# UNDAMPED ELECTROSTATIC PLASMA OSCILLATIONS IN THE PRESENCE OF AN EXTERNAL FIELD

D D A SANTOS, B V RIBEIRO AND M A AMATO

ABSTRACT.

The small-amplitude undamped waves in an unmagnetized electronic plasma in the presence of an external radiation field are discussed. In the present model, the collision-free infinite and homogeneous plasma is treated under a semi-classical approach, with the electrons been studied in quantum mechanical viewpoint whereas the external electromagnetic (e.m.) field in the classical context. This theoretical background provides, in the classical limit ($\hbar \to 0$), a detailed description about the effects of the radiation field on the collective plasma oscillations once the strength and the number of photons of the e.m. field appear explicity in the expression of the dielectric function.

In order to take into account the trapping of particles effects on the wave dispersion relation, we introduce a small discontinuos plateau in the equilibrium distribution function centered on the wave phase velocity. The Landau velocity integral in the dielectric function is performed by means of a trapezoidal scheme and the electrostatic undamped modes are obtained numerically through the solutions of the dispertion relation equation. We found that the external radiation field acts as a mechanism able to excite modes off of the usual thumb curve from Ref.[1]. For small wavenumber plasma oscillations, the dispersion relation corresponding to many photons process are virtually identical. We investigte the sensitivity of the roots of the dielectric function to different amplitudes of the external field and found that as we increase the strength of the e.m. field the range of modes that can propagate in the medium becomes narrower. Following the same lines discussed in Ref. [2] for free plasmas, we finalized the work investigating the existence of corner modes, that arise when we assume the existence of a smooth plateau in the equilibrium distribution function instead of a discontinuous one.

## REFERENCES

[1] J. P. Holloway and J. J. Dorning *Undamped plasma waves*, Phys. Rev. A, **44**, 3856-3868 (1991).

[2] F. Valentini et al. *Undamped electrostatic plasma waves*, Phys. of Plasmas, **19**, 092103 (2012).

INSTITUTO DE FÍSICA, UNIVERSIDADE DE BRASÍLIA, CP: 04455, 70919-970 - BRASÍLIA - DF, BRAZIL, CNPQ FOUNDATION, MINISTRY OF EDUCATION OF BRAZIL, BRASÍLIA - DF 70040-020, BRAZIL, das@fis.unb.br

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