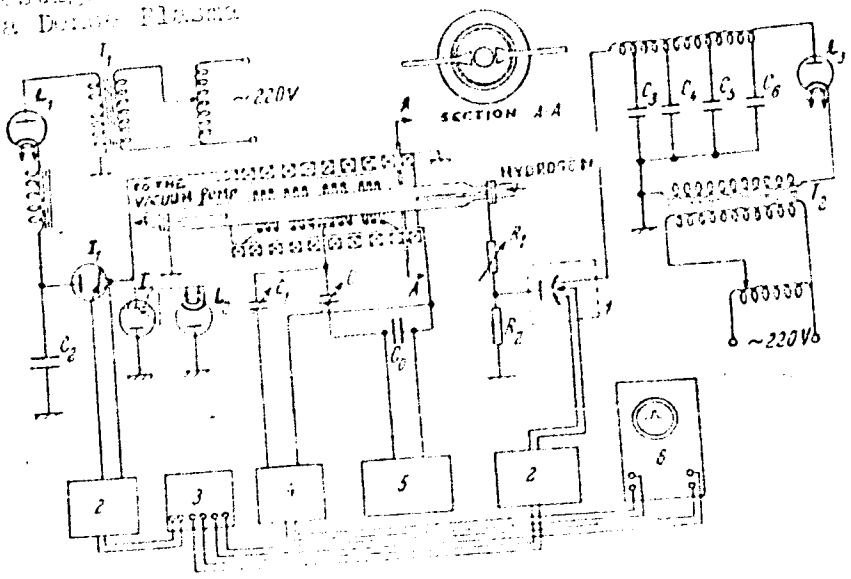

Fig. 1.
See caption on Card 3/11.

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Caption to Fig. 1. Diagram of the experimental setup: (1) discharge tube; (2) triggering device; (3) triggering scheme; (4) detector; (5) generator of 10 mc; (6) oscillograph ENO-1.

A straight discharge represents the source of the plasma inside a 60-cm-long tube, 6 cm in diam. The discharge was generated by means of 800 μsec square potential impulses. Discharge current could go up to 500 a and was regulated by means of ballast resistance R_1.

The discharge tube was along the axis of a 70-cm-long solenoid, 20 cm in diam. Its magnetic field reached the maximum value up to 10^4 oersted in $4.7 \cdot 10^{-3}$ sec. The coil was fed by means of a battery of condensers with a maximum stored energy of 40,000 joules at potentials up to 5 kv. The uniformity of the magnetic field over a length of 45 cm was not worse than 1%. Four sections of three-turn each, connected in antiphase, served as

Investigations of Ion Cyclotron Resonance in a Dense Plasma

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SOV/57-30-3-5/15

the coil for introducing the high-frequency power into the plasma. Axial periodicity of the electromagnetic wave was 11 cm. The inductivity (1 μH) of the coil together with the C and C_o capacitance constituted a resonance circuit with a Q-factor of 270, and was driven by a 1 kw generator supplying a continuous range of 6-12 mc oscillations. Ion cyclotron resonance was observed through the change in potential across the resonant circuit which was transmitted through the capacitance C to a germanium detector, and then to the amplifier of the vertical deflections of the oscillograph EN0-1. The triggering circuit enabled a buildup of the discharge at all values of the magnetic field. Density of the plasma was deduced by L. A. Dushin and V. I. Konenko from the condition of transmission of millimeter waves. Tests showed that the relation between the resonant peak and the generator frequency follows the law $\omega_{ci} = eH/me$ for plasma densities $n \leqslant 10^{12}$ cm^{-3}.

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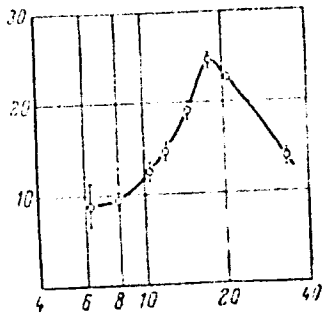
Figures 3 and 4 show that the optimum conditions for absorption of the high frequency power by the plasma are determined by the density of the neutral and charged particles. Measurements of the half-widths of the resonant curves show strong interactions between the accelerated ions and neutral atoms.



Card 5/11 Fig. 3. (Caption on Card 6/11)

Fig. 3. Resonant absorption of h-f power versus hydrogen pressure at constant discharge current. The abscissa represents pressure in μ Hg; the ordinate shows amplitude of resonant absorption in relative units.

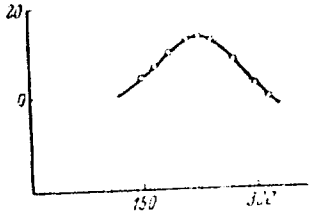


Fig. 4. Resonant absorption of h-f power versus discharge current in hydrogen at 7.5 μ Hg pressure. The abscissa represents current in amperes; the ordinate is same as on Fig. 3.

Similar results were obtained by Dubova and others (results to be published in Atomnaya energiya) at FTI AN USSR (FTI AS UkrSSR) investigating the cyclotron resonance under stationary conditions in a PIG source of plasma, fed by means of a generator of a few hundredths of a milliwatt. That work showed also that the Coulomb collisions have little influence on the consumption of energy by resonant ions. The authors investigated also the relationship between the power absorption and frequency, the displacement of the resonant peak and the intensity of the discharge current, and the relationship between the resonant absorption of the power and the time after the discharge current was cut off (see Fig. 2). Since this time is related to the density of the plasma, the curve testifies that there exists an optimum density of the plasma for absorption of power.

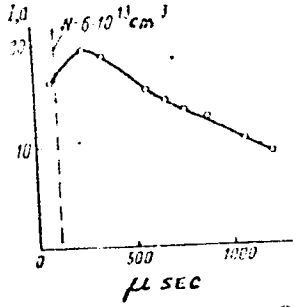


Fig. 9. Resonant absorption of h-f power versus time after cutting off discharge current. Pressure 15 μ Hg; discharge current 250 a.

At densities higher than the optimum one, the authors suspect that a kind of h-f field screening effect of the plasma occurs. The authors also observed that with the increase of plasma density, an asymmetry of the resonant absorption peak appears

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in a Dense Plasma

[illegible] with a higher resonance
[illegible] explain this anomaly by an escape of a
part of the r-f power into the generation of ionic
[illegible] a general
[illegible] theory cannot be
[illegible] does not
[illegible] theory.
[illegible] some of the data.
[illegible] absorption at an
[illegible], while the ex-
[illegible]. Similar results
[illegible] the asymmetry of the peak which
agree with the results of the oscillator V-69. The
authors, therefore, conclude that the r-f power
[illegible] into a plasma with densities above
[illegible]. It is of paramount importance to confirm un-
[illegible], by experiment, the existence of ionic
[illegible] and the possibility of their
[illegible] which is used to produce answers

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Investigations [illegible] in a Dense Plasma

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[illegible] possible to heat plasmas with densities [illegible]. The authors note that there also [illegible] possibilities for keeping the parameter

$\gamma \sim \frac{\lambda}{T_i}$ [illegible], and [illegible] achieving plasma

heating [illegible] plasma densities. Here λ - length [illegible] of the excitation coil; T_i - ion

temperature. While the dependence on T_i is quite [illegible], a reduction of λ by a half allows the increase of density [illegible] order of magnitude. In addition, [illegible] λ corresponds to a larger h-f power absorption W, since $W \sim 1/\lambda^2$. The reduction of λ

[illegible], therefore, a very attractive possibility, and the authors consider it a matter of expediency to [illegible] investigation of this problem. There are [illegible] figures and [illegible] references, [illegible] Soviet, [illegible] U.S. [illegible] K. S. W. Champion.

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Investigations of Ion Cyclotron Resonance in a Dense Plasma

77839
SOV/57-30-3-5/15

Proc. Phys. Soc., 70, 446 B, 212, 1957; T. N. Stix, R. W. Palladino, Proc of 1958 Gen. Conf. A (15, p 360); T. N. Stix, Proc. of 1958 Gen. Conf. A (15, p 361).

ASSOCIATION: Physico-Technical Institute AS UkrSSR, Khar'kov (Fiziko-tekhnicheskiy institut AN USSR, Khar'kov)

SUBMITTED: October 22, 1959

Card 11/11

SINELNIKOV, K. D., AMONENKO, V. M., TIKHINSKIY, G. F. and IVANOV, V. YE.

"Some Properties of Pure Beryllium."

Report presented (by V. Ye., Ivanov) at the Atomic Energy Research Establishment Harwell UK August 1961

Physical-Technical Institute, Academy of Sciences, Ukrainian SSR

S/058/63/000/001/015/120
A062/A101

AUTHORS: Shel'nikov, K. D., Grishayev, I. A., Grizhko, V. M., Pisun, A. N., Zykov, A. I., Kitayevskiy, L. Kh.

TITLE: A 30 MeV energy linear travelling-wave electron accelerator

PERIODICAL: Referativnyy zhurnal, Fizika, no. 1, 1963, 39 - 40, abstract 1A374 (In collection: "Elektron. uskoriteli." Tomsk, Tomskiy un-t, 1961, 3 - 9)

TEXT: The authors describe a 30 MeV linear electron accelerator designed at the Physico-technical Institute of the Academy of Sciences of the Ukrainian SSR. The accelerator consists of two sections connected with each other - the buncher section and the main section (with a constant wave phase speed); the length of the main section is 2.8 m, the value ka = 2.48 (k - wave vector, a - [illegible] radius). The two sections are energized by one klystron power amplifier, modified by a magnetron generator. The power dissipated in the main section and in the output load is 16 Mw (in the load 3.3 Mw); the field intensity is [illegible] MV/m. The accelerating system is composed of separate resonators; the

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S/057/61/031/002/014/015
B124/B202

26.2311

AUTHORS: Nazarov, N. I., Yermakov, A. I., Tolok, V. T., and Sinel'nikov, K. D.

TITLE: Propagation of ion cyclotron waves in a plasma

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 2, 1961, 254-255

TEXT: The experiments were made by means of a device similar to that described in Ref. 1. Gas discharge took place in a 1.6 m long glass tube with a diameter of 60 mm, in an axially magnetic field with a field intensity of up to 15 kilooersteds. The magnetic field attained its maximum value within 10^{-2} sec, it dropped by 2.7 times within $8 \cdot 10^{-2}$ sec. Hydrogen in the pressure range from 10^{-4} to 10^{-2} mm Hg served as working gas. The high-frequency energy was fed into the plasma by means of an induction coil usually used in cyclotron heating. It consisted of six parts connected in phase opposition. The axial periodicity of the h.f. magnetic field in the coil was 16 cm. The load current circuit consisting of this coil and vacuum condensers had the quality factor 310. The current circuit

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was fed by an h.f. generator with quartz stabilization and a power of 80 kw. The duration of pulses varied between 10^{-5} and 10^{-2} sec, the working frequency of the generator varied from 3 to 30 Mcps. The absorption of the h.f. power by the plasma in the region of ion-cyclotron resonance was determined by measuring the voltage in the current circuit as well as from the change of the electron density during discharge, and from the intensity of the hydrogen spectral line Hβ. With given parameters of the h.f. current circuit about 5 kw were introduced into the plasma in the region of ion-cyclotron resonance. Owing to the resulting high degree of ionization of the gas no plasma formation by direct electrode discharge was necessary. In this case, experiments could be made also at low hydrogen pressures (up to $2 \cdot 10^{-4}$ mm Hg). The upper curve in Fig. 1 shows the change of load of the h.f. current circuit in the region of ion-cyclotron resonance, the lower curve shows the intensity of the Hβ line. The duration of pulses of the h.f. generator is about 3 msec. After 0.5 msec hydrogen is intensively ionized. The upper curve of Fig. 2 shows a curve analogous to that in Table 1, the lower one shows the curve of the amplitude change of the h.f. (wave) signal at the electrode. The signal occurred only when the h.f. current circuit was loaded in the region of

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ion-cyclotron waves. Both figures show that the amplitude of the wave signal at the probe mainly depends on the degree of plasma ionization. The results obtained prove the penetration of h.f. energy into the plasma in the form of ion-cyclotron waves. The mentioned data also prove the results of the experiments of T. Stiks et al. in the stellarators B-65 (V-65) and B-66 (V-66) (Refs. 2, 3). Besides, also waves shorter than the cyclotron waves were observed in the magnetic fields. The working pressure in this case was 10^{-3} mm Hg. Under the experimental conditions of the authors such waves were observed only at pressures exceeding $8 \cdot 10^{-3}$ mm Hg. Their occurrence has hitherto not been explained. There are 2 figures and 3 Soviet-bloc references.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN USSR, Khar'kov (Institute of Physics and Technology of the AS UkrSSR, Khar'kov)

SUBMITTED: September 10, 1960

Card 3/4

89168

89169

S/057/61/031/002/015/015
B124/B202

26.2321

AUTHORS: Volkov, Ya. F., Tolok, V. T., and Sinel'nikov, K. D.

TITLE: Study of the electrodeless discharge in a magnetic trap with additional azimuthal magnetic field

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 2, 1961, 255-258

TEXT: The plasma can be heated by a fast magnetic trap. In such a system, the diameter of the plasma cylinder is shortened during compression, which leads to a looser connection between coil and plasma in experiments of plasma heating by means of ion-cyclotron resonance. The presence of an initial magnetic field H_φ may prevent a strong shortening of the radius of the plasma cylinder without changing the degree of compression. Experiments were made with the field H_φ to obtain a hollow plasma cylinder and to explain the interaction between the plasma and such a system of magnetic fields. The authors also studied gamma radiation which almost always accompanies such discharges. The discharge of two condenser batteries caused the formation of a three-phase field with the voltage E_{φ_1} = 30 v/cm, E_{φ_2} = 3v/cm with a period of 20 and 270 msec, respectively, with an axial

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Study of the electrodeless...

magnetic field intensity $H_z = 5$ koe and a mirror ratio of 2:1. A further condenser battery was discharged above a rod which lies in the axis of the system thus producing a field $H\varphi$; discharge current $I = 20$ ka. Fig. 2,a,b,v, g shows the "SFR-graphs" in argon, which indicate that $H\varphi$ causes no plasma compression; the plasma exists in the form of two coaxial cylinders one of them bordering the rod (Fig. 2,a,b). The drift along the axis Z (Fig. 2, v,g) is caused by the force acting upon the ions as a result of their motion relative to the axis in the field $H\varphi$. With changed sign of $H\varphi$ also the direction of drift is reversed. The same holds for the hydrogen plasma. X-radiation was studied under the following conditions: 1) Anti-parallel connection of coils without occurrence of gamma radiation; 2) parallel connection of coils in the presence of $H\varphi$; under these conditions gamma radiation had an energy of about 50 kev and a mean intensity of 20 mr/discharge. Gamma radiation was observed in argon in the pressure range $p = 5 \cdot 10^{-4} - 5 \cdot 10^{-3}$ mm Hg and in hydrogen at $p = 2 \cdot 10^{-3} - 3 \cdot 10^{-2}$ mm Hg. Fig. 3,a,b shows the oscillograms of the magnetic field, the shf signal ($\lambda = 4$ mm), and of gamma radiation. By means of a lead collimator the author shows that radiation in the region

Study of the electrodeless...

of the minimum of the magnetic field occurs between the mirrors. With $E_{\varphi 2}$ = 3 v/cm no gamma radiation occurs independently of the other conditions; 3) parallel connection of the coils in the presence of H_φ. The presence of H_φ changes the character of gamma radiation; the energy increases up to about 100 kev; the pressure region in which gamma radiation is formed is shifted to the high-vacuum by one order of magnitude; with increasing H_φ gamma radiation occurs every half period beginning with the formation of the plasma. The intensity of gamma radiation increases and amounts to approximately 2.5 r/discharge. The photography of discharge in X-rays shows that the emission from the rod has its origin in the region between the mirrors. The glass tube which is inserted parallel to the rod at a distance of 1 cm reduces radiation intensity by 7-10 times. Fig. 3,v shows the oscillograms of radiation and the field H_z in the presence of H_φ. There are 2 figures and 1 Soviet-bloc reference.

SUBMITTED: September 10, 1960

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89169

SINEL'NIKOV, K.D.; SAFRONOV, B.G.; AZOVSKIY, Yu.S.; ASEYEV, G.G.; VOYTSENYA, V.S.

Studying the magnetic properties of a plasma behind a strong shock wave front. Zhur.tekh.fiz. 31 no.8:893-898 Ag '61. (MIRA 14:8)

1. Fiziko-tekhnicheskiy institut AN USSR, Khar'kov.
(Plasma (Ionized gases)--Magnetic properties)
(Shock waves)

SINEL'NIKOV, K.D., akademik, otv. red.; LABINOVA, N.M., red.; LIBERMAN, T.R., tekhn. red.

[Reports on plasma physics and problems of controlled thermonuclear synthesis] Fizika plazmy i problemy upravliaemogo termoiadernogo sinteza; doklady. Kiev, Izd-vo Akad. nauk USSR, 1962. 175 p. (MIRA 15:6)

1. Konferentsiya po fizike plazmy i probleme upravlyayemykh termoyadernykh reaktsiy. 1st, Kharkov, 1959. 2. Akademiya nauk USSR (for Sinel'nikov).
(Plasma (Ionized gases)) (Thermonuclear reactions)

SINEL'NIKOV, K.D., akademik, otv. red.; LARIONOVA, N.M., red.; LIBERMAN, T.R., tekhn. red.

[Plasma physics and the problems of controlled thermonuclear synthesis; reports]Fizika plazmy i problemy upravliaemogo termoiadernogo sinteza; doklady. Kiev, Izd-vo Akad. nauk USSR, 1962. 175 p. (MIRA 15:10)

1. Konferentsiya po fizike plazmy i probleme upravlyayemykh termoyadernykh reaktsiy. 1st, Kharkov, 1959. 2. Akademiya nauk Ukrainskoy SSR (for Sinel'nikov).
(Plasma (Ionized gases)) (Thermonuclear reactions)

S/781/62/000/000/019/036

AUTHORS: Sinel'nikov, K. D., Safronov B. G., Azovskiy Yu. S., Aseyev, G. G., Voytsenya V. S.

TITLE: Study of magnetic properties of a plasma behind the front of a strong shock wave

SOURCE: Fizika plazmy i problemy upravlyayemogo termoyadernogo sinteza; doklady I konferentsii po fizike plazmy i probleme upravlyayemykh termoyadernykh reaktsiy. Fiz.-tekh. inst. AN Ukr. SSR. Kiev, Izd-vo AN Ukr. SSR, 1962. 86-92

TEXT: The scope of the investigation is similar to that of Shao, Resler, and Kantorowitz (ref. 3: J. Appl. Phys. 26, 95 (1955), except that the shock waves under consideration are stronger (with Mach number closto 50 rather than the upper limit of 17 in the cited paper). The experimental setup consisted of a shock tube with conical shock-wave source made of organic glass, placed in a solenoid which could be so set as to make the shock wave travel in a homogeneous or inhomogeneous magnetic field. The change in magnetic field connected with the passage of the shock wave was registered with a magnetic probe, and the velocity of the shock

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wave in the probe region was registered with two photomultipliers whose entrance slits were spaced 5-6 cm apart. The principal measurements were made in air at an initial pressure 0.2 mm Hg, It was found during the course of the experiments that the magnetic probes had a higher resolution than the photomultipliers.

Figures are presented showing oscillograms of the probe and photomultiplier signals, the dependence of the probe signal amplitude on the magnetic wave and on the velocity of the shock wave, and the emf induced in the probe when a plasma disc moves in a magnetic field relative to the probe.

The principal conclusions are that in the case of strong shock waves the distribution of the conductivity behind the front of the shock wave cannot be determined with the aid of this procedure, inasmuch as the half-width of the conductivity zone behind the front of the shock wave greatly decreases with increasing Mach number. In the case of the work of Shao et al, this procedure can be used, but the results must be approached with caution, since only the eddy currents were taken into account and thermal diamagnetism was completely ignored. Certain preliminary experiments were also made to determine the polarization of the plasma behind the front of the shock wave, showing that when a shock wave

moves in a homogeneous transverse field it becomes polarized in a plane perpendicular to the magnetic field. Attempts to measure the polarization voltage as a function of the magnetic field intensity have led to values only half as large as the theoretical voltage, and the reason for this is not yet clear. There are seven figures and four references, all to Western literature.

S/861/62/000/000/005/022
B125/B102

AUTHORS: Sinel'nikov, K. D., Zeydlits, P. M., Nekrashevich, A. M., Shutskever, Ya. S. (Deceased), Akhiyezer, A. I., Faynberg, Ya. B., Lyubarskiy, G. Ya.

TITLE: The physical bases of the injector of the 10-Bev proton synchrotron

SOURCE: Teoriya i raschet lineynykh uskoriteley, sbornik statey. Fiz.-tekhn. inst. AN USSR. Ed. by T. V. Kukoleva. Moscow, Gosatomizdat, 1962, 94 - 108

TEXT: The linear accelerator discussed here is the injector of the proton synchrotron of the OIYaI. It furnishes a strong flux of accelerated particles in short pulses. The pulses are separated by relatively long intervals of time. The resonator, containing screening tubes, excites standing waves. It needs only a relatively small r-f power and it allows of synchronizing several generators feeding the accelerator. Simultaneous phase stability and radial stability of the accelerated bunch is achieved with the screening tubes and nets. The injection energy is 600 kev and the synchronous phase 20°. The generator wave length is 215 cm, the periods of

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The physical bases of the...

the accelerator have the length $L_k = c\beta_k T$, where $T = \lambda/c$, and the mean effective field strength in all the gaps of the resonator is 19.9 kv/cm. The phase focusing effect is accompanied by radial defocusing. The critical phase $\varphi_{s\ max}$ lies between 54° and 71°; in the present case, $\varphi_{s\ max} > 2\varphi_s$. The utilization factor of the current injected should be increased by inserting a clystron-type buncher between injector and injecting accelerator. During one period of the r-f oscillations, the energies absorbed by a particle of phase φ and by the synchronous particle are different. The first term of the final particle energy at the accelerator output is the energy calculated, and the second term is the deviation from it. The relative energy spread is $0.3 \cdot 10^{-2}$ in the case considered here. Supplementary investigations are necessary to determine the spread in energy due to radial oscillations; in particular, the way the accelerating field E_z depends on the radius must be studied. The capture angle calculated for $\varphi_s = 20°$ has a minimum at $\varphi = 30°$. Currents of less than 10 ma have but little effect on capture during acceleration. Furthermore, the effect of the space charge on the radial stability of the accelerator discussed here is insignificant. The angle of

The physical bases of the...

divergence of the emitted bunch is about 0.15°, while its radius is 3 cm at the most. This paper was written in 1952. There is 1 figure.

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44875

S/861/62/000/000/006/022
B125/B102

AUTHORS: Sinel'nikov, K. D., Faynberg, Ya. B., Zeydlits, P. M.

TITLE: A possible modification of the linear and cyclic methods of acceleration

SOURCE: Teoriya i raschet lineynykh uskoriteley, sbornik statey. Fiz.-tekhn. inst. AN USSR. Ed. by T. V. Kukoleva. Moscow, Gosatomizdat, 1962, 109 - 113

TEXT: A type of accelerator combining the advantages of cyclic and linear accelerators is discussed. It is a linear accelerator bent to a nonclosed ring or another non-closed curve. The accelerated particles are kept in their trajectories of constant or variable radius by a magnetic field. Radial and axial stability is attained in the way customary for cyclic accelerators. Phase stability can be achieved using the dependence of the revolution period of the accelerated particles on their frequency. High energies can be attained in systems of large radius and comparatively moderate field strength ($\sim$1 kgauss for 1 Bev). The condition of phase stability is $\Omega_\varphi^2 = eV\omega_H^2 N^2 k/\varepsilon_s$ where Ω_φ is the frequency of the phase

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A possible modification of the...

oscillations and N is the number of the periods of the linear accelerator. The frequency of the generator can be kept constant by varying the structural period of the linear accelerator. The advantages of such accelerators are simplicity of injecting and extracting particles, considerable increase of the beam current, constancy of the generator frequency and of the magnetic field strength. The energy gained per revolution is of the same order of magnitude as the total energy. The magnetic field is a function of radius and angle. When the quasistationarity condition $\Omega_\varphi^2/\omega_H^2 \ll 1$ is fulfilled and when the magnetic field strength and the number N of the periods of the accelerating system vary slowly, $\omega_r = N\omega_H$ is the condition of synchronism between particle and wave. The generator frequency, therefore, is significantly higher than the revolution frequency of the particle. The radial deviations Δr_1 for radial-phase oscillations and Δr_2 for free radial oscillations can be diminished significantly to Δr_1 = 1-6 cm and Δr_2 = 1-5 cm. Rather large variations in momentum and in amplitude of the phase oscillations then correspond to small radial variations. Near the end of acceleration, the amplitude of the radial oscillations decreases by

Card 2/3

34217
S/057/62/032/002/019/022
B124/B102

24.6730

AUTHORS: Tolok, V. T., and Sinel'nikov, K. D.

TITLE: A feasible method for plasma injection into closed magnetic traps

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 32, no. 2, 1962, 248 - 249

TEXT: The injection of plasma into a stellarator system is performed in two steps, i. e., introduction (Fig. 1) and forcing through (Fig. 2). Single-turn coil 1 induces an alternating magnetic field $H_{\sim}$ which, if directed opposite to the basic field H_o, leads to the formation of a system of opposed magnetic fields having two annular slits in the basic retarding magnetic field. In order to eliminate the action of turn 1 on coil 2, which produce the basic field H_o, the latter are equipped with metallic shields. Plasma injection is performed through the annular slits. When the sign of $H_{\sim}$ is changed, the slits disappear, and magnetic pressure on the plasma is increased to $\leq \frac{(H_o + H_{\sim})^2}{8\pi}$, whereby the plasma is forced through

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SINEL'NIKOV, K.D.

37256
S/057/62/032/005/003/022
B102/B104

24.6714 (3423)
24.6740

AUTHORS: Nazarov, N. I., Yermakov, A. I., Lobko, A. S., Bondarev, V. A., Tolok, V. T., and Sinel'nikov, K. D.

TITLE: Examination of ionic cyclotron waves

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 32, no. 5, 1962, 536-540

TEXT: The authors continued previous experiments (ZhTF, 31, 254, 1961) on the excitation and propagation of ionic cyclotron waves. In an apparatus schematically shown in Fig. 1, a powerful h-f discharge in hydrogen and deuterium was studied in a range near ionic cyclotron resonance, and the conditions of forced resonance excitation of ionic cyclotron waves and of their propagation along the magnetic field were determined. Polarization and attenuation of these waves was also measured. The discharge took place in a tube of molybdenum glass (2 m long, 60 mm thick) arranged in a solenoid which created a quasi-constant magnetic field. The arrangement was such that two field regions were present: one for resonance excitation and another for the damping of the ionic cyclotron waves. The overall length of the coil was

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S/057/62/032/005/003/022
B102/B104

Examination of ionic cyclotron waves

1.5 m. The field was created by discharging a capacitor bank with a total capacity of $2.25 \cdot 10^{-2}$ f, which could be charged up to 5 kv. The field reached 20-25 kilogauss within 5 msec. The exciting electromagnetic field had a wavelength of 16 cm. The resonance circuit had a quality factor of 400 with an 80-kw generator (3-30 Mc/sec), and the maximum voltage in the circuit was 30 kv. Hydrogen of 10^{-2}-10^{-4} mm Hg was blown through the evacuated (1.10^{-6} mm Hg) discharge tube, and after a long-time aging of the system with h-f discharges, voltage and probe-signal oscillograms were recorded. At the moment of resonance load, the generated wave starts traveling along the constant magnetic field. Its magnetic-field distribution and phase variation along the field were measured (Figs. 5, 6). The wave was found to be circularly polarized; the polarization vector rotated in the same sense as did the free ion in the magnetic field. The damping process was studied with waves traveling in a region of magnetic fields equal to that of the cyclotron waves. Damping was found to set in only at a certain distance with various field geometries, which cannot be attributed to collision damping only. At $H = H_{cyclotron}$, cyclotron damping becomes more effective. There are

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S/057/62/032/005/003/022
B102/B104

Examination of ionic cyclotron waves

8 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN USSR (Physicotechnical Institute AS UkrSSR) Khar'kov

SUBMITTED: June 3, 1961

Card 3/5

41565

S/057/62/032/010/003/010
B104/B102

AUTHORS: Zykov, V. C., Il'yenko, B. P., Lats'ko, Ye. M., Stepanenko, I. A., Ternopol, A. M., Tolok, V. T., and Sinel'nikov, K. D.

TITLE: Investigation into the properties of magnetic surfaces in systems with a helical magnetic field

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 32, no. 10, 1962, 1190-1196

TEXT: The shapes of the magnetic surfaces in systems with stabilizing helical windings were studied by the method of the preceding electron beam, developed by P. V. Karmanov and P. A. Cherenkykh at the Institut atomnoy energii im. I. V. Kurchatova (Institute of Atomic Energy imeni I. V. Kurchatov) and by injecting plasma clouds into a right cylinder with a three-turn coil, or by injecting them into the curvilinear section of a stellarator model. In the experiments with the preceding electron beam a fluorescent screen was used in the right cylinder (Fig. 1); in the experiments with the plasma clouds special targets were used, superficially charged by the plasma particles. If no current flows in the helical windings, the electron beam forms concentric circles on the fluorescent

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Investigation into ...

screen. As the amperage in the helical winding increases, the circles degenerate to triangles, whose sides later bend inward. The largest and smallest radii of the separatrices measured as functions of I_{hel}/H_z, and the distortions of the magnetic surfaces caused by deviations of the magnetic axis from the geometric axis, are in agreement with theoretical results. The cross sections of the plasma clouds were studied as functions of I_{hel}/H_z in clouds completely filling the cross section of the tube, and in clouds partially screened by diaphragms. In the former case two types of particles were distinguished, one type remaining trapped in the central part of the cloud bounded by a separatrix, the other escaping from the confinement region. In the second case all plasma particles remained in the confinement region if the radius of the separatrix exceeded that of the clouds, but if it was smaller the same result was obtained as in the first case. The separatrix is a function of the confining induction and of the amperage in the helical windings. This agrees with the theory. The magnetic surfaces in the curvilinear chamber of a stellarator model was studied by the same methods, yielding practically the same results with the electron beam as those obtained with the right cylinder. It is only in the

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S/057/62/032/010/003/010
B104/B102

Investigation into ...

initial stage of the discharge that the electrons escape to the copper-walls of the vacuum chamber (diameter 80 mm) which was shaped as a semi-tore (mean radius of curvature 42 cm). It is concluded that at low velocities and small densities the plasma particles move along the lines of the magnetic field. There are 8 figures.

SUBMITTED: November 29, 1961

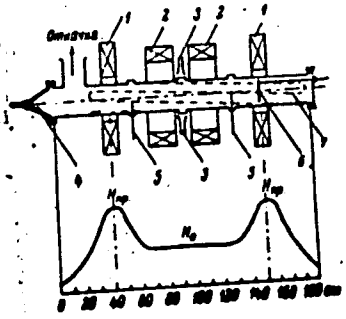

Fig. 1. Experimental arrangement (right cylinder).
Legend: (1) coils producing the magnetic mirror field; (2) coils producing the main field; (3) mouthpiece for 3-cm waves; (4) conic plasma gun; (5) electric probes; (6) fluorescent screen; (7) helical winding.

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SINEL'NIKOV, K.D., akademik, otv. red.

[Plasma physics and problems of controlled thermonuclear synthesis; reports] Fizika plazmy i problemy upravliaemogo termoiadernogo sinteza; doklady. Kiev, Izd-vo AN USSR, 1963. 366 p. (MIRA 17:5)

1. Konferentsiya po fizike plazmy i problemam upravlyayemogo termoyadernogo sinteza. 3d, Kharkov, 1962. 2. Akademiya nauk Ukr.SSR.

SINEL'NIKOV, K.D., akademik, otv.red.; KADASHEVICH, O.A., tekhn.red.

[Reports of the Conference on Plasma Physics and the Problem of Controlled Thermonuclear Synthesis] Doklady Vtoroi konferentsii po fizike plazmy i probleme upravliaemogo termoiadernogo sinteza. Kiev, Izd-vo Akad.nauk USSR. No.2. 1963. 343 p. (MIRA 16:7)

1. Konferentsiya po fizike plazmy i probleme upravlyayemogo termoyadernogo sinteza. 2d, Kharkov, 1960.
(Plasma (Ionized gases))
(Thermonuclear reactions)

ACCESSION NR: AT4036054 S/2781/63/000/003/0164/0168

AUTHORS: Nazarov, N. I.; Yermakov, A. I.; Tolok, V. T.; Sinel'nikov, K. D.

TITLE: Investigation of instability in the cyclotron method of plasma heating

SOURCE: Konferentsiya po fizike plasmy* i problemam upravlyayemogo termoyadernogo sinteza. 3d, Kharkov, 1962. Fizika plazmy* i problemy* upravlyayemogo termoyadernogo sinteza (Plasma physics and problems of controlled thermonuclear synthesis); doklady* konferentsii, no. 3, Kiev, Izd-vo AN UkrSSR, 1963, 164-168

TOPIC TAGS: cyclotron resonance phenomena, plasma instability, plasma heating, plasma ion oscillation, plasma decay, microwave plasma, gyromagnetic resonance

ABSTRACT: To clarify the question of the effectiveness of plasma heating by ion cyclotron waves and to study the influence of the

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level of the high-frequency power on the plasma heating in the ion gyroresonance region, an experiment was performed with a setup described in detail elsewhere (ZhTF v. 32, No. 5, 1962). The results of the tests indicate that there exist two distinctly different modes of plasma behavior, one in which the plasma exists for a relatively long time, and one in which the plasma begins to decay even before the termination of the high-frequency power pulse. A radical decrease in the lifetime of the plasma occurs at a definite critical power level supplied to the plasma, and the smaller the pressure the smaller the critical power. The critical power depends on the cleanliness of the system and increases for a poorly preconditioned system. This dependence on the pressure and on the purity of the system suggests that the observed instability is due to the appearance of ion currents with large directional velocities. At the present time the nature of the observed instability cannot be reconciled with the existing theory. "In conclusion the authors thank Ya. B. Faynberg and V. I. Kurilko for interest in the work and for a

ACCESSION NR: AT4036054

discussion of the results, and also A. L. Lobko, V. A. Bondarev, and Ye. S. Khokhlov for help with the experiment. Orig. art. has: 5 figures.

ASSOCIATION: None

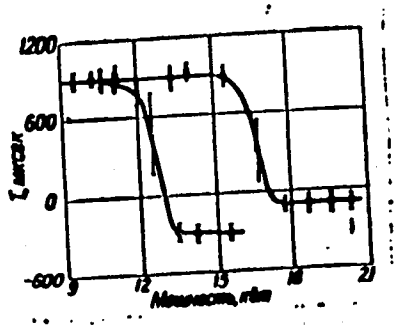
SUBMITTED: 00 DATE ACQ: 21May64 ENCL: 02

SUB CODE: ME NR REF SOV: 003 OTHER: 002

Card 3/5

ENCLOSURE: 01

ACCESSION NR: AT4036054



Dependence of the lifetime τ of a plasma with n ~ 1.2 x 10^{12} cm^{-3} after termination of the high-frequency pulse, on the power, for two pressures: o - 0.997 and Δ - 0.585 n/m²

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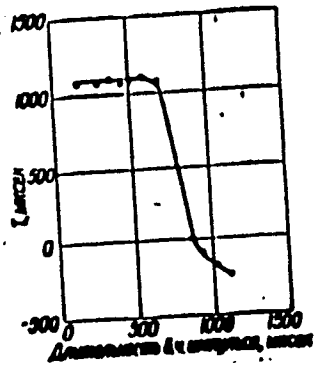
ENCLOSURE: 02

ACCESSION NR: AT4036054



Dependence of τ on the duration of the high-frequency pulse

Card 5/5

ACCESSION NR: AT4036065 S/2781/63/000/003/0232/0236

AUTHORS: Sinel'nikov, K. D.; Safronov, B. G.; Padalka, V. G.; Demidenko, I. I.

TITLE: Visual study of plasmoids

SOURCE: Konferentsiya po fizike plazmy* i problemam upravlyayemogo termoyadernogo sinteza. 3d, Kharkov, 1962. Fizika plazmy* i problemy* upravlyayemogo termoyadernogo sinteza (Plasma physics and problems of controlled thermonuclear synthesis); doklady* konferentsii, no. 3, Kiev, Izd-vo AN UkrSSR, 1963, 232-236

TOPIC TAGS: plasmoid, plasmoid acceleration, toroidal drift instability, plasma research, plasma magnetic field interaction, plasma diffusion

ABSTRACT: Apparatus is described for visual observation of the shape of a plasmoid moving in electric and magnetic fields. The apparatus

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ACCESSION NR: AT4036065

described can be used successfully even for plasmoids with relatively low ion concentration (10^8--10^9 cm^{-3}) which are difficult to investigate by their waves (for example, high speed photography and spectroscopy). The instrument (called "plasmoscope" by A. V. Zharinov) is based on accelerating the plasma electrons between grids and causing them to induce glow of a luminor on a flat glass. The techniques required for the preparation of the plasmoscopes are described. The apparatus was used to investigate the entry and passage of a plasmoid in a longitudinal homogeneous magnetic field and in a field of toroidal configuration, using a source of the Bostick type and a discharge from 1 microfarad capacitor at 4 kV. The plasmoid velocity was (7--8) x 10^4 m/sec. The broadening of the plasmoid in the homogeneous-field region may be due to differences in the angle at which the plasmoid enters the gradient field near the solenoid. In the case of toroidal configuration, it is assumed that the magnetic field compensates for the plasma polarization. The length of the toroidal part of the field must not exceed

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ACCESSION NR: AT4036065

the length of the plasmoid for such a model, and as the plasma moves along the helical solenoid the plasmoid passes through it only so long as its length exceeds the length of the helix. Otherwise a strong drift of the plasmoid is observed and the plasma does not get through. An experiment was performed to ascertain the effect to which the toroidal configuration can clear the plasmoid of the "tail" of heavy ions. The results indicate the feasibility of such a cleaning method. Orig. art. has: 6 figures.

ASSOCIATION: None

SUBMITTED: 00 DATE ACQ: 21May64 ENCL: 01

SUB CODE: ME NR REF SOV: 001 OTHER: 001

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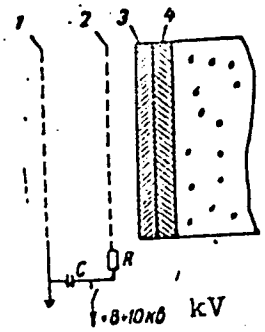
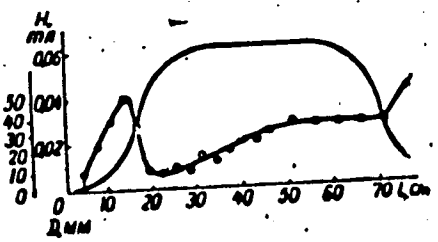
ENCLOSURE: 01

ACCESSION NR: AT4036065



Tesla



Left - diagram of plasmoscope. 1 - grounded dense copper grid, 2 - accelerating grid, 3 - aluminum layer, 4 - luminor

Right - variation of plasmoid diameter with distance from source (lower curve) and magnetic field distribution (upper curve)

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ACCESSION NR: AT4036069 S/2781/63/000/003/0262/0273

AUTHORS: Zy*kov, V. G.; Stepanenko, I. A.; Tolok, V. T.; Sinel'nikov, K. D.

TITLE: Investigation of plasma capture in a magnetic trap

SOURCE: Konferentsiya po fizike plazmy* i problemam upravlyayemogo termoyadernogo sinteza. 3d, Kharkov, 1962. Fizika plazmy* i problemy* upravlyayemogo termoyadernogo sinteza (Plasma physics and problems of controlled thermonuclear synthesis); doklady* konferentsii, no. 3. Kiev, Izd-vo AN UkrSSR, 1963, 262-273

TOPIC TAGS: plasmoid, plasma source, plasmoid plasma interaction, magnetic trap, plasma confinement, Coulomb repulsion force, plasma injection

ABSTRACT: The first reports are presented of experiments on the confinement of a plasma in a trap with bucking fields, with simultaneous

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ACCESSION NR: AT4036069

injection of plasma in the opposite direction. The apparatus consists of a cylindrical vacuum chamber 20 cm in diameter made of stainless steel and placed inside the field-producing coils. Each coil is connected to buck the neighboring one, so that three traps with sharp-angle magnetic field geometry are produced, with a 15.6 cm distance between magnetic gaps. Conical plasma guns were used. The plasma was injected into the apparatus pumped out to 6.6×10^{-4} n/m^2. The central trap was the principal one and the outer ones served for injection of the plasma into the central trap. Double electrostatic probes were used to measure the ion density, the electron temperature, and the time dependence of the density. The plasma propagation in the trap was investigated by using targets of photographic paper, the surface of which burned out after several impacts by the plasma. The apparatus and the probes are described in detail. The interaction of the opposing plasma streams is confirmed by several of the results of the investigations. Estimates also show that Coulomb interaction exists between the plasmoid particles. It is

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ACCESSION NR: AT4036069

pointed out that both the apparatus and the method are preliminary and this affects the accuracy of the final results. Orig. art. has: 12 figures.

ASSOCIATION: None

SUBMITTED: 00	DATE ACQ: 21May64	ENCL: 01
SUB CODE: ME	NR REF SOV: 003	OTHER: 003

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ACCESSION NR: AT4036069

ENCLOSURE: 01

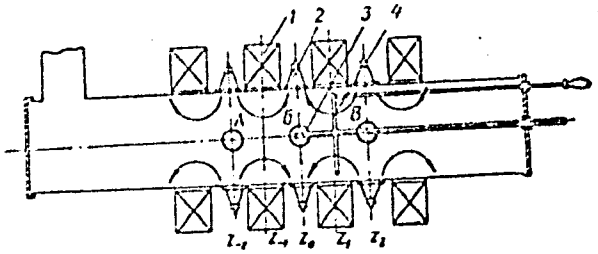

Diagram of setup: 1 - magnetizing coils, 2 - plasma gun, 3 - double electric probe, 4 - diamagnetic probe.

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ACCESSION NR: AT4036070 S/2781/63/000/003/0273/0282

AUTHORS: Zy*kov, V. G.; Stepanenko, I. A.; Tolok, V. T.; Sinel'nikov, K. D.

TITLE: Injection of plasma through an annular gap of a trap with opposing magnetic fields

SOURCE: Konferentsiya po fizike plazmy* i problemam upravlyayemogo termoyadernogo sinteza. 3d, Kharkov, 1962. Fizika plazmy* i problemy* upravlyayemogo termoyadernogo sinteza (Plasma physics and problems of controlled thermonuclear synthesis); doklady* konferentsii, no. 3. Kiev, Izd-vo AN UkrSSR, 1963, 273-282

TOPIC TAGS: plasmoid, plasma source, plasmoid plasma interaction, magnetic trap, plasma confinement, plasma injection

ABSTRACT: With an aim at reducing the particles lost when a plasma is injected into the trap through one of the axial magnetic mirrors,

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ACCESSION NR: AT4036070

the authors investigated the injection of plasma through the annular gap in the magnetic field from sources distributed around the gap periphery. The report describes the first experiments in which injection was investigated both in a stationary gap in the magnetic field, as well as in the gap existing during a certain time ("magnetic valve"). To simplify the initial experiments, the injection gap was produced by a constant field, with the coils connected to buck each other. A 20-cm diameter and 180-cm long cylindrical stainless steel vacuum chamber was used. Eight conical plasma guns were distributed uniformly around the periphery of the chamber in the magnetic gap plane. The synchronization circuit permitted simultaneous switching of all eight guns or a fraction of them. The plasmoids injected by each gun had a density 2×10^{14} cm^{-3} and a velocity of 3×10^{4} m/sec. The working vacuum was 6.6×10^{-4} n/m^{2}. The maximum magnetic field intensity, equal to 2×10^{5} A/m, was located 40 cm away from the magnetic gap. The experiments have shown that a plasma injected into a gap between opposing magnetic fields moves subse-

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ACCESSION NR: AT4036070

quently along the system axis. A strong interaction was observed between the opposing plasma streams, even in the absence of external magnetic fields. The nature of this interaction, and the time of confinement of the plasma in the trap when such an injection method is used, will be investigated in the future. Orig. art. has: 9 figures.

ASSOCIATION: None

SUBMITTED: 00	DATE ACQ: 21May64	ENCL: 01
SUB CODE: ME	NR REF SOV: 002	OTHER: 002

Card 3/4

ACCESSION NR: AT4036070

ENCLOSURE: 01

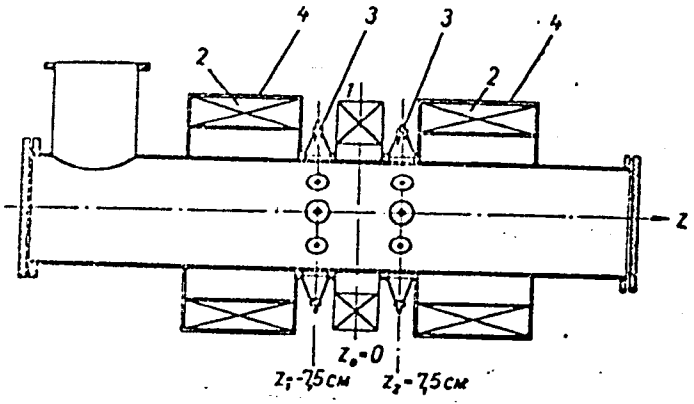

Diagram of set-up: 1 - coil of opposing magnetic field, 2 - coil of main magnetic field, 3 - plasma guns, 4 - protective shield

Card 1/4

DUSHIN, L.A. [Dushyn, L.O.]; KONONENKO, V.I.; KOVTUN, R.I.; SKIBENKO, A.I. [Skybenko, A.I.]; SINEL'NIKOV, K.D. [Synel'nykov, K.D.]; TOLOK, V.T.

Study of a plasma using a microwave interferometer. Ukr. fiz. zhur. 8 no.7:740-746 Jl '63. (MIRA 16:8)

1. Fiziko-tekhnicheskiy institut AN UkrSSR, Khar'kov.
(Plasma (Ionized gases))
(Interferometry)

SINEL'NIKOV, K.D.; SAFRONOV, B.G.; PADALKA, V.G.; DEMIDENKO, I.I.

Visual study of plasma clots. Zhur. tekh. fiz. 33 no.9:
1055-1058 S '63. (MIRA 16:11)

SINEL'NIKOV, K.D.; AZOVSKIY, Yu.S.; GUZHOVSKIY, I.T.; PANCHENKO, V.Ye.; SAFRONOV, B.G.

Interaction of plasma bunches with an axially symmetric magnetic field. Zhur. tekh. fiz. 33 no.10:1159-1168 O '63. (MIRA 16:11)

[illegible]NIKOV, Kirill Dmitriyevich; [illegible], Boris Nikolayevich; MOROZOV, Ye.P., prof., otv. red.; VAYNBERG, D.A., red.

[Lectures on plasma physics] Lektsii po fizike plazmy. Khar'kov, Izd-vo Khar'kovskogo gos. univ. im. A.M.Gor'kogo, 1964. 241 p. (MIRA 17:7)

ACCESSION NR: AP4041992 S/0057/64/034/007/1183/1190

AUTHOR: Domidonko, I.I.; Padalka, V.G.; Safronov, B.G.; Sinel'nikov, K.D.

TITLE: Interaction of plasma bursts with a transverse magnetic field

SOURCE: Zhurnal tekhnicheskoy fiziki, v.34, no.7, 1964, 1183-1190

TOPIC TAGS: plasma, plasma-magnetic field interaction, plasmoid, plasma source

ABSTRACT: The behavior of plasma bursts on meeting a transverse magnetic field was investigated experimentally. The plasma bursts were produced by 15-kv discharges of a 3-microfarad capacitor bank through a conical plasma gun with plastic walls, and traveled at 2.3 x 10^6 cm/sec down an 8-cm-diameter copper drift tube. At 70 cm from the plasma gun the drift tube intersected, at right angles, a second copper tube 10 cm in diameter, in which an approximately uniform axial magnetic field of a strength up to 725 oe was maintained with a solenoid. The behavior of the plasmas was observed with magnetic probes, a shielded electric probe, and a "plasmascope" (a fluorescent screen which is photographed when the plasma impinges upon it). Mass spectroscopic analyses of the plasmas were also performed. When a plasma burst entered the transverse magnetic field, a portion of it passed through the field in

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ACCESSION NR: AP4041992

the original direction with reduced velocity, and a portion of it was "captured" by the field and traveled down the side tube in both directions along the lines of force. The captured plasma moved virtually parallel to the lines of force (the shadow image of a grid of 8-mm-diameter holes on 8-mm centers was quite sharp at 30 cm) and it traveled with a considerably greater velocity than the original plasma burst. The velocity of the captured plasma increased with increasing magnetic field, and amounted to 6.3×10^6 cm/sec in a field of 450 oe. The portion of the plasma traversing the magnetic field suffered a displacement perpendicular both to the field and to the direction of motion. It is suggested that this displacement is due to drift resulting from a longitudinal polarization of the plasma. The plasma consisted chiefly of H^+, C^+, O^+, Fe^+, C^{2+}, O^{2+}, and O^{3+}. Most of the heavy ions traversed the transverse field, and only H^+ and C^+ were found in the captured portion. The mechanism of the capture and acceleration of the plasma by the transverse magnetic field is discussed very briefly; it is not understood. The authors assert that a pure hydrogen plasma is much more easily captured by a transverse magnetic field than the impure plasmas investigated in the present work, and they call for further investigation of the role of the heavy ions in this process. Orig.art.has: 10 figures and 2 tables.

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ACCESSION NR: AP4041992

ASSOCIATION: none

SUBMITTED: 22Jul63	ATD PRESS: 3081	ENCL: 00
SUB CODE: ME	NR REF SOV: 003	OTHER: 002

Card 3/3

ACCESSION NR: AP4042928 S/0057/64/034/008/1417/1423

AUTHOR: Zy*kov, V. G.; Sinitsa, N. G.; Stepanenko, I. A.; Tolok, V. T.; Sinel'nikov, K. D.

TITLE: Investigation of interaction of plasma fluxes in a transverse magnetic field

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 34, no. 8, 1964, 1417-1423

TOPIC TAGS: plasma thermalization, plasma interaction, plasma flux collision

ABSTRACT: This article is a continuation of experimental investigations of the possibility of complete slow-down and thermalization of fast opposed plasma fluxes in order to convert the kinetic energy of their directed motion into thermal energy. The investigation was carried out with apparatus consisting of a plasma source, a plasma guide, a magnetic screen, 8 magnetic coils, a vacuum chamber, a double electric probe, and a collector probe. The chamber, which was 20 cm in diameter, was placed in a longitudinal magnetic field produced by coils driven by a d-c current generator. The field could be

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L 6728-65 EWT(l)/EWG(k)/EW(m)/EPA(sp)-2/EPF(c)/EPA(w)-2/EEC(t)/T/EEC(b)-2/EWP(q)/EWP(b)/EWA(m)-2 Pf-4/Pi-4/Po-4/Pr-4/Pz-6/Pab-24 IJP(c)/AEDC(b)/ASD(p)-3 RAEM(a)/SSD/AFWL/AFETR/ESD(gs)/ESD(t) AT/JD/HM

ACCESSION NR: AP4044877 S/0020/64/157/006/1335/1337

AUTHORS: Demidenko, I. I.; Padalka, V. G.; Safronov, B. G.; Sirel'nikov, K. D. (Academician AN UkrSSR)

TITLE: Energy spectra of a plasma interaction with a transverse magnetic field

SOURCE: AN SSSR. Doklady*, v. 157, no. 6, 1964, 1335-1337

TOPIC TAGS: plasma source, plasma magnetic field, plasma trapping, plasma charged particle distribution, plasma axial inhomogeneity, plasmoid ionic component

ABSTRACT: This is a continuation of earlier tests by the authors (ZhTF v. 34, No. 7, 43, 1964), and its purpose is a detailed analysis of the ionic component of a plasma produced by a conical source and traveling in a magnetic field. The experimental setup for studying the interaction between plasmoids and a transverse magnetic

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field was the same as used by the authors before, and the mass analyzer employed was that described by A. A. Kalmy*kov et al (pribory* i tekhn. eksp. No. 5, 142, 1963). The results indicate that the ability of the plasma ions to penetrate through the transverse magnetic field increases with increasing m/Z (m -- ion mass, Z -- charge) and with decreasing ion energy. The plasma captured by the magnetic field contains much more hydrogen than the plasma ejected from the source. With increasing intensity of the magnetic field, the energy spectrum of the hydrogen ions of the plasma passing through the field shifts towards lower energies, whereas the energy spectrum of the protons of a plasma moving along the magnetic field shifts towards the higher energies. The results suggest that the density of the leading front of the plasma, where the higher-energy hydrogen ions are situated, is not high enough so that when the plasma enters the transverse magnetic field the front part of the plasmoid becomes detached. There is no broadening of the plasma pulses after passing through the magnetic field, and the perpendicu-

L 6728-65
ACCESSION NR: AP4044877

lar ion velocity is very rapidly transformed into longitudinal velocity. Orig. art. has: 2 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut Akademii nauk UkrSSR (Physicotechnical Institute, Academy of Sciences, UkrSSR)

SUBMITTED: 21Feb64 ENCL: 00

SUB CODE: ME NR REF SOV: 003 OTHER: 001

Card 3/3

ACC NR: AT6024[illegible] SOURCE CODE: UR/0000/65/000/000/0005/0016

AUTHOR: Sinel'nikov, K. D.; Rutkevich, B. N.

ORG: none

TITLE: Transverse injection of a plasma in a magnetic field

SOURCE: AN UkrSSR. Issledovaniye plazmennykh sgustkov (Study of plasma clusters). Kiev, Naukova dumka, 1965, 5-16

TOPIC TAGS: plasma injection, plasma charged particle, particle collision, dielectric constant, plasmoid, plasma magnetic field

ABSTRACT: Making use of the laws of conservation of the number of particles, of the energy, and of the momentum, the authors calculate the drift velocity, the components of the dielectric tensor, the field energy density, the plasma velocity, the flux density of the energy of orbital motion of the electrons and the ions, and other parameters of a plasma injected transversely into a magnetic field. Special attention is paid to the spreading of the plasma along the magnetic field, and it is shown that this effect is not due to collisions alone, but also to the effect of the electric fields which result from the distortion of the magnetic field at the point where the plasma is injected. Orig. art. has: 2 figures and 41 formulas.

SUB CODE: 20/ SUBM DATE: 11Nov65/ ORIG REF: 004

Card 1/1

ACC NR: AT.... (N) SOURCE CODE: UR/0000/65/000/000/0021/0026

AUTHOR: Demidenko, I. I.; Lomino, N. S.; Padalka, V. G.; Safronov, B. G.; Sinel'nikov, K. D.

ORG: none

61
B+1

TITLE: Possible occurrence of instabilities in a plasma captured by a transverse magnetic field

SOURCE: AN UkrSSR. Issledovaniye plazmennykh sgustkov (Study of plasma clusters). Kiev, Naukova dumka, 1965, 21-26

TOPIC TAGS: plasma containment, plasma instability, plasmoid, plasma injection

ABSTRACT: This is a continuation of earlier investigations of plasma captured by a transverse magnetic field (ZhTF, 1964, v. 34, 1183 and elsewhere). Although the conditions in the earlier investigations were such that no instabilities could develop in the plasma, the authors show that such instabilities can develop after the plasmoid passes through a diaphragm which is installed at a sufficiently large distance from the point of injection of the plasma in the magnetic field. At the large distance from the injection point, the plasmoid has a sufficiently large ratio of longitudinal energy to transverse energy, and an appreciable density gradient. The instability begins to develop in the region of maximum plasma density, and the inhomogeneity of the density over the cross section of the plasmoid stimulates the development of the instability. Arguments are presented in favor of classifying this as a

ACC NR: AT6033631

Rayleigh-Taylor type of instability which develops in the homogeneous magnetic field as a result of plasma rotation. A similar instability was observed when the dielectric diaphragm was replaced by a metallic but ungrounded diaphragm. When the metallic diaphragm was grounded, practically no instability developed. Certain qualitative explanations of the phenomena are presented. Orig. art. has: 4 figures.

SUB CODE: 20/ SUBM DATE: 11Nov65/ ORIG REF: 005/ OTH REF: 005

Card 2/2

L 27602-65 EWT(1)/EPA(sp)-2/EPA(w)-2/EEC(t)/T/EWA(m)-2 pz-6/po-4/pab-10/pi-4
IJP(c) AT

ACCESSION NR: AP5003238 S/0057/65/035/001/0062/0071

56
41 B

AUTHOR: Zykov, V.G./ Stepanenko, I.A./ Tolok, V.T./ Sinel'nikov, K.D.

TITLE: Investigation of the capture of plasma in a magnetic trap with opposing fields

SOURCE: Zhurnal tekhnicheskoy fiziki, v.35, no.1, 1965, 62-71

TOPIC TAGS: plasma confinement, magnetic mirror, cusp field, plasma interaction

ABSTRACT: The authors have investigated the confinement of plasma by a three-cusp magnetic field produced in a 20 cm diameter stainless steel cylinder by four windings disposed as shown in Enclosure 01. The maximum magnetic field at the wall of the chamber in the cusps was 1200 Oe. Hydrogen plasma was injected at one or more of the cusps by four conical plasma guns equally spaced about the periphery. The ion density and electron temperature were measured with probes, and the magnetic properties of the plasma were studied with a magnetic probe. Particular attention was given to the density and persistence of the plasma in the plane of the central cusp (Z_o in the figure). It was found that when the plasma was injected only in the

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ACCESSION NR: AP5003238

central cusp the magnetic field did not tend to confine it to this region. The magnetic field did, however, tend to confine to the central region plasma that was injected at one of the side cusps (e.g. Z_2), and this tendency was markedly increased (the decay time increased from 30 to 55 microsec) when plasma was injected at both side cusps (Z_2 and Z_{-2}) simultaneously. This behavior is ascribed to interaction between the opposing plasma streams entering the central region from the two sides. The maximum density reached by the plasma on the axis in the Z_0 plane when it was simultaneously injected at all three cusps was 7.5×10^{14} cm^{-3}. In all cases the electron temperature (approximately 4.5 eV) was independent of time. "In conclusion the authors express their gratitude to A.P.Dolgom for his technical assistance with the measurements." Orig.art.has: 12 figures.

ASSOCIATION: Fizichesko-tekhnicheskiy institut AN UkrSSR,Khar'kov (Physicotechnical Institute, AN UkrSSR)

SUBMITTED: 13Jan64 ENCL: 01 SUB CODE: ME

NR REF SOV: 004 OTHER: 002

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ACCESSION NR: AP5003238

ENCLOSURE: 01

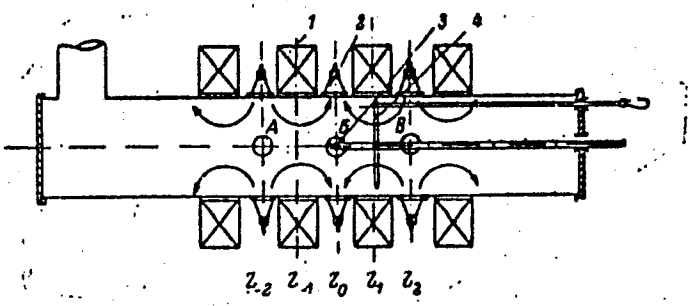

Diagram of the apparatus: 1 - windings, 2 - plasma guns, 3 - double electric probe, 4 - magnetic probe.

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L 26966-65 EWT(l)/EPA(sp)-2/T/EEC(t)/EPA(w)-2/EWA(m)-2 Pz-6/Po-4/Pab-10/Pi-4
IJP(c) AT
ACCESSION NR: AP5003252 S/0057/65/035/001/0154/0156

AUTHOR: Demidenko,I.I./ Lomino,N.S./ Padalka,V.G./ Safronov,B.G./Sinel'nikov,K.D.

TITLE: On possible development of instabilities in a plasma captured by a transverse magnetic field 21 42 41 B

SOURCE: Zhurnal tekhnicheskoy fiziki, v.35, no.1, 1965, 154-156

TOPIC TAGS: plasma, plasma instability, transverse magnetic field, longitudinal magnetic field

ABSTRACT: The development of instabilities in plasma bursts trapped by a transverse magnetic field and traveling parallel to it were investigated. The apparatus and the peculiarities of the capture and propagation of the plasma bursts have been previously described by four of the present authors (ZhTF 34,1183,1964). In the present experiments the plasma bursts passed through a 1.5 cm diameter circular aperture in a screen located 30 cm from the point of capture and were obeerved at various distances from the screen with a "plasmascope". When the screen was of dielectric material, or when it was of metal but floating, a tongue emerged from the more dense side of the plasma, grew, and reached the wall of the chamber after the plas-

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L 26966-65
ACCESSION NR: AP5003252

ma burst had traveled some 60 cm from the screen. This instability is assumed to be of the Rayleigh-Taylor type and due to the rotation of the plasma, its inhomogeneity, and the presence within it of a net negative charge. When the screen was of metal and grounded, the development of this instability was almost entirely suppressed. Experiments were also performed with a screen containing a 4 mm wide slot instead of a circular aperture. In this case the instability did not develop. The failure of flute instability to develop in the plasma sheets that passed through the slot is discussed briefly. Orig.art.has: 4 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN UkrSSR,Khar'kov(Physicotechnical Institute, AN UkrSSR)

SUBMITTED: 14 Aug64 ENCL: 00 SUB CODE: ME,EM

NR REF SOV: 004 OTHER: 005

Card 2/2

[redacted], [redacted], [redacted], [redacted], [redacted], [redacted], [redacted], [redacted]

Instability occurring in a plasma gripped by a transverse magnetic field. Zhur. tekh. fiz. 35 no.1:154-156 Ja '65. (MIRA 18:3)

1. Fiziko-tekhnicheskiy institut AN UkrSSR, Khar'kov.

L 52020-65 EPF(n)-2/EPA(w)-2/EWT(1)/EWG(m) Pi-4/Po-4/Pz-6/Pab-10 IJP(c) AT

ACCESSION NR: AP5012046 UR/0057/65/035/005/0823/0826

AUTHOR: Demidenko,I.I.; Lomino,N.S.; Padalka,V.G.; Safronov,B.G.; Sinel'nikov,K.D.

TITLE: Investigation of some properties of a plasma captured by a transverse magnetic field

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 35, no. 5, 1965, 823-826

TOPIC TAGS: plasma trapping, plasma magnetic field, plasma polarization, plasma injection

ABSTRACT: The authors have previously found (ZhTF, 34, 43, 1964; DAN SSR, 157, 1335, 1964) that a portion of the plasma injected into a transverse magnetic field is captured by the field and moves parallel to it. They have continued their investigation of this phenomenon (which is not understood) with an apparatus similar to that previously employed, but larger. In the present apparatus the longitudinal magnetic field is maintained in a 12 cm diameter, 300 cm long drift tube; with the plasma transversely injected at the center of the drift tube, the motion of the captured plasma could be followed for 120 cm. The polarization of the captured plasma was observed with probes. After a decrease of 20 to 50% in

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ACCESSION NR: AP5012046

the first 30 or 40 cm, the polarization decreased only very slowly with distance from the injection point. The expected drift of the captured plasma in the crossed fields (the electric field due to polarization and the applied magnetic field) was observed with the aid of a slotted plastic diaphragm and a "plasmascope" (L.I.Yelizarov and A.V.Zharinov, Nucl. Fus., Suppl., 2, 699, 1962). The effect of shorting out the plasma polarization with a copper disk was investigated; this was found, in accord with the findings of D.A.Baker and J.F.Hammel (Phys. Rev. Letters, 8, 157, 1962), to inhibit the transverse motion of the captured plasma. Orig. art. has: 2 formulas and 3 figures.

ASSOCIATION: Fiziko-tekhnicheskiy institut AN SSSR, Khar'kov (Physico-technical Institute, AN SSSR)

SUBMITTED: 18May64 ENCL: 00 SUB CODE: ME

NR REF SOV: 004 OTHER: 002

Card 2/2 714

L 13460-66 EWT(l)/T IJP(c)

ACC NR: AP6002450 SOURCE CODE: UR/0057/65/035/012/2232/2234

AUTHOR: Akshanov, B.S.; Marinin, V.G.; Strel'tsov, A.I.; Sinel'nikov, K.D.

52
12

ORG: none

TITLE: Injection of charged particles into a magnetic mirror trap

SOURCE: Zhurnal tekhnicheskoy fiziki, v. 35, no. 12, 1965, 2232-2234

TOPIC TAGS: magnetic mirror, cusped magnetic field, charged particle, ~~particle injection, nonhomogeneous magnetic field~~, magnetic field intensity, magnetic trap

ABSTRACT: This "brief communication" is a continuation of another paper by two of the authors, K.D.Sinel'nikov and B.S.Akshanov (Sb. "Fizika plazmy i problemy upravlyayemogo termoyadernogo sinteza", No. 4, p. 103, Izd, AN USSR, Kiyev, 1965), in which a method was proposed for injecting charged particles into a magnetic mirror system by allowing them first to pass through a magnetic field with cusped geometry, part of which forms one of the mirrors of the trap. It is shown that a criterion given by K.D.Sinel'nikov, N.A.Khizhnyak, et al.(Ibid. p. 388) for penetration by the injected particles of the second magnetic mirror in the case of equal magnetic field strength in the two mirrors becomes more stringent (particles are captured over a wider range of energy and injection radius) provided the magnetic field strength in the second mirror is greater than that in the first. The theoretical conclusion was tested

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L 13460-66
ACC NR: AP6002450

experimentally by injecting electrons of different energies into an asymmetric bi-conical cusped field, and reasonable agreement was found. It is concluded that the proposed method of particle injection will be reasonably efficient in strong fields, provided the ratio of the field strengths is properly chosen. Orig. art. has: 10 formulas and 1 figure.

SUB CODE: 20 SUBM DATE: 10May 65 ORIG. REF: 002 OTH REF: 000

Card 2/2

L 16930-66 EWT(1)/T IJP(c)

ACC NR: AT6002496 SOURCE CODE: UR/3137/64/000/070/0001/0013

AUTHOR: Sinel'nikov, K.D.; Khizhnyak, N.A.; Repalov, N.S.; Zeydlits, P.M.; Yamnitskiy, V.A.; Azovskaya, Z.A.

63
B+1

ORG: none

21,44,55

TITLE: Injection of particles through an acute-angled magnetic trap into a mirror trap with increasing fields of the mirrors

SOURCE: AN UkrSSR. Fiziko-tekhnicheskiy institut. Doklady, no. 70, 1964. Inzhektsiya chastits v zerkal'nuyu lovushku s narastayushchim polem v probkakh cherez magnitnuyu lovushku ostrougol'noy geometrii, 1-13

TOPIC TAGS: magnetic mirror machine, ~~particle~~ ~~trapping~~, magnetic trap, computer calculation, charged particle

ABSTRACT: The authors investigate the passage of charged particles injected through an end slit parallel to the axis of the magnetic field through an acute-angled magnetic trap. A general introduction of magnetic mirror effect is followed by a theoretical study of the effect of acute-angled field geometry on the eccentricity of particles passing through the zero field plane, and the filling of an increasing field mirror trap by particles passing

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L 16930-66

ACC NR: AT6002496

through the acute-angled trap. The paper gives 1) the conditions for the passage of particles with large and small displacement of the particle rotation center from the magnetic axis; and 2) the results of the numerical calculations of the trap filling carried out on the UMShN electronic computer. Curves presented depict the conversion of longitudinal into transverse velocity as a function of the injection-to-final-radius ratio, and as a function of the initial radial velocity, and particle trapping during a slow field increase. The results show that the method for particle trapping presented is technologically feasible. Acute-angled traps with higher field harmonics are not studied. Orig. art. has: 21 formulas and 8 figures.

SUB CODE: 20 / SUBM DATE: none / ORIG REF: 002

Card 2/2

L 18840-66 EWT(1) IJP(c) GS

ACC NR: AT5028589 SOURCE CODE: UR/0000/65/000/000/0388/0402

AUTHOR: Sinel'nikov, K. D. (Academician AN UkrSSR); Khizhnyak, N. A.; Repalov, N. S.; Zeydlits, P. M.; Yamnitskiy, V. A.; Azovskaya, Z. A.

ORG: none

TITLE: Investigation of the charged particle motion in picket fence magnetic traps

SOURCE: Konferentsiya po fizike plazmy i problemam upravlyayemogo termoyadernogo sinteza. 4th, Kharkov, 1963. Fizika plazmy i problemy upravlyayemogo termoyadernogo sinteza (Physics of plasma and problems of controllable thermonuclear synthesis); doklady konferentsii, no. 4, Kiev, Naukova dumka, 1965, 388-402

TOPIC TAGS: magnetic trap, relativistic particle, plasma charged particle, particle trajectory, particle motion, magnetic field

ABSTRACT: The properties of charged particle motion in magnetic traps of the "picket fence" and "magnetic wall" (with negative field curvature) types are considered and their trajectories determined by numerical integrations. The traps are characterized by axial symmetry and small angles between field lines. The analytical form of the fields is described by the expansion of the scalar magnetic potential

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L 18840-66

ACC NR: AT5028589

in Bessel functions, retaining the first term only. Since both curl and divergence of the field within magnetic coils vanish, the magnetic intensity for "picket fence" traps (easily generalized to other geometries) is determined and analytical expressions are derived for two extreme cases of extended and compressed traps. A method for determining the fields in the throat area of the trap of a given radius is also given. Application of the Lagrangian and Hamiltonian of the charged particle motion and the utilization of the cyclic azimuthal coordinate of axisymmetric fields leads to derivation of a potential in which a particle moves and determines the extent of regions of particle confinement. It is found that there always exists a region through which particles can escape. The escape criteria and a classification of transmitted and reflected particles in which the gyroradius of the particles, and hence mass, play a strong role are presented. Additional classification relative to the initial particle parameters is also discussed. In particular, it is shown that the behavior of particles injected in a direction opposite to the system axis is similar to that of those injected parallel to the axis, excepting that the initial radial separation of the former from the axis is greater. Representative trajectories are graphed. The discussion is further generalized to the relativistic particles for which presently realizable magnetic confinement schemes require very strong fields. Orig. art. has: 17 figures, 34 formulas.

SUB CODE: 20/ SUBM DATE: 20May65/ ORIG REF: 002/ OTH REF: 002

Card 2/2 vmb

L 18839-66 EWT(1) IJP(c) GS

ACC NR: AT5028590 SOURCE CODE: UR/0000/65/000/000/0403/0410

AUTHOR: Sinel'nikov, K. D. (Academician AN UkrSSR); Akshanov, B. S. 49 B+1

ORG: none

TITLE: Experimental investigation of charged particle motion in picket fence magnetic traps 21,44,55

SOURCE: Konferentsiya po fizike plazmy i problemam upravlyayemogo termoyadernogo sinteza, 4th, Kharkov, 1963. Fizika plazmy i problemy upravlyayemogo termoyadernogo sinteza (Physics of plasma and problems of controllable thermonuclear synthesis); doklady konferentsii, no. 4. Kiev, Naukova dumka, 1965, 403-410

TOPIC TAGS: magnetic trap, electron gun, particle trajectory, plasma injection, electron reflection

ABSTRACT: The main objective of the experiment was to study the trajectories of injected electrons with the help of luminescent screens inserted into the trap region. Experimental study of the electrons injected into a magnetic trap formed by two opposing fields (cusp geometry) has shown that a plasma of relatively long duration (0.1 sec) and of 10^{12} cm^{-3} density can be obtained. A series of photographs

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ACC NR: AT5028590

of observed trajectories are shown including those of repeatedly reflected electrons. This technique led to the solution of several problems associated with the injection of electrons into magnetic traps. It was found that the electron gun position relative to the magnetic axis has a strong effect on the plane of reflection and region of trapping. The critical energy of the reflected particles was consequently plotted as a function of the radial position of the injector. The dependence of the adiabatic particles on the injection energy and their reflection and transmission for various radial positions of the injector were also studied. It was found that the resulting spiral trajectories must be controlled in their relation to the axis in order to obtain optimum trapping. Some experiments (not described in this work) with magnetic mirror traps were also performed. Orig. art. has: 12 figures.

SUB CODE: 20/ SUBM DATE: 20May65/ ORIG REF: 003/ OTH REF: 001

Card 2/2 vmb

L 18837-66 EWT(1) IJP(c) GS

ACC NR: AT5028592 SOURCE CODE: UR/0000/65/000/000/0431/0441

AUTHOR: Borovik, Ye. S.; Busol, F. I.; Sinel'nikov, K. D. (Academician AN UkrSSR)

ORG: none

TITLE: Computation of filling a GVL-2 magnetic trap with plasma

SOURCE: Konferentsiya po fizike plazmy i problemam upravlyayemogo termoyadernogo sinteza. 4th, Kharkov, 1963. Fizika plazmy i problemy upravlyayemogo termoyadernogo sinteza (Physics of plasma and problems of controllable thermonuclear synthesis); doklady konferentsii, no. 4. Kiev, Naukova dumka, 1965, 431-441

TOPIC TAGS: fluted magnetic field, magnetic trap, Coulomb collision, strong magnetic field, plasma density, magnetic mirror, ion density

ABSTRACT: The process of filling a magnetic mirror configuration of small volume, formed by very strong magnetic field, is studied. The system considered is a magnetic trap of the GVL-2 device described in Borovik, Ye. S., Busol, F. I., Kovalenko, V. A., Yuferov, V. B. and Skibenko, Ye. I., p. 421, *Konferentsiya*. The system has a mirror ratio which can be varied from 1.5 to 4. To predict the ion den-

Card 1/2

L 23580-66 EPF(n)-2/EWT(l)/ETC(f)/EWG(m) IJP(c) AT/GS
ACC NR: AT6008838 SOURCE CODE: UR/0000/65/000/000/0005/0018

AUTHOR: Sinel'nikov, K. D.; Khizhnyak, N. A.; Repalov, N. S.; Zeydlits, P. M.; Yamnitskiy, V. A.; Azovskaya, Z. A. 53 B+1

ORG: none

TITLE: Injection of particles into a mirror trap with an increasing field through a magnetic cusp configuration

SOURCE: AN UkrSSR. Magnitnyye lovushki (Magnetic traps). Kiev, Naukova dumka, 1965, 5-18

TOPIC TAGS: magnetic [redacted] trap, plasma injection, particle trajectory, magnetic mirror

ABSTRACT: The behavior of a plasma in a magnetic mirror trap formed by particles injected through a cusp configuration is studied. The particles selected for investigation are those which at injection have curvature radius of less than 71% of the Larmor radius, i. e. those which proceed without reflection into the magnetic mirror region. The eccentricity of the particle trajectory (passing through the zero field plane) due to the cusp configuration is analyzed. Two competing processes become evident; one tends to establish an E-layer as in the Astron machines and another tends to fill the axial region of the mirror trap. The analysis is further extended to determine the accumulation in the magnetic mirror trap of particles passing through a

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ACC NR: AT6008838 O

smooth cusp field having only a zeroth harmonic. The conversion of longitudinal energy into transverse particle energy is determined as a function of the initial radial distance of the trajectory from the magnetic axis. The number of particles trapped indicates that construction of an experimental machine is feasible provided the proper magnetic field configuration is used. It is estimated that a field with high harmonic components would trap particles with broader initial velocity and injection angle parameters. Orig. art. has: 7 figures, 10 formulas.

SUB CODE: 20/ SUBM DATE: 20Oct65/ ORIG REF: 002/ OTH REF: 000

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L 23591-66 EWT(l)/ETC(f)/EPF(n)-2/EWG(m) IJP(c) AT/GS
ACC NR: AT6000839 SOURCE CODE: UR/0000/65/000/000/0018/0027

AUTHOR: Akshanov, B. S.; Volkolupov, Yu. Ya.; Sinel'nikov, K. D. 71 B+1

ORG: none

TITLE: Investigation of injection and confinement of charged particles by a magnetic mirror trap

SOURCE: AN UkrSSR. Magnitnyye lovushki (Magnetic traps). Kiev, Naukova dumka, 1965, 18-27

TOPIC TAGS: magnetic trap, magnetic mirror [illegible], plasma confinement, plasma injection, electron gun, ionization, charged particle

ABSTRACT: The present work describes experiments in which the injection of particles into magnetic mirror traps is accomplished using a circular electron gun generating directed flow of particles which pass through the magnetic cusp configuration into the mirror trap. At the opposite end of the mirror trap, an additional strong field coil is added to provide a reflecting barrier for those particles which can pass through the main trap. The injected beam was studied by the use of luminescent screens which show that the beams are sufficiently intense to cause ionization of the atoms in the magnetic trap. Another beam of low intensity was used for probing the plasma and the main beam. This beam probing technique led to the conclusion that almost all inject-

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L 23581-66
ACC NR: AT6008839

ed particles stagnate in the trap region. The resulting space-charge lifetime was determined by the same technique. These results were obtained by introducing discriminating modulation on the probing beam. The results of these experiments confirm theoretical predictions of the mechanism converting linear flows into spiral ones. It was also found that plasma duration time corresponds to the burnout time (complete ionization) which creates a plasma of about $8 \cdot 10^{11}$ cm^{-3}. It is concluded that beam electron trapping was due not only to ionization and charge exchange but also to the development of beam instability. Orig. art. has: 6 figures.

SUB CODE: 20/ SUBM DATE: 20Oct65/ ORIG REF: 004/ OTH REF: 000

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L 23561-66 EWT(1)/ETC(f)/EPF(n)-2/EWG(m) IJP(c) GS/AT

ACC NR: AT6008840 SOURCE CODE: UR/0000/65/000/000/0027/0035

AUTHOR: Akshanov, B. S.; Volkolupov, Yu. Ya.; Sinel'nikov, K. D. 66

ORG: none 2/ B+1

TITLE: Confinement of charged particles pulse-injected into a trap with ntationary fields

SOURCE: AN UkrSSR. Magnitnyye lovushki (Magnetic traps). Kiev, Naukova dumka, 1965, 27-35

TOPIC TAGS: magnetic trap, electron gun, plasma injection, magnetic mirror, charged particle

ABSTRACT: Experimental injection of charged particles into magnetic traps is studied using high power electron guns in which the accelerating potential, amplitude and duration were regulated to produce square, half-sine, and sawtooth waves. The magnetic coils and field configuration (for injection through a cusp into a magnetic mirror with constricted far end) are shown in figure 1. Probing electron beams and luminescent screens were used to show that plasma confinement time is in the tens of microseconds and depends on such parameters as initial density, injection pulse time and amplitude. The luminescent screen surrounding the plasma gives evidence that the injected beam strikes the wall at critical energies. Plasma confinement time and the onset of a rapid breakup of the plasma are increasingly delayed as the initial pres-

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ACC NR: AT6008840

sure increases. The method employed can produce 10^{12} cm^{-3} plasma. The resulting plasma is very similar to one produced by continuous injection but it maintains high elec-

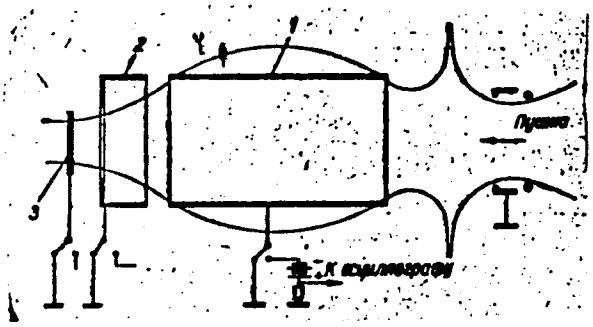

Figure 1.

tron temperatures for a somewhat longer time. Orig. art. has: 6 figures.

SUB CODE: 20/ SUBM DATE: 20Oct65/ ORIG REF: 004/ OTH REF: 000

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