Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Interaction of a finite-sized particle with wall turbulence[1] LANYING ZENG, S. BALACHANDAR, FADY NAJJAR, University of Illinois, Urbana-Champaign, PAUL FISCHER, Argonne National Laboratories — Interaction of a *finite-sized* particle (diameter comparable or bigger than flow scales) with wall turbulence is quite complex. For example, in such situations the applicability of standard drag and lift correlations, which have been developed based on simple ambient flow conditions, can be questioned. Furthermore, the complex wake dynamics of a finite-sized particle has the potential significantly modify the carrier phase turbulence and in the presence of a nearby wall influences the wall shear stress and drag. In order to get the insight into this problem, we consider a turbulent channel flow with an embedded spherical particle of diameter varying from 2 to 20 times the Kolmogorov scale. The position of the particle is varied from near the wall, to within the buffer region and to the channel center. The particle Reynolds number in these cases varied from 40 to about 500. All relevant length and time scales of turbulence, attached boundary layers on the particles, and particle wakes are faithfully resolved. The results from the direct numerical simulation are compared with the corresponding predictions based on standard drag and lift relations, added-mass, and Basset history formulation. The details of wake dynamics and its influence on turbulence and wall shear stress is also considered.

[1]Supported by CSAR under contract B341494 from DoE

S. Balachandar
University of Illinois

Date submitted: 12 Aug 2005 Electronic form version 1.4