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$$\sigma_{ef} = \sigma_0 \left(\frac{\delta}{T_\Omega} + \frac{\delta}{\tau}\right) \frac{1}{v} \frac{1}{1 + (\Omega\tau)^2}$$

This expression shows the behaviour of conductivity in all range of magnetic field. For the limit case of weak magnetic fields the conductivity speeds to the expression being valid under anomalous skin-effect. Under another limit case the conductivity speeds to zero. Under the intermediate conditions there must take place a weak maximum which have been observed at surface impedance as a quasi-resonance energy absorption on non-central electrons.

Electron iso-energetic surface openness and helicon type wave in metal

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Magnetic field stimulates the propagation of transverse waves in metal for example helicon and Alfen-type. Helicon waves take place in metals having uncompensated electron and hole volumes. These waves exist due to specific static conductivity tensor having off-diagonal hall components of high value before diagonal components. Here the task of possibility of existence of similar type wave in metal having open iso-energetic surface is discussed. In other words what is the role of dispersion law anisotropy in limit case. To answer this question it is necessary to analyze microscopic task of connection between field and charge movement in given point and to make the total macroscopic analysis in accordance with wave equation. The first part of task is based on differential kinetic Boltzman equation with the respective boundary conditions. However for long wave limit being under this analysis the electric field varies slowly on the space. So it is possible to apply the conductivity tensor in the limit of homogeneous electric field. Such tensor representation is peculiar to static charge transfer. For the standard form of wave $\sim e^{-i(\omega t - kr)}$ the characteristic equation system must be analyzed

$$\left(k_z^2 - \frac{4\pi i\omega}{c^2}\sigma_{xx}\right)E_x + \left(-\frac{4\pi i\omega}{c^2}\sigma_{xy}\right)E_y - \frac{4\pi i\omega}{c^2}\sigma_{xz}E_z = 0$$
$$\frac{4\pi i\omega}{c^2}\sigma_{xy}E_x + \left(k_z^2 - \frac{4\pi i\omega}{c^2}\sigma_{yy}\right)E_y + \left(-\frac{4\pi i\omega}{c^2}\sigma_{yz}\right)E_z = 0$$
$$\frac{4\pi i\omega}{c^2}\sigma_{xz}E_x + \left(-\frac{4\pi i\omega}{c^2}\sigma_{yz}\right)E_y + \left(-\frac{4\pi i\omega}{c^2}\sigma_{zz}\right)E_z = 0$$

Here x-direction of the orthogonal coordinate system coincides with the direction of openness for iso-energetic surface. Wave vector direction k coincides with z-direction. Larmor frequency is much higher of wave frequency and of reversal relaxation time. The solution of mentioned equation system shows that wave vector can be represented as $k_z^2 = \left(4\pi i\omega/c^2\right)\sigma_{xx}$. So the existence of wave similar to helicon geometry is impossible on the reason of complexity of wave vector. When a magnetic field will be oriented non-orthogonally strictly there is a chance to excite the helicon type wave having ellipsoidal polarization.

References

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