Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Force on a small grain in the plasma wake of another[1] I.H. HUTCHINSON, MIT — A solid, negatively charged, grain lying in the plasma wake of another experiences a transverse force that often aligns or misaligns the two grains. The force arises in part from the oscillatory plasma wake potential, but hitherto the importance of the additional ion-drag perturbation has been controversial. The ion-drag perturbation is intrinsically one order smaller than the wake-potential force in the ratio of grain size (r_p) to Debye length (λ_{De}). So ion-drag perturbation is important only in nonlinear wakes and can't be evaluated by linear analytic approximations. Fluid treatments are likewise unsatisfactory. Therefore, rigorous kinetic-ion 3D PIC simulations of the force in the nonlinear regime are here performed, providing for the first time a quantitative calculation of the wake force between two interacting grains. It is found that even for quite large grains, $r_p/\lambda_{De} = 0.1$, whose wake amplitude is already partially limited by nonlinearity, the force is dominated by the wake-potential-gradient. The ion-drag perturbation is a small effect at relevant grain separations. The wake potential structure can then on its own help explain the preferred alignment of floating dust grains.

[1]Work supported in part by NSF/DOE Grant DE-FG02-06ER54982.

I.H. Hutchinson
MIT

Date submitted: 06 Jul 2011 Electronic form version 1.4