MAXWELL PLASMA AND QUANTUM FLUCTUATIONS OF ELECTROMAGNETIC FIELD

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Generally they construct the theory of high temperature classical electron –ion plasma being in thermodynamical state using Vlasov's equation [1,2]. In such a way one gets the plasma oscillations with frequency $\Omega_e = \sqrt{e^2 n_e / m_e}$. This frequency does not depend on wave length. The quantum electrodynamics by taken into account the quantum properties of electromagnetic field brings in theory the dimensionless parameter [3] $Z = e^2 T / 2\pi^2 \hbar^2 v_e \Omega_e$ .This parameter connecting with Planck constant $\hbar$ dramatically changes the results of the theory. Here $v_e = \sqrt{T/m}$. Theoretically the Maxwell plasma may be as in state $Z << 1$ (without the quantum fluctuations of electromagnetic field) and in state $Z >> 1$ (in present of the quantum fluctuations of electromagnetic fields). The Vlasov's theory deals with the case $Z = 0$. The linear with respect to Z correction terms to the Vlasov's theory are inversional proportional to $\hbar^2$, This fact excludes as the limit $\hbar \to 0$ and the existence of Vlasov's theory itself. The aggressive feed –back action of thermal exciting electromagnetic Langmuir waves on plasma electrons and ions describing by Z parameter dramatically changes the dispersion equations. In real conditions in Maxwell plasma the parameter $Z >> 1$ is much larger then unity. That is why the properties of plasma dramatically differ of Vlasov's equation descriptions. Instead of Langmuir's frequency Ω_e one has now an another character quantum frequency $\varpi = \Omega_e \sqrt{2Z} = (1/\hbar\pi)\sqrt{Te^2 / r_D}$, The two branches of electron oscillations appear. One of them describes the electron sound with the velocity $V_e = v_e \sqrt{\hbar\varpi th(\hbar\varpi / T)/2T}$. The ions of plasma possess as the sound branch of spectrum and another branch which rests finite by small wave numbers [4]. The properties of transversal and longitudinal dielectric permittivity's dramatically differ each to another especially at small wave numbers.

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