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WEDNESDAY, 28 OCTOBER 2020

10 AM BOSTON, 3 PM LONDON, 10 PM BEIJING



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MULTI-SCALE AND TRANS-SCALE ANALYSIS IN PARTICLE-LADEN TURBULENCE

Sand/dust storm is a kind of extreme dynamic process in natural environment dominated by windblown sand particles and air turbulence. It leads to the sand transport, the formation and evolution of sand ripples and dune fields, the charge-to-mass ratio of sand particles, as well as the electric field in sandstorms which all demonstrate multi-scale characteristics in time and space. In this presentation, two types of trans-scale approaches proposed by the Center for Particle-laden Turbulence of Lanzhou University will be outlined. The first one is a trans-scale model to simulate and reproduce the formation and evolution process of dune fields with hundreds of square kilometers over decades; and the second one is a trans-scale inversion approach to reconstruct the electric structure of sand/dust storms and the distribution of sand-grain charge-to-mass ratio based on locally observed electric field data. The insights gained from the two issues are: in the former case, the gap from small- to large-scale processes can be linked through the statistical analysis of small-scale processes so as to extract the statistics that reflect the nature of the problem; while in the latter case, the downscaling leap from large- to small-scale physics is an ill-posed problem in mathematics, the inversion of which requires a regularization operation as a preliminary. Finally, key issues needed to be highlighted in the extreme mechanics research will be presented.

Xiaojing Zheng, professor, academician of CAS (Chinese Academy of Sciences) and TWAS (The World Academy of Sciences), Director of the Center for Particle-laden Turbulence, Lanzhou University, Editor-in-Chief of the 'Acta Mechanica Sinica' etc. Her research interests include High-Reynolds number wall turbulence, particle-turbulence interactions in multi-phase flows, multi-scale modeling and simulations of environmental disasters, such as dust storms, dune fields and wind-blown sand flows. She is the founder of the Qingtu Lake Observation Array (QLOA) which is a unique field facility for scientific research on gas-solid two-phase flows in Atmospheric Surface layer with $Re \sim 10^6-7$. She has co-authored more than 200 papers in peer-reviewed journals, and 3 monographs. She is also the Laureate of the National Natural Science Award (twice) and the National Awards for S&T Progress etc.

Discussion leader: **Yujie Wei**, Institute of Mechanics, Chinese Academy of Sciences

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