

DISPERSION IN THERMAL PLASMA INCLUDING ARBITRARY DEGENERACY AND QUANTUM RECOIL

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The longitudinal response function for a thermal electron gas was calculated including two quantum effects exactly, degeneracy and the quantum recoil. The Fermi-Dirac distribution was expanded in powers of a parameter that is small in the non-degenerate limit and the response function was evaluated in terms of the conventional plasma dispersion function [1, 2] to arbitrary order in this parameter. The infinite sum was performed in terms of polylogarithms in the long-wavelength and quasi-static limits, giving results that apply for arbitrary degeneracy [3, 4]. The results were applied to the dispersion relations for Langmuir waves and to screening, reproducing known results in the non-degenerate and completely degenerate limits [5], and generalizing them to arbitrary degeneracy. The occupation number for the completely degenerate limit is shown in the Fig. 1. The importance of the results regarding to semiconductor plasmas were highlighted [4].

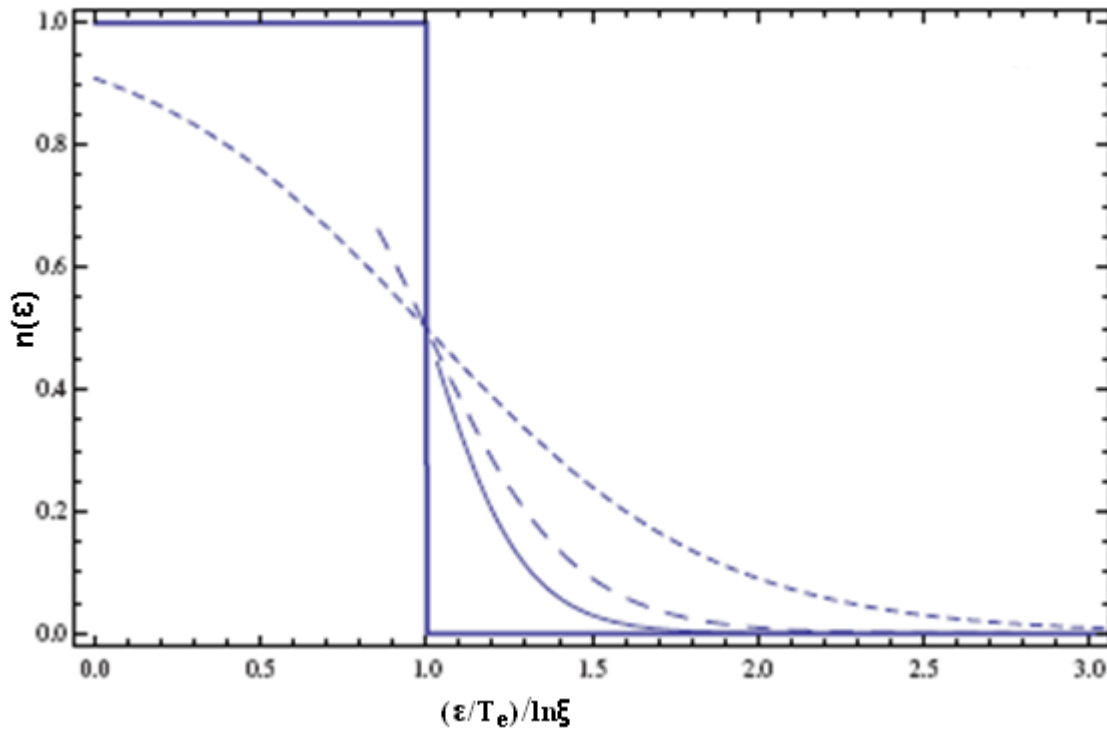


Fig. 1 Plot of the occupation number for Fermi-Dirac distribution for different values of temperature ratio

References

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