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Derivation of Landau damping by *N*-body mechanics

D.F. Escande[1], D. Bénisti[2], Y. Elskens[1], D. Zarzoso[1], F. Doveil[1]
[1] Aix-Marseille Université, CNRS, PIIM, Marseille, France, [2] CEA, DAM, DIF F-91297 Arpajon,

e-mail : dominique.escande@univ-amu.fr

While the description of microscopic plasma physics by *N*-body mechanics had been deemed impossible since the beginning of this physics, such a description developed during the last three decades [1, 2, 3, 4]. Various phenomena, presented in textbooks mainly in a Vlasovian setting, are now introduced by using classical mechanics only and no statistical setting, which makes obvious the interpretation of these phenomena. This mechanical approach provides three different derivations of Landau damping: a very short, yet rigorous, one germane to Kaufman's in a Vlasovian setting [5], one exhibiting phase mixing à la van Kampen, and one recovering the usual Vlasovian dielectric function and providing both Landau damping and Debye shielding [2, 3]. The latter involves a singular limit, but is faster than the second one. The first two derivations are new and result from the reformulation and the extension of previous one-dimensional results in three dimensions [6].

References

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