Collision rates estimated from exact *N*-body simulations

E. Gravier[1], T. Drouot[1], M. Lesur[1], A. Guillevic[1], G. Lo-Cascio[1], J. Moritz[1],

D. F. Escande[2], G. Manfredi[3]

[1] *Université de Lorraine, CNRS, Institut Jean Lamour, UMR 7198, F-54000 Nancy, France*

[2] *Aix-Marseille Université, CNRS, PIIM, UMR 7345, F-13000 Marseille, France*

[3] *Université de Strasbourg, CNRS, IPCMS, UMR 7504, F-67000 Strasbourg, France*

In a plasma, the charged particles interact via long-range forces and this interaction causes the plasma to exhibit collective effects. If the graininess or coupling parameter g goes to zero (ideal collisionless plasma), two-body collisions are negligible while collective effects dominate the dynamics. In contrast, when g~1 collisions play a significant role. To study the transition between a collisionless and a collisional regime, a *N*-body code was developed and used in this work. The code solves exactly, in one spatial dimension, the dynamics of N infinite parallel plane sheets for both ion and electron populations [1-3]. We illustrate the transition between individual and collective effects by studying two basic plasma phenomena, the two-stream instability and Langmuir waves, for different values of g. The numerical collision rates given by the *N*-body code increase linearly with g for both phenomena, although with proportionality factors that differ by roughly a factor of two, a discrepancy that may be accounted for by the different initial conditions. All in all, the usual collision rates published in the literature (Spitzer collisionality [4]) appear to compare rather well with the rates observed in our simulations [5].

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