Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Interface-resolved simulations of small inertial particles in a turbulent channel flow[1] FRANCESCO PICANO, University of Padova, PEDRO COSTA, LUCA BRANDT, KTH Mechanics — Turbulent flows laden with small inertial particles are found in different contexts. Dealing with very dilute conditions, the so-called one-way coupling regime takes place with particles transported by the fluid without back and mutual reactions. Even in this regime, models for particle dynamics are crucial to accurately simulate their transport. In this work, we compare data from interface-resolved and one-way-coupled point-particle direct numerical simulations (DNS) of a turbulent channel flow laden with small inertial particles, with high particle-to-fluid density ratio of 100 and particle diameter of 3 viscous units. The most dilute flow considered, solid volume fraction $O(10^{-5})$ shows the particle feedback on the flow to be negligible, whereas differences with respect to the unladen case are found for volume fraction $O(10^{-4})$. The most dilute case is taken as the benchmark for accessing the validity of usual point-particle model considering only a non-linear drag. In the bulk of the channel, particle velocity statistics from the point-particle DNS agree well with those from the interface-resolved DNS, while major differences are found close to the wall. We show that they are due to particle-wall interactions that are not reproduced by usual point-particle model.

[1]This work was supported by the European Research Council grant no. ERC-2013-CoG- 616186, TRITOS. We acknowledge computer time provided by SNIC (Swedish National Infrastructure for Computing), and PRACE for awarding us access to the supercomputer Marconi, based in Italy at CINECA under project 2017174185 DILPART

Francesco Picano
University of Padova

Date submitted: 19 Jul 2019 Electronic form version 1.4