lective effects in the target. Collective interactions can arise in a plasma of such density only when the temperature of the plasma is not less than 1 keV. At this temperature the plasma becomes an "ideal" plasma. Estimates show that owing to Coulomb collisions in the target, the reverse current is capable of heating the fuel to 1 keV. Collective effects have been well studied in the case of weak electron beams, but the theory on which they are based can be carried over with sufficient accuracy to the case of very powerful beams. This work was done by Faĭnberg, Shapiro, Tsytovich, Rudakov, Ivanov, Ryutov, and others.

Without going into details, which may be found in the works of the indicated investigators, we should say that the slowing-down length of the beam in a plasma of temperature higher that 1 keV is shorter by several orders of magnitude than the Coulomb slowing-down length, and the mean free path of the beam in the solid target is a fraction of a millimeter or a few millimeters. This result can be considered to be quite satisfactory from the point of view of the problem of target heating. It is worth noting that if the D-T mixture is surrounded by a heavy shell, then the electron beam passes easily through the shell and undergoes collective deceleration only in the mixture.

It remains to be considered the complex technical problem of producing high-power relativistic electron beams. The method used in forming the beams usually consists in a discharge of a high-voltage line unto a plasma cathode near which a thin, grounded foil—the anode—is located. The plasma that then forms in the gap between the cathode and the anode emits electrons, which penetrate the anode (foil) and move on the other side of the foil in a relatively tenuous plasma, which compensates the repulsion of the beam. To produce beams with a current strength of up to 10^7—10^8 A, the wave impedance of the line should be very low. But this can be achieved only by decreasing the thickness of the insulation of the line, i.e., by increasing the electric field strength in the dielectric. The power flux through 1 cm^2 of the line is equal to*

$$w = c\varepsilon^{1/2}\,[\mathrm{EH}/4\pi].$$

In a running wave $\mathbf{E} = \mathbf{H}$, and

$$w = c\varepsilon^{1/2}E^2/4\pi.$$

If E_m is the maximum strength of the electric field in the dielectric, then w_m is the maximum power attainable in the line. It is known that E_m increases sharply when the time the voltage potential acts on the dielectric is reduced; therefore to achieve the maximum power, the line must be charged impulsively and discharged rapidly unto the load. It is as yet not clear which dielectrics are most suitable for high-power lines. Water, however, seems to be one of the prospective insulating materials for which E_m possibly attains the value of 10^7 V/cm, which corresponds to $w_m = 2 \times 10^{12}$ W/cm^2. Therefore such a line with a cross section $s \approx 10^3$ cm^2 can produce in the load the power $w_m \sim 2 \times 10^{15}$ W. One should probably connect lines of such dimension to tabular cathodes of large cross section, and then focus the beams as discussed above.

*[EH] ≡ E × H.

What are the prospects of producing high-power electron beams? Unfortunately, in our country we have little experience in working with relativistic beams, and it is difficult to determine when this experience will be gained. Very roughly, we can expect that the fundamental problems of beam focusing will be solved in the seventies and that 10^{13}—10^{14}-W plants will be constructed during the same period. At such powers experiments on the collective interactions in solid targets will be possible.

If by the end of this period electron beams prove, for some reason, to be more promising than lasers, then one can imagine that an economically advantageous thermonuclear reaction in the form of microexplosions and, possibly, a chain reaction will be realized by the middle of the eighties.

It should be noted that the situation may turn out to favor the laser, or that each of the techniques will find its own areas of application. The last possibility is very probable, since high-power lasers and electron beams can, undoubtedly, be used in other areas of technology, and the extensive development of them within the next few years is inevitable.

Thus, on the basis of the very rough estimates one can expect that the main problems of thermonuclear microexplosions can be solved within the next 10—15 years.

In the wake of this, we shall probably see a very rapid utilization of microexplosions for power, space flight, etc., so that thermonuclear energetics may usher in a new era of technological progress by the year 2000.

G. A. Smolenskiĭ. A Magnetic Memory for Future Generations of Electronic Computers. The current methods of recording and readout of information in electronic computers with the aid of, as a rule, ferrite cores do not allow the solution of problems of the future. An urgent necessity arises for the capacity and speed of response of the memories of future generations of the electronic computer to be increased. In this connection intensive work is being done at present on the application of a number of new principles for the construction of memories, using integrated solid-state circuits, cylindrical magnetic domains, devices with charge coupling, optical phenomena (thermomagnetic, electro-optical, and other modes of recording, including the holographic method), and superconductors.

The fundamental investigations of domain structure and magneto-optical phenomena, as well as the discovery of new types of magnetically ordered media[1-7] formed the basis upon which the new types of magnetic memory were constructed.

1. Cylindrical Domains. It turned out that isolated cylindrical domains of small dimensions (a few microns) can be produced in certain magnetic crystals[8,9]. Such a domain structure is realized when weak external magnetic fields are applied in thin films with the direction of easy magnetization perpendicular to the surface of the film, when the field of the magnetic crystallographic anisotropy is stronger than the saturation magnetization. In the presence of a magnetic field gradient, the cylindrical domains can move through the crystal. A. Bobeck suggested that these mobile domains (they are called magnetic bubbles abroad) could be used as information carriers in large-capacity logical and mem-

ory devices[10]. The signals corresponding to "ones" and "zeros" are the presence or absence of domains at definite points of the film.

The prospects of the development of domain devices are determined by the high density with which they record information, their low power consumption, their sufficiently high readout rate, and their cheapness.

For these purposes the optimum set of properties is possessed by epitaxial films of the rare-earth ferrites with the garnet structure: these films are ferrimagnetic[11-13].

At present methods have been developed for: controlling the motion of the cylindrical domains (recording and shifting of information), the production of domains (introduction of information), and registration (detection) of domains[14-15]. Control of the domain motion implies both a controlled migration of a domain in the plane of the crystal and the immobilization of it at definite locations—magneto-optical traps. For this purpose one uses methods based on the interaction of the domains with the nonuniform magnetic fields produced by current or ferromagnetic appliqué. Domain production is accomplished by the motion of the original domains when the same, but somewhat modified appliqué is used. The readout of information is performed by different methods: inductive, galvanomagnetic and magneto-optical, and magnetic probes. Preference is given to galvanomagnetic and magneto-optical detectors[16-18].

A number of recorders based on cylindrical domains have already been constructed, e.g., a 1000-bit shift detector for a recorded-information density of 2.5×10^5 bit and a readout rate of 3×10^5 bit/sec[19].

2. Thermomagnetic Recording. This technique combines the optical method of recording and readout with the magnetic method of information storage. A small section of a ferromagnetic film is heated with the aid of a laser in the presence of a magnetization-reversing magnetic field. As a result, the direction of the magnetization of this section of the film is reversed after cooling, while the remaining part retains its original magnetization. Because this method is connected with the local heating of a magnetic film, it is called a thermomagnetic method. Magneto-optical effects are used for the readout. The first thermomagnetic recording was accomplished in 1958 by Mayer by heating a MnBi film with an electron beam[20]. In view of the construction of lasers and the progress made in the area of magnetic-film production, this method attracts much attention.

In a recording on magnetic films with the aid of a laser beam, the dimension of the spots is limited by light diffraction, and can, in the limit, be comparable with the wavelength of the light. This allows us to achieve a high, information-recording density $\sim 10^8$ bit/cm^2. It is possible to achieve at the same time a sufficiently high recording rate and an even higher readout rate. A laser of less intensity can be used for the readout and, therefore, a readout is done without destroying the recorded information. Thermomagnetic recording is performed at the Curie point, at the balance point, at the point of rearrangement of the magnetic structures, on films with a strip structure, etc.

Optical memories, including the thermomagnetic ones, have a great future. These memories guarantee the possibility of a holographic mode of recording. In the limit, the capacity of a holographic memory may reach 10^{10} bit/cm^2. In perspective, the transition to local systems with holographic introduction and retrieval of information promises the creation of elements for tremendously high-speed electronic computers.

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N. A. Borisevich. Afterglow of Complex Molecules in the Gaseous Phase. Molecular spectroscopy and luminescence were adopted as two of the main research directions of the Physics Institute of the BSSR Academy of Sciences when the Institute was being organized. Investigations in molecular spectroscopy, including laser spectroscopy, constitute at present a significant proportion of the themes of the Institute. In the present paper we consider only specific problems of the spectroscopy of polyatomic molecules in the gaseous phase.

Investigations of rarefied gases and vapors allow us