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Efficient Technique to Evaluate the Lindhard Dielectric Function.
LORENZO UGO ANCARANI, Universite de Lorraine, HERVE JOUIN, Universite de Bordeaux — Since the pioneering work of Lindhard, the dielectric response function obtained in [1] from first principles within the Random Phase Approximation (RPA) has been and is widely used in many areas of Physics such as Plasma Physics, Atomic Physics in plasmas, Solid State Physics, Plasmonics and Nuclear Physics. Indeed, the dielectric function is the fundamental ingredient for many theories related to the response of matter to an external perturbation characterized by a wavenumber k and a frequency ω. In all the above applications the Lindhard dielectric function has to be evaluated many times (for given temperature T, and given values of a real parameter which depends on k and ω). It is notorious that the integral defining its real part presents a logarithmic divergence which renders the numerical calculation delicate and time consuming. Through a simple but very efficient mathematical trick we are able to remove the singularity and obtain a useful integral expression which is trouble-free, i.e., it can be dealt with any standard numerical quadrature [2]. Our analytical expression greatly facilitates the computation of the dielectric function. [1] J. Lindhard, K. Dan. Vidensk. Selsk. Mat. Fys. Medd., 28(8), 1 (1954). [2] L.U. Ancarani and H. Jouin, Eur.Phys. J.-Plus, 131, 114 (2016).

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