Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Heat Transfer in turbulent convection described by Lagrangian Statistics[1] JANE PRATT, Georgia State University, ANGELA BUSSE, University of Glasgow, WOLF-CHRISTIAN MUELLER, Technische Universitt Berlin —
In direct numerical simulations of turbulent flows driven by convection, there is considerable variation in the contributions to the Nusselt number, both because of the local spatial variations of plumes and because of convective variation in time. We present a new exit-distance statistic, constructed from Lagrangian tracer particles, that we have developed to more completely describe the structure of heat transfer. We call this the Lagrangian heat structure. In a comparison between direct numerical simulations of homogeneous turbulence driven by Boussinesq convection, the Lagrangian heat structure reveals significant non-Gaussian character, as well as clear trends with Prandtl number and Rayleigh number. For large temperature differences, the Lagrangian heat structure produces converging results; this is encouraging for simulations that focus on large scales, such as large eddy simulations of natural systems including Earths atmosphere and oceans, as well as planetary and stellar dynamos.

[1]This work received support from the Thomas Jefferson Fund/FACE Foundation

Jane Pratt
Georgia State University

Date submitted: 10 Aug 2020 Electronic form version 1.4