

SIG 35, Multipoint Turbulent Structure and Modelling: Recent, past activities and plans (dated October first 2010)

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The last similar document was sent in September 2009.

Brief Reminder of topics: SIG 35, or ‘Multipoint Turbulence Structure & Modelling’, MPTSM hereinafter, does share a part of the domain of turbulence modelling with, e.g., SIG 15, but from a more fundamental viewpoint. An important overlapping also exists with LES-SIG 1, SIG 14 and SIG 4, and some other ones (not to mention the close connection with the recently established SIG 42, rediscussed below.)

The list of themes given in the ERCOFTAC website remains valid, with the purpose to promote applications. All the following aspects must be oriented towards applications to geophysical, environmental and industrial complex flows: Lagrangian statistics and dynamics, multipoint (and therefore multiscale) approach, structuring effects of mean gradients and body forces on (highly anisotropic) turbulent flows, wave-vortex dynamics, fractal structure and forcing. More effort is expected for improving practical LES, and the refined investigation of *two-time* two-point statistics/dynamics is useful for turbulent diffusion (passive tracers, pollutants, slow chemistry), as well as for aero-acoustics.

The last aspect is an important topic of the SIG 42, ‘Synthetic Turbulence Models’, established in 2007. Double labelling, SIG 42 and SIG 35, was used in previous meetings, the last one being Warsaw (July 2009). Now we prefer to separate the events, in order to preserve the individual career of both SIG’s.

Dynamical aspects are essential in SIG 35, with fully nonlinear theory and modelling, supported by very high resolution DNS and LES, and close contact with scientists involved in the ITER (controlled nuclear fusion) project, geodynamo and astrophysics. For instance, we will continue to promote progress towards turbulence in fluids, MHD (MagnetoHydroDynamics) flows and plasmas, in which Lagrangian diffusion is altered by waves (inertia, gravity, Alfvén, etc., and combination of them) more than by coherent vortices. Mixing by vortices is dominant in engineering flows, whereas impact of waves is increasingly relevant from ‘hydro’ geophysics to plasma physics.

Application to modelling of turbulence in compressible, high-speed, flows is important and has impact on engineering flows: Past events (‘Turbulence and mixing II’, Marseille, Summer School, July 2007, and ‘ASTROFLU’ workshop in Lyon, November 2008) illustrate this contribution of SIG 35 to activities of SIG 4, which was reinforced on the occasion of the next Summer School (Turbulence and mixing III, Oléron island.)

1 Past activities (from 2007)

The SIG 35 was established with a kick-off meeting held in Imperial college, London, May 10th 2001. *The SIG received a specific financial support from ERCOFTAC in 2007, 2008 and 2009.* From 2006, the following meetings took place:

- ERCOFTAC/SIG 35 workshop, Luminy (near Marseille), November 13-14, 2006, *3D structure and Lagrangian aspects in turbulence for fluids and plasmas*, co-organised by Kai Schneider and Claude Cambon. Given the short notice after the first proposal submitted to the SPC meeting (Athens, 2006), no scholarship was obtained.
- IMS/ERCOFTAC/SIG 35/COST 20 workshop, IC London, March 26-28, 2007, *Interscale energy transfer in various turbulent flows*, co-organized by Claude Cambon, Arkadi Tsinober, & Christos Vassilicos. Report in ERCOFTAC bulletin 73, June 2007.
- ERCOFTAC/SIG 35 workshop, Sheffield (UK), May 29-30 2007, *Synthetic turbulence models I*, co-organized by Franck Nicolleau, Claude Cambon & Christos Vassilicos. Report in ERCOFTAC bulletin 75, December 2007.
- Summer school, Cargèse (Corsica), August 13-25, 2007, *Small-scale turbulence: theory, phenomenology and applications*, coorganised by Luminita Danaila (Sig’s new young member), Philippe Petitjeans & Alain Noullez. *Both SIG’s 4 and 35 were involved, as well as France-West and Centre Henri Bénard PC’s.* Report in the ERCOFTAC bulletin 75, December 2007.
- ERCOFTAC/SIG 14/SIG 35/SIG 42 workshop, CUM, Vilanova, November 29-30 2007, *Synthetic turbulence models II*, co-organized by Jose Rondono, Franck Nicolleau and Claude Cambon. Report in ERCOFTAC bulletin 76, March 2008.
- International workshop, CIRM, Luminy (near Marseille), April 21-25 2008, *Multiscale methods for fluid and plasma turbulence : Applications to magnetically confined plasmas in fusion devices*, co-organized by Marie Farge and Kai Schneider. No scholarship requested.
- ERCOFTAC/SIG 42/SIG 35 workshop, Newcastle (UK), July 3-4 2008, *Synthetic turbulence models III*, co-organized by Elena Meneguz, Andrew Baggaley, Mike Reeks, Franck Nicolleau, & Claude Cambon. Report in ERCOFTAC bulletin 79, December 2008.

- ERCOFTAC/Henri Bénard PC and SIG 35 workshop, Lyon, November 12-13, 2008, *AS-TROFLU colloquium*, co-organized by a local committee from both ENS-Lyon and ECL-Lyon. This joint meeting gathered astrophysicists and specialists of fluid mechanics, in order to identify common themes and to launch collaborations. It was also a follow-up of the Summer School on ‘Turbulence and mixing in compressible flows II’ held in Marseille in July 2008.
- Conference TI-2009, Sainte Luce, La Martinique (French oversea department), May 31-June 5 2009, *Turbulence & Interaction*, co-organized by Michel Deville, Thièn Hiệp Lê, and Pierre Sagaut. *Both Henri Bénard PC and SIG 35 were involved. Pierre Sagaut is a very active participant of the Henri Bénard PC.*
- International ERCOFTAC/SIG 42/SIG 35 workshop, Warsaw (Poland), July 1-3 2009, *Workshop on synthetic turbulence models and vortex flows*, co-organized by Andrzej Nowakowski, Konrad Bajer, Jacek Rokicki, Franck Nicolleau & Claude Cambon. Report in ERCOFTAC bulletin 81, December 2009.
- **W2009-12** ERCOFTAC/Henri Bénard PC and SIG 35 workshop, Lyon, December 7-8 2009, *Velocity gradients and increments, dynamics and statistics, in turbulent flows with effect of rotation, stratification and/or MHD*, co-organized by Aurore Naso, Franck Nicolleau, Fabien S. Godeferd & Claude Cambon. Report in ERCOFTAC bulletin 83, June 2010.
- Winter School, Ecole de physique des Houches (France), February 21-26, 2010, *New challenges in turbulence research*, co-organized by Mickael Bourgoin, Bernard Rousset, Jean-François Pinton & Claude Cambon. Both SIG 35 and Henri Bénard PC were involved. Four themes were addressed: Cryogenic turbulence, new sounding experiments, strongly anisotropic turbulence, real-life particle motion in turbulent flows. Report in ERCOFTAC bulletin 83, June 2010.

2 Plan of activities and initiatives in 2011 and 2012

The last SIG 35 workshop in 2010 is as follows:

ERCOFTAC/SIG 35 workshop, CIRM, Luminy (near Marseille), October 4-6 2010, *Instabilities, turbulence and interactions in rotating shear flows*, co-organized by Kai Schneider, Thierry Lehner & Claude Cambon.

The last Winterschool in February 2010 was considered as very successful, so that we will render it bi-annual, with the next one in Winter 2012. The period February 12-17 2012 is just fixed with ‘Ecole de Physique des Houches’.

Next year, a workshop at smaller scale with label SIG 35 is planned as a follow-up, as *Workshop on statistical mechanics, fractals, instabilities, turbulence in fluids and superfluids*, to be held in Paris, April 13-15.

In addition to the themes addressed in the last Winterschool, a very important new one will be ‘from stable stratification to instable cases’. Stably stratified turbulence with and without rotation is a long-term topic in SIG 35, particularly in Lyon. New recent elements yield to re-attack, with the tools of MPTSM, buoyancy-driven flows such as thermal convection (destabilising temperature gradient) and even

Rayleigh-Taylor instability with transition to turbulence. Collaboration with the CEA (A. Llor, B-J Gréa) is particularly encouraging, from spectral approaches (RDT, nonlinear closures,) supported by high resolution DNS towards LES to engineering-oriented models, like bi-fluid $k - \varepsilon$. This theme is also important for the SIG 14.

Another small workshop will take place on the same topic, probably in Autumn 2011, in possible connection with the ‘Pan-european non-Homogeneous Lab.’ project of Jose Redondo.

SIG 35 will be involved in the next Summerschool *Morphology and dynamics of anisotropic flows*, to be held in Cargese, Corsica, July 18-30 2011, with Luminata Danaila as main organiser.

Finally, contacts are in progress with the group of Bernard Knaepen, Université Libre de Bruxelles, for organising a SIG 35 workshop on MHD (Magnetohydrodynamics), with DNS, LES, spectral closures and structure-based modelling. A contribution from the group of Stavros Kassinos (University of Cyprus) is expected.

3 Agreement with the ‘concordat’

We confirm our agreement with the concordat and in particular our commitment to attending SPC meetings.