Relativistically Intense EM Waves in a Degenerate Fermi Gas

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ABSTRACT. We discuss some aspects of interactions of high-frequency electromagnetic (EM) waves with quantum Fermi gas, assuming that the intensity of EM waves is sufficiently large. Relativistic statistical thermodynamics of quantum electron-ion gas at presence electromagnetic waves has been considered. In this case the distribution function of particles becomes anisotropic, due to high power EM waves. By the new distribution function we study all the thermodynamic quantities as function of densities, temperatures and the amplitude of EM waves.

We investigate the cavitation phenomenon of degenerate Fermi electron gas. We obtain a novel set of adiabatic equations. For two cases we obtain expressions of the specific heat, which is strongly dependent from the amplitude of EM waves, namely, the coefficient of the electron specific heat increases with the increase of the amplitude of EM waves.

Skin depth is calculated in a particular frequency regimes and shown that penetration depth λ_{sk} increases when increase the amplitudeof EM waved.

Then, the modulation and filamentation instabilities of relativistically intense EM waves are investigated and the growth rates for various plasma parameters are determined.