Joran Rolland

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Positions

07/2022 **Associate professor**, *Laboratoire de Mécanique des Fluides de Lille, École Centrale de Lille*

09/2020 – 06/2022 **Assistant professor**, *Laboratoire de Mécanique des Fluides de Lille, École Centrale de Lille*

09/2018–08/2020 **Fixed term assistant professor as *agrégé***, *Laboratoire de physique de l'ENS de Lyon*, Team Statistical and non linear physics and hydrodynamics
Topics: internal wave in atmospheric flows and rare events in transitional wall turbulence

09/2017–08/2018 **Fixed term assistant professor as *agrégé***, *ENSMA and institut PPrime*, Poitiers, Team: aerodynamics, acoustic and turbulence
Topic internal waves in atmospheric flows & rare events in geophysical and transitional wall turbulence

10/2014–08/2017 **Fixed term assistant professor**, *Frankfurt University*, Institute for environmental and atmospheric science, group of Ulrich Achatz
Topic: Internal waves in atmospheric flows

10/2012–09/2014 **Post doc**, *INLN*, Nice, with Eric Simonnet and Freddy Bouchet (ENS Lyon)
Topic: rare events in turbulence

09/2009–09/2012 **PhD student**, *LADHYX*, Palaiseau, supervised by Paul Manneville
Topic: Transitional wall turbulence

Teaching

09/2020 **École Centrale Lille & International master of turbulence**

09/2018–08/2020 **Physics department of ENS de Lyon**, *Undergraduate and graduate physics*, Lecture, Exercise and experimental classes
150 hours per year

09/2017–08/2018 **ENSMA Poitiers**, *Exercise and experimental classes*
230 hours

10/2014–08/2017 **Geoscience department, Frankfurt university**, *Exercise and numerical classes in geophysical fluid dynamics and stochastic processes*
96 hours per year

09/2009–08/2012 **University Orsay Paris 11**, *Exercise and experimental classes in mechanics and thermodynamics*
64 hours per year

09/2008–08/2009 **Lycée Saint Louis, Paris**, *Undergraduate physics*
48 hours

Supervision

02/2015–10/2018 **PhD student**, *Frankfurt University*, Steffen Hien, Cosupervised with Ulrich Achatz
PhD defended on 22/10/2018

09/2021–2024 **PhD student**, *Lille university de Lille*, Indra Kanshana

09/2021–2024 **PhD student**, *École Centrale Lille*, Ge Jin, Cosupervised with J. Christos Vassilicos
CSC Grant

10/2023–2026 **Doctorant**, *École Centrale Lille*, Baptiste Caro, Co-encadré avec G. Tanguy (ONERA - LMFL) et M. Buguet (ONERA)
Bourse ONERA région

04/2021–08/2021 **Master Intern**, *École Centrale Lille*, Antoine Barlet

04/2022 – 07/2022 **Master Intern**, *École Centrale Lille*, Luis Baiza

Education

06/2022 **Habilitation à diriger des recherches**, *Université de Lille*, *(Highest degree in the French academic system required for independent PhD student supervision and application to professor positions)*

09/2009–09/2012 **Phd student**, *Speciality: Mechanics*, École Polytechnique

09/2005–08/2009 **Normalien undergraduate student**, *Fundamental physics and applied mathematics*, École Normale Supérieure de la rue d'Ulm

09/2007–08/2008 ***Agrégation*: competitive examination for secondary and undergraduate teachers**, *Physics*

09/2002–08/2005 ***Classe préparatoires*, selective undergraduate program**, accepted in ENS Ulm after competitive examination, Lycée Gambetta Tourcoing and Lycée Faidherbe Lille

Publications

1. P. Manneville, J. Rolland, *On modelling transitional turbulent flows using under-resolved direct numerical simulations: the case of plane Couette flow*, Theor. Comput Fluid Dyn. **25**, 407–420 (2010).

2. J. Rolland, P. Manneville, *Ginzburg–Landau description of laminar-turbulent oblique band formation in transitional plane Couette flow*, Eur. Phys. J B, **80**, 529–544 (2011).

3. J. Rolland, P. Manneville, *Pattern Fluctuations in Transitional Plane Couette Flow*, J. Stat. Phys. **142**, 577–591 (2011)

4. J. Rolland, *Turbulent spot growth in plane Couette flow: statistical study and secondary instability*, Fluid Dyn. Res. **46**, 015512 (2014).

5. J. Rolland, *Formation of spanwise vorticity in oblique turbulent bands of transitional plane Couette flow, part 1: numerical experiments*, Eur. J. Mech. B flu. **50**, 52–59 (2015).

6. J. Rolland, E. Simonnet, *Statistical behavior of adaptive multilevel algorithms in simple models*, J. Comp. Phys. **283**, 541–558 (2015).

7. J. Rolland, *Mechanical and statistical study of the laminar hole formation in transitional plane Couette flow*, Eur. Phys. J. B, **88**: 66 (2015).

8. J. Rolland, *Stochastic analysis of the time evolution of Laminar-Turbulent bands of plane Couette flow*, Eur. J. Phys. E **38**,121 (2015).

9. J. Rolland, *Formation of spanwise vorticity in oblique turbulent bands of transitional plane Couette flow, part 2: linear analysis*, Eur. J. Mech. B fluids. **56**, 13–27 (2016).

10. J. Rolland, F. Bouchet, E. Simonnet, *Computing transition rates for the 1-D stochastic Ginzburg–Landau–Allen–Cahn equation for finite-amplitude noise with a rare event algorithm*, J. Stat. Phys. **162**, 277-311 (2016).

11. S. Hein, J. Rolland, S. Borchert, L. Schoon, C. Zülicke, U. Achatz, *Spontaneous inertia-gravity wave emission in the differentially heated rotating annulus experiment*, J. Fluid Mech. **838**, 5–41 (2018).

12. J. Rolland, *Extremely rare collapse and build-up of turbulence in stochastic models of transitional wall flows*, Phys. Rev. E **97**, 023109 (2018). *Featured in Phys. Rev. E'd Kaleidoscope of February 2018.*

13. J. Rolland, *Finite size analysis of a double crossover in transitional wall turbulence*, J. Stat. Mech.093207 (2018).

14. F. Bouchet, J. Rolland, E. Simonnet, *A rare event algorithm links transitions in turbulent flows with activated nucleations*, Phys Rev. Lett **122**, 074502 (2019).

15. F. Bouchet, J. Rolland, J. Wouters, *Rare events sampling methods*, Chaos **29**, 080402 (2019). Introduction of a special issue of Chaos on rare events simulation methods, coediteed par F. Bouchet, J. Rolland et J. Wouters.

16. E. Simonnet, J. Rolland, F. Bouchet, *Multistability and rare spontaneous transitions in barotropic β-plane turbulence*, J. Atmo. Sci. **78** (6), 1889–1911 (2021).

17. J. Rolland, *Collapse of transitional wall turbulence captured using a rare events algorithm*, J. Fluid Mech. **931**, A22 (2022).

18. A. Fuchs, C. Herbert, J. Rolland, M. Wächter, F. Bouchet, J. Peinke, *Instantons and the path to intermittency in turbulent flows*, Accepted in Phys. Rev. Lett. **129**, 034502 (2022).

19. D. Lucente, J. Rolland, C. Herbert, F. Bouchet, *Coupling rare event algorithms with data-based learned committor functions using the analogue Markov chain*, J. Stat. Mech. 083201 (2022).

20. J. Ge, J. Rolland, J.-C. Vassilicos, *The production of uncertainty in three-dimensional Navier–Stokes turbulence*, **977** A17 J. Fluid Mech. (2023).

21. J. Rolland, *Does rare, noise-induced, bypass transition in plane Couette flow bypass instantons?*, Phys. Rev. E arxiv:2401.055555 (2024).

Peer-reviewed conference proceedings

1. D. Lucente, S. Duffner, C. Herbert, J. Rolland, F. Bouchet, *Machine learning of committor functions for predicting high impact climate events*, 9$^{\text{th}}$ international workshop on climate informatics (2019).

Preprints

a) J. Rolland, *Does rare, noise-induced, bypass transition in plane Couette flow bypass instantons?*, arxiv:2401.055555 (2024).

Skills

- Languages: French (native speaker), English (fluent), German (Practial)
- Programation languages: c++, fortran, matlab, python. Distributed memory parallelisation with MPI. Use of Unix OS and parallel computation clusters (OAR, PBS *etc.* environments). Use of data format netcdf and hdf5.
- Development of solvers of stochastic and deterministic differential equations. Development of the genetic method *Adaptive Multilevel Splitting* for rare events calculations, parallelised with distributed memory in *Plug & Play* mode (any DNS code can be plugged in in a systematic manner). Use of HPC codes: ICON (weather forecast), YALES2 (LES with unstructured mesh, mesher: gmsh).
- Analytic solution in hydrodynamics, non linear and statistical physics.

Seminars

- Webinar, Laboratoire de Mécanique des Fluides de Lille, 21/10/2021.
- Webinar, Unité de Mécanique de Lille, 14/10/2021.
- Laboratoire de mécanique des fluides de Lille, 25/02/2020.
- Institut d'Alembert, Paris 05/02/2019.
- LMFA, Écully 14/12/2018.
- PPrime, Chasseneuil du Poitou 12/10/2017.
- LadHyX, Palaiseau 23/02/2017.
- LPS-ENS, Paris 12/01/2017.
- LOMC, Le Havre 08/11/2016.
- LMD, école polytechnique 08/03/2016.
- LEGI, Grenoble: le 10/11/2015 et 13/02/2018.
- Laboratoire de physique, ENS Lyon: le 26/09/2014, et 16/01/2018.
- Rencontres Niçoises de mécanique des fluides 04/14/2014.

Editorial work

- Reviews for Zeitschrift für Angewandte Mathematik und Physik, European Journal of Mechanics B: fluids, Physica A, Journal of Fluid Mechanics, Journal of Computational Physics, Physics of Fluids.
- Invited editor for a special issue of the journal Chaos focused on theoretical and numerical methods of study of rare and extreme events. A dozen of article have been solicited and submitted and are in review, revision or accepted.

Conference presentations (selected)

with proceedings

- J. Rolland, *Relaminarisations rares dans un modèle de turbulence de paroi transitionnelle: au delà des experiences et DNS*, Rencontres du Non-Linéaire (2017).
- J. Rolland, *Analyse taille finie d'une crise de fluctuation dans l'écoulement de Couette plan transitionel*, Rencontres du Non-Linéaire (2015).
- J. Rolland, P. Manneville, *Turbulent pattern formation in plane Couette flow: modeling and investigation of mechanisms*, 13$^{\text{th}}$ European turbulence conference, Warsaw (2011).
- F. Moisy, M. Rabaud, J. Rolland, *Mesure de la déformation d'une surface libre par analyse du déplacement apparent d'un motif aléatoire de points*, Congrès Français de mécanique, Grenoble (2007).

without proceedings

- J. Rolland, *Using rare events methods to study multistability in models and simulations of wall flows transiting to turbulence*, Perspectives in computation statistical physics, CIRM, Marseille (2018).
- J. Rolland, D. I. V. Domeisen *Using the Bi-Orthogonal Decomposition framework to compute the three dimensional Empirical Orthogonal Functions of stratospheric planetary waves from time correlation matrices*, U. Achatz, M. Fruman, S. Hien, J. Rolland,

S. Borchert, *Educing the emission mechanism of internal gravity waves in the differentially heated rotating annulus*, EGU (2016).

- J. Rolland, *Fluctuation crisis at the disappearance of oblique laminar-turbulent bands of plane Couette flow*, EUROMECH EC565 COLLOQUIUM: subcritical transition to turbulence, Cargèse (2014).
- J. Rolland, *Numerical study of Kelvin–Helmholtz instability in the laminar-turbulent oblique bands of plane Couette flow*, FOR1182 workshop on Dynamics of coherent structures in turbulent flow, Bad Dürkheim (2011).
- J. Rolland, P. Manneville, *Temporal fluctuations of laminar-turbulent patterns in transitional plane Couette flow*, 24$^{\text{th}}$ Statistical physics conference, Cairns (2010).