Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Particle in cell calculation of plasma force on a small grain in a non-uniform collisional sheath[1] IAN H. HUTCHINSON, MIT PSFC — Dusty plasma experiments often involve grains suspended in a sheath. The plasma forces on them are complicated by several factors. Ion-neutral collisions, essential to the pre-sheath physics, control the ion velocity distribution and can directly affect the ion drag force; there is no length-scale separation between the non-uniformity of the sheath itself and the grain's plasma perturbation; and non-linearity is important in the ion-grain interactions. The multidimensional particle in cell code COPTIC has been used to calculate fully self-consistently the plasma force, when charge and height in a (charge-exchange) collisional DC plasma sheath are specified. The background sheath ion velocity distribution functions for the unperturbed sheath are observed to vary substantially with collisionality. The grain force is found to agree quite well with a combination of sheath electric field force plus ion drag force. However, the drag force must take account of the non-Maxwellian (and spatially varying) ion distribution function, and the collisional drag enhancement. Practical formulas are provided to enable equilibrium including other forces such as gravity to be calculated.

[1]Supported in part by NSF/DOE Grant DE-SC0010491.

Ian H. Hutchinson
MIT PSFC

Date submitted: 10 Jul 2014 Electronic form version 1.4