the current with increasing equilibrium phase. When the latter increased from the usual values 35–45° to 85–90°, the current increased to 6–10 A. However, the preliminary bunching necessary to obtain indifferent equilibrium is quite difficult to accomplish. In addition, the increased equilibrium phase shifts can be allowed only in limited regions of the accelerator.

An accelerator was therefore considered with an equilibrium phase shift equal to 85–90° at the beginning and then decreasing gradually. The investigation has shown that the admissible decrease of the equilibrium phase shifts along the accelerator is limited from below by a certain limiting curve. In the case of injection of the continuous beam, other accelerator parameters remaining the same, the proton currents do not exceed 1 A. Preliminary bunching into constant-density bunches makes it possible to increase the currents attainable in the considered examples to 3 A. The attainment of such currents is perfectly realistic.

G. V. Voskresenskiĭ and V. N. Kurdyumov. Radiative Losses of Electron Rings in Inhomogeneous Structures

The calculation of radiative losses accompanying the motion of electron rings in inhomogeneous structures, for example when passing through junctions of waveguides with different cross sections, resonators of the accelerating system, etc., is of interest in connection with the development of the collective method of ion acceleration. In practice, the most important aspect of this calculation is a clarification of the dependence of the total loss to radiation on the kinetic energy of the source. However, the sought equation for the losses turns out to be different and to depend essentially on the model assumptions used by the different authors. The present paper considers critically certain models which make it possible to obtain an approximate estimate of the losses: 1) excitation of a completely closed resonator [1,2]; 2) geometrical-optics calculation[3]; 3) the Lawson diffraction model[4]; 4) calculation in the Kirchhoff approximation[5]. The shortcomings inherent in approximate calculation methods require a rigorous electrodynamic calculation of the radiation in a single resonator with connecting waveguides. The paper presents the results of a solution of the electrodynamic boundary-value problem for such a region. The problem, reduced to an infinite system of linear algebraic equations for the coefficients of excitation of the eigenwaves in the connecting waveguides, is solved by numerical methods. The spectral distribution of the losses is calculated. The solution is different qualitatively in different frequency regions. In the low-frequency band there is excited a denumerable number of discrete harmonics, analogous to the modes of a closed cavity. In the region of high frequencies, a continuous radiation spectrum is generated. The spectrum broadens with increasing source energy, leading to a linear dependence of the loss on the energy for ultrarelativistic electron rings. The rapid growth of the losses with the energy imposes stringent requirements on the choice of the accelerating system for high-energy electron-ring accelerators.

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M. G. Nikulin. Dynamic Stabilization of Plasma Pinches

The paper considers different schemes for high-frequency dynamic stabilization of a current-carrying plasma pinch against long-wave flexural perturbations. The flexural instability of the pinch with direct current, in the absence of an external longitudinal field, can be suppressed, as is well known, by a well-conducting jacket located close enough to the surface of the pinch. In systems with large degrees of plasma compression, where this stabilization method is not effective, and also in systems without a conducting jacket, the suppression of long-wave deflections of the pinch can be realized by means of the standing or rotating high-frequency quadrupole magnetic field. To stabilize a pinch with alternating current, one can use either a constant or a high-frequency quadrupole field.

In systems with an external longitudinal field, the changeover from a direct current to a high-frequency alternating current makes it possible to weaken greatly the limitation imposed on the value of the current by the condition that the pinch be stable against long-wave helical perturbations. Consequently, an alternating longitudinal current in conjunction with a transverse high-frequency magnetic field can be used for equilibrium containment of an annular θ pinch, and in conjunction with a conducting jacket or a quadrupole magnetic field that adds an additional margin of stability to the plasma pinch against long-wave perturbations, it is possible to suppress the unstable Shafranov-Kruskal mode of a pinch with direct current or the unstable Haas-Wesson mode of a corrugated θ pinch.

The paper also considers the effect of parametric buildup of natural oscillations of the plasma pinch under the influence of high-frequency magnetic fields. Possible methods of eliminating this effect are considered.

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