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FINAL REPORT
PUBLICATIONS/PATENTS/PRESENTATIONS/HONORS/STUDENTS REPORT

for

GRANT: N00014-9510444
PR Number 96PR03405

Scalings in Homogeneous and Inhomogeneous Turbulence

Zhen-Su She, Principal Investigator

Department of Mathematics, UCLA
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PR Number: 96PR03405
Grant Number: N00014-9510444
Grant Title: Scalings in Homogeneous and Inhomogenous Turbulence
Principal Investigator: Zhen-Su She
Mailing Address: Department of Mathematics, UCLA, Los Angeles, CA 90095
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http address: None
a. Number of papers submitted to referred journals, but not yet published: 3


b. Number of papers published in referred journal: 3

Published Papers in Referred Journals


c. Number of books or chapters submitted, but not yet published: 1

- She, Z.-S., Non-equilibrium Dynamics of Turbulent Fluctu-

d. Number of books or chapters published: 1


e. Number of printed technical reports/non-referred papers: 0

f. Number of patent filed: 0

g. Number of patent granted: 0
OFFICE OF NAVAL RESEARCH
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• h. Number of invited presentations: 16

Invited Presentations

• Z.-S. She, “On a Scaling Theory of Turbulence”, at the ’96 Symposium on Computational Physics, China, June 1996.
• Z.-S. She, “A New Symmetry in Turbulence”, at the International Workshop on “Dynamical Models of Turbulence”, Observatoire de Nice (France), December 1996.
• Z.-S. She, “A New Scaling Theory of Turbulence”, Special Invited Lecture at the National Turbulence Workshop (China),
Wuhan (China), May 1997.
○ Z.-S. She, "Inertial Range Dynamics of Turbulence", A series of four lectures at the Summer School on "Turbulence", Beijing University (China), June 1997.
○ Z.-S. She, "Invariance Principle and Hierarchical Structures in Turbulence", Invited talk at the 12th Nishinomiya Symposium on the "Dynamics Origonization" (Japan), November 1997.
○ Z.-S. She, "Nonlinear Fluctuation Dynamics of Turbulence", Invited talk at the workshop "Nonlinear Phenomenology", Kyoto University (Japan), November 1997.
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• i. Number of submitted presentations: 0

• j. Honors/Awards/Prizes for contract/grant employees: 0

• k. Total number of Full-time equivalent Graduate Students and Post-Doctoral associates supported during this period, under this R&T; project number: 2
  • Graduate Students: 2
  • Post-Doctoral Associates: 0.2
  • including the number of
    • Female Graduate Students; 1
    • Asian Graduate Students: 1

• l. Other funding:

Sloan Foundation Research Fellowship, $8,000. Total of $30,000 over three years. This fund mostly supports international travels to scientific meetings.
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(PART II)

a. P. I.: Zhen-Su She

b. Phone Number: (310) 8258576

c. Program Officer: Michael F. Shlesinger

d. Program Objective:

Understand the fundamental processes which leads to the generation of small-scale fluctuations. Describe the scaling properties of turbulence based on features of fluid structures. Develop theories of turbulence for universal scaling laws and for applications

e. Significant Results:

• Using direct numerical simulations, we show clear evidence for the scaling deviation from Kolmogorov law for all structure functions in the Navier-Stokes flow
• We show that the She-Leveque model give accurate predictions about the scaling exponents for the NS flow as well as for other dynamical system of energy cascade.
• We show that the high Reynolds number liquid Helium turbulent flows are also characterized by a hierarchy of structures (S-L model), but with slightly different
leading singularity from homogeneous open turbulent flows

- We show that spatially extended chaotic system is also characterized by a hierarchy of structures predicted by the She-Leveque model
- We develop a "special relativity" theory for the study of the multiscaling field of turbulence. This theory postulates the existence of an invariance property for any generic scaling field with finite fluctuation range, and explain therefore the success of the She-Leveque model for a large variety of systems