

Final report of Scientific Workshop “Particles in turbulence”

14 May 2012 through 16 May 2012

Lorentz Center

Leiden, The Netherlands

Scope and challenges

Fluid turbulence is ubiquitous and so is its ability to transport particulate matter such as dust, soot or droplets. The dynamics of particles in a turbulent flow is fundamental to everyday life - examples of open scientific and technological issues include rain formation in clouds, pollution dispersion in the atmosphere, optimization and emission reduction in combustion, plankton population dynamics - and constitute a major scientific challenge with immediate practical implications and applications. Open scientific issues such as inertia, finite particles sizes, collisions, advection in complex flow geometries are examples of fundamental key ingredients which pose challenging theoretical problems and need to be understood in order to have an impact on applications.

Aim and format

The goal of the workshop was to bring together scientists working on the fundamental statistical properties of particle transport in turbulence and related phenomena. The idea was to have a short but intense meeting (the workshop was organized over only 3 full days) bringing together scientists working on experimental, numerical, and theoretical as well as applied aspects.

The format was specifically chosen in order to facilitate exchange amongst scientists with different expertise (plenary meetings, joint working group meetings, time for free individual discussions amongst participants) as well as to stimulate technical discussions and collaborations (e.g. within the four parallel working group sessions).

The workshop and beyond

The workshop was one of the annual activity of the EU COST Action MP0806 “Particles in turbulence” and attracted many participants from within the COST Action. There were 6 keynote plenary lectures aimed at stimulating discussions and at providing an update on the state-of-the-art on few outstanding open issues. The workshop was divided in 4 parallel working groups sessions alternated by joint discussion sessions. Time was left for individual interaction amongst participants during the conference program as well as during the social events. Scientific presentations have been made available on the Lorentz Center website. In the end of the workshop few research challenges were identified that are starting to attract the attention of several participants both from the experimental, numerical, theoretical or application point of view. These are:

- the dynamics of complex particles, e.g. like colloids, which aggregate and break under the influence of turbulent fluctuations and transport;
- the dynamics of particles with complex shapes (e.g. non spherical) or with deformable shape (e.g. droplets);
- the dynamics of active (e.g. swimming) and reactive (e.g. reproducing) biological entities transported by turbulent currents.

Acknowledgment

The organizers wish to express their sincere gratitude to the Lorentz Center for facilitating the organization of the workshop. We acknowledge financial support from EU COST Action MP0806 “Particles in turbulence”.

Federico Toschi (Eindhoven, The Netherlands)

Eberhard Bodenschatz (Goettingen, Germany)

Program

Monday 14 May 2012

- 09:00- 10:00 Welcome and Coffee
- 10:00- 10:15 Introduction by the manager of Lorentz Center **Mieke Schutte**
- 10:15- 10:30 Introduction by the workshop organizers
- 10:30- 11:00 Participants introduce themselves
- 11:00- 11:45 Keynote lecture: **Haitao Xu**: Dynamics of small, weakly inertial particles in turbulent flows
- 12:00- 13:30 Lunchbreak @ Gorlaeus Restaurant, and Informal Discussions (during lunch all MC members will meet for the MP0806 MC meeting in the Gratama room)
- 13:30- 14:00 Introduction to the Working Groups

	WG1	WG2	WG3	WG4
14:00- 14:30	Monchaux	Toschi	Onishi	Simonin
14:30- 15:00	Saha	Soldati	Bajer	Reeks
15:00- 15:30	Sun	Bäbler	Boffetta	Rimbert

- 15:30- 16:00 Coffee/tea break
- 16:00- 16:30 **Ke-Qing Xia**: Experimental Studies of Lagrangian Acceleration and Pair Dispersion in Thermally-Driven Turbulence
- 16:30- 17:00 **Lian-Ping Wang**: Turbulence modulation by inertial particles
- 17:00 Wine and Cheese party @ Common room

Tuesday 15 May 2012

09:00- 09:45 Keynote lecture: **Herman Clercx**: Table-top rotating turbulence: an experimental insight through particle tracking

09:45- 10:15 **Nicholas Ouellette**: Active Particles in Complex Flow

10:15- 11:00 Coffee/tea break

	WG1	WG2	WG3	WG4
11:00- 11:30	Bodenschatz	Casciola	Chevillard	Abel
11:30- 12:00	Xu	Biferale	Bec	Perlekar

12:00- 13:00 Lunchbreak @ Gorlaeus Restaurant, and Informal Discussions

13:00- 15:00 Free Discussion time

15:00- 15:45 Joint WG discussion time

15:45- 16:15 Coffee/tea break

	WG1	WG2	WG3	WG4
16:15- 16:45	Hardalupas	WG Discussion	Cencini	Wilkinson
16:45- 17:15	Westerweel	WG Discussion	Mehlig	

17:30 Departure by bus

18:00- 22:00 [Workshop dinner and boat trip](#)

Wednesday 16 May 2012

09:00- 09:45 Keynote lecture: **Gregory Falkovich**: Stochastic geometry of turbulence

09:45- 10:30 Keynote lecture: **Bernhard Mehlig**: Clustering, caustics, and collisions of inertial particles in random flows

10:30- 11:00 Coffee/tea break

		WG1	WG2	WG3	WG4
11:00-	11:20	Elsinga	Minier	Martins-Afonso	Scatamacchia
11:20-	11:40	Kunnen	Rosa	Ray	Tagawa
11:40-	12:00	Traugott	Clercx	Feudel	

12:00 13:00 Lunchbreak @ Gorlaeus Restaurant, and Informal Discussions

13:40 14:00 Joint Working Groups meeting

		WG1	WG2	WG3	WG4
14:00-	14:20	Du Puits	Brethouwer	Musacchio	Falkovich
14:20-	14:40	Funfschilling	Pozorski	Devenish	Bocanegra Evans
14:40-	15:00	Nagendra Prakash	Van Hinsberg	Guseva	Warncke
15:00-	15:20	Discussion	Discussion	Discussion	Discussion

15:30- 16:15 Keynote lecture: **Luca Biferale**: Dynamics and breakup of droplets in turbulence

16:15- 16:45 Coffee/tea break

16:45- 18:00 Closing keynote lecture: **Detlef Lohse**: News from the Twente Turbulent Taylor-Couette (T³C) facility

----end of workshop----