

ERCOFTAC/Henri Bénard/SIG 35/SIG 24/SIG 33/Workshop at Ecole Centrale de Marseille, M2P2, Marseille): ‘A systems approach to turbulence and interactions: towards high Reynolds number.’

**dates, location, organisers:** May 15 & 16, 2017. The workshop will take place at Ecole Centrale de Marseille, M2P2, domaine universitaire de Chateau Gombert, Marseille. It is co-organised by Pierre Sagaut and Claude Cambon.

## Scope of the workshop

This workshop is partly a follow-up of previous ones, in D’Alembert, Paris, in May 2015 and May 2016. Transport of passive scalar by an isotropic velocity field has been extensively studied. What happens when the velocity flow is rendered anisotropic by various effects, as mean shear and mean stratification, is not well known; triadic closures, with quantitative comparisons to high resolution DNS’s, are well suited for a systems approach to such anisotropic turbulence. In addition, it is informative to compare the passive scalar and the active one, such as the density, temperature or concentration fluctuation with a feedback to fluctuating velocity via buoyancy effects. Of course, a broader range of models, theories, applications, DNS, LES and physical experiments will be addressed as follows:

- Extension of spectral theory towards anisotropic shear flows, with passive and active (buoyant here) scalar field. Application to practical (simpler) models for engineering and environment,
- Towards unsteady and inhomogeneous flows. Contribution to a mean flow theory. Wall-bounded turbulent flows.

About the generic term ‘A systems approach to’, we have now a well advanced project in mind, far beyond both the domain of classical hydrodynamic stability and the domain of RANS modelling. With respect to the first theme, the base flow for stability is replaced by a *mean* flow (Reynolds decomposition), which is not known a priori, and the three couplings are investigated, mean-to-fluctuating, as in ‘Rapid Distortion Theory’, feedback from the fluctuating-to-mean via generalized Reynolds stresses, and fluctuating-to-fluctuating, via elaborate nonlinear models. Particularly the last interaction allows us to investigate very high Reynolds numbers, outside the scope of hydrodynamic stability theory. With respect to RANS modelling, of course one recovers the Reynolds decomposition and the three (mean-to-fluctuating, fluctuating-to-mean, and fluctuating-to-fluctuating) interactions, but the statistical approach is performed scale-by-scale, including for instance two-point spectral models, and gives access to dominant modes and leading structures of the turbulent flow.

## Programme: Monday May 15th

- 13:30 - 14:00 Opening (Pierre Sagaut & Claude Cambon)
- 14:00 - 14:30 Benjamin Favier (IRPHE, Marseille), *Inertial wave turbulence driven by elliptical instability.*
- 14:30 - 15:00 Antoine Briard (D’Alembert, Paris), *Anisotropic spectral modelling for unstably stratified homogeneous turbulence.*
- 15:00 - 15:30 Benoît- Joseph Gréa (CEA, near Paris) *What is the final size of mixing zones driven by Faraday instability?.*
- 15:30 - 16:00 Abdelaziz Salhi (Faculté des Sciences de Tunis), *Nonlinear dynamics in precessing sheared homogeneous turbulent flows.*
- 16:00 - 16:30 Coffee break
- 16:30 - 17:00 Bruno Chaouat (ONERA, near Paris), *On the use of the PITM method using inlet synthetic turbulence generation of the turbulent flow in a small axisymmetric contraction.*
- 17:00 - 17:30 Wouter Bos (LMFA, Ecole Centrale de Lyon), *Explaining the universality of non-equilibrium turbulence.*

## Programme: Tuesday May 16th

- 9:30 - 10:00 Carlo Cossu (IMFT, Toulouse), *Solutions cohérentes exactes à grande échelle dans les écoulements de proche paroi.*
- 10:00 - 10:30 Corentin Herbert (LP, Ecole Normale Supérieure de Lyon), *Mean-flow and turbulence in planar flows.*
- 10:30 - 11 h Sadruddin Benkadda (PIMMH, Marseille), *On the last recent ITER Spring school.*
- 11:00 - 11:30 Coffee break
- 11:30 - 12:00 Robert Chahine (LMFA, Ecole Centrale de Lyon), *Effet dynamo dans les réacteurs à fusion nucléaire.*
- 12:00 - 12:30 Pierre Barge (LAM, Marseille), *Tourbillons dans les disques protoplanétaires.*
- 12:30 - 14:00 Lunch
- 14:00 - 14:30 Philippe Fraunié (LSEET, Toulon), *Interdisciplinarité en dynamique des fluides géophysiques et astrophysiques.*
- 14:30 - 15:00 Thierry Lehner (LUTH, Observatoire de Meudon, near Paris), *Génération d'ondes spirales de densité par le cisaillement dans un disque d'accrétion magnétisé.*
- 15:00 - 15:30 Round table: *A nonlinear systems approach to turbulence, far beyond conventional hydrodynamic stability?*
- 15:30 - 16:00 Coffee break
- 16:00 - 16:30 Michael Le Bars (IRPHE, Marseille), *Mass transport induced by a turbulent jet impinging on a density interface: the role of interfacial wave breaking.*
- 16:30 - 17:00 Fabien S. Godeferd (LMFA, Ecole Centrale de Lyon and ERCOFTAC/Henri Bénard PC), *Le nouveau GDR CNRS sur la turbulence / (and with Donato Vallefucoco:) Recent results in forced rotating turbulence.*