where θ_1, φ_1, θ_2, φ_2 are the angles of the vectors $\mathbf{n}_1$ and $\mathbf{n}_2$ in a system of spherical coordinates, when the z-axis is along the magnetic field.

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[2]K. Adler, Phys. Rev. **84**, 369 (1951).

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Nonlinear Theory of Longitudinal Plasma Oscillations

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IN Refs. 1 and 2 there was considered the one dimensional oscillations of the electronic plasma, without taking into account the temperature effects, on the assumption that the electron density n, the electrical field E and the electron speed v are linear functions of the combination $x - Vt$, where V is the velocity of the wave, propagating along the x-axis. In the present note we obtain a fundamental result of this work —a relation between the frequency of the longitudinal wave and the amplitude for a more general assumption, namely, for an arbitrary relation between the quantities n, E and v and x and t. The entire derivation is very much simplified if the basic equations are transformed from the Eulerian to the Lagrangian form.

We write the equation of motion of the electron and Maxwell's equations

$$dp/dt = eE, \tag{1}$$

$$dE/\partial x = 4\pi e\,(n - n_0), \tag{2}$$

$$0 = (1/c)\,(\partial E/dt) + (4\pi/c)\,env, \tag{3}$$

where n_0 is the ion density, which is assumed to be fixed; e, m and p are the charge, mass and momentum of the electron. From (2) and (3) follow

$$dE/dt = \partial E/\partial t + v\partial E/\partial x = -4\pi en_0 v. \tag{4}$$

Differentiating Eq. (1) with respect to time and comparing with (4), we obtain

$$d^2p/dt^2 + \omega_0^2 mv = 0, \quad \omega_0^2 = 4\pi^2 n_0/m. \tag{5}$$

In the non-relativistic case $p = mv$ and, consequently $(d^2 v/dt^2) + \omega_0^2 v = 0$, i.e., the frequency of the plasma oscillation does not depend on the amplitude.[1]

In the relativistic case we express the velocity in terms of the momentum,

$$\frac{d^2p}{dt^2} + \frac{\omega_0^2}{\sqrt{1 + p^2/m^2c^2}}\,p = 0,$$

from which the dependence of the frequency on amplitude follows directly, as was obtained in Ref. 2.

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A Note on Mixed Meson Theory

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FEYNMAN[1] has made the statement that in a mixed theory of scalar and vector mesons with vector coupling, nonrenormalizable infinities cancel if the coupling constants are equal. Reference 2 is devoted to the application of this theory. Such a statement also occurs in Ref. 3. Actually, however, the cancellation of nonrenormalizable infinities is equivalent in this case to the fact that the equation for the vector meson

$$(p^2\delta_{\nu\mu} - p_\nu p_\mu)\,\varphi_\mu = -s_\nu$$

is transformed into

$$p^2\varphi_\nu = -s_\nu.$$

In this case the field φ_ν describes particles with spin one and zero, where components with spin zero correspond to a negative energy (see Ref. 4). This circumstance is also noted in Ref. 1.

Starting from a Hermitian Lagrangian for two fields with spin zero and one, interacting with the