the plasma transverse energy decreases step-wise. Two different types of instability have been identified. At low density (somewhat above 3×10^{10} cm^{-3}) a velocity space instability occurs with important particle scattering into the loss cone. At higher densities ($\simeq 1{\cdot}5 \times 10^{11}$ cm^{-3}) the plasma exhibits a motion in one radial direction and a considerable amount of plasma is lost on one side of the vacuum chamber. In both cases polarized microwave radiation in the vicinity of the electron–cyclotron frequency is emitted during the instability. The anisotropy in velocity space of the electron distribution can be measured. It is found that $p_{e\parallel}/p_{e\perp}$ is usually about 15% and it increases during the instability.

Toroidal confinement with temperature gradients*

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This paper deals with a model steady-state plasma in the toroidal magnetic field of stellarator geometry ($\beta \ll 1$) in which a temperature gradient forms as a result of the input energy being transported to the wall by thermal conduction. No particle source is needed to maintain steady-state conditions. There is a region where the thermal conductivity parallel to the field lines is sufficiently high to keep the temperature constant in zeroth order on a magnetic surface. In this region the energy equation can be expanded and the temperature profile can be obtained from an ordinary second-order differential equation, just as in a linear discharge. Here, however, the thermal conductivity is increased by the amount of the reciprocal of the rotational transform compared with the linear case. The density profile can be derived from a solubility condition that has to be imposed on the equation of continuity. The thermal diffusion coefficient thereby plays an important part in Ohm's law because it establishes a relation between the density and temperature gradients.

* Presented by the author.

Destruction of magnetic surfaces in toroidal systems

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The problem of resonances in the magnetic surface structure is discussed. The equations for the magnetic field lines are transformed into Hamiltonian form and asymptotic perturbation theory is developed which helps to determine the resonance destruction of the magnetic surfaces due to violation of rotational symmetry. The results of analytic considerations are compared with numerical values for the vacuum magnetic field which is of toroidal shape like that of the stellarator. It was assumed to have the form

$$\varphi = z + \tfrac{1}{3}z^3 \sin 3(\varphi - z) + \varepsilon r^q \sin (m\varphi - pz),$$

where φ is the potential of the magnetic field and the parameters are $\varepsilon = 10^{-2}$–10^{-4}, $m = 2, 4, 90$; $q = 2, 3, 4$; $p = 0{,}3$.

* Presented by G. Zaslavski. Paper submitted to *Nuclear Fusion*.

Equilibrium and stability in toroidal systems

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A general survey of equilibrium and stability in low-β collisionless plasmas is given with special emphasis on new results obtained by the author in collaboration with P. H. Rutherford. We first discuss the general problem of the containment of magnetic field lines in toroidal configurations. We then go on to discuss single particle confinement in these fields using the small Larmor radius approximation. It is pointed out that different forms of the particle distribution function are imposed depending on whether equilibrium is required on the short time scale $t \approx L/v_{\parallel}$ or on the long time scale