François P. Landes

Born on April 2, 1988 – French – 2 kids

Contact Information

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Current Position

Maître de Conférences (assistant professor) **2018 - current**
Université Paris-Sud, Orsay, Laboratoire Interdisciplinaire des Sciences du Numérique (LISN is the merger of LRI and LIMSI). Team A & O (Algorithms and Optimization), Inria team TAU (TAckling the Underspecified).

Research interests

- Development and applications of new Machine Learning approaches to solve fundamental physics problems. In particular, I have 3 recent or active projects that I focus on:
  - Deep SE(3)-equivariant (Graph) Neural Networks, applied to structural glasses.
  - Scale-Equivariant Neural Networks: predict rare and large events from datasets containing mostly numerous small ones.
  - Ensemble CNNs for predicting aftershocks from ground deformation data (as measured by GPS stations). (This projet is frugal data-wise, with about 100 usable sample "images" to learn from).
- Interdisciplinary opening: starting collaborations with Inrae researchers from the IDEEV lab, applying Machine Learning to problems of agro-ecological interest.
- Physics expertise (application domain expertise): Statistical Physics.
  In particular: dynamics of glassy or supercooled liquids, out of equilibrium, disordered systems, dynamical phase transitions, avalanches, some knowledge of seimicity.
- Older interests: Markov State Models building: density-based clustering, Robust PCCA

Supervision

PhD Supervision at Univ. Paris-Saclay **2018-current**

- Anaclara Alvez, M2 internship then **PhD**, ED PIF, co-supervised (50%) with Cyril Furtlehner, CR Inria (TAU), (2023-2026) *Scale Invariant Neural Networks for avalanches prediction.*
- Francesco Saverio Pezzicoli, M2 internship then **PhD**, ED STIC, co-supervised (60%) with Guillaume Charpiat, CR Inria (TAU), (2021-2024) *Graph Neural Networks for amorphous materials.*
- Vincenzo Maria Schimmenti, M2 internship then **PhD**, ED PIF, co-supervised (45%) with Alberto Rosso, DR CNRS (LPTMS), (2020-2023). *Earthquake modelling & prediction with Machine Learning.*

Interns supervision at Univ. Paris-Saclay **2018-current**

- Quang Phuoc HO, TER+M1 internship, from our own M1 of Artificial Intelligence "*Grain classification from Hyperspectral images*" (May-July 2024), co-supervised with Thimothée Flutre (INRAE) and Martin Ecarnot (INRAE).

- Michel DOROCH, TER+M1 internship, from our own M1 of Artificial Intelligence "*Pollinator classification from IR videos*" (May-July 2024), co-supervised with Fabrice Requier (INRAE).
- Philippe Massouf, M1 internship, from our own M1 of Artificial Intelligence "*Exploration of attention mechanisms for SE(3)-equivariant GNNs*" (May-July 2023)
- Anaclara Alvez, M2 internship, from ENS Ulm's iCFP Theoretical Physics Master, (co-supervised with Cyril Furtlehner, CR Inria) "*Scale-Invariant Neural Networks*" (April-July 2023)
- Francesco Saverio Pezzicoli, M2 internship, from international master PCS (Physics of Complex Systems) "*Graph Neural Networks for amorphous materials.*" (April-July 2021)
- Vincenzo Maria Schimmenti, M2 internship, from Padova University. (co-supervised with Alberto Rosso, DR CNRS) "*Earthquake modelling & prediction with Machine Learning.*" (March-July 2020)
- Rémi Perrier, M1 internship, Univ. Paris 7. "*structure-dynamics relationship in glasses: regression vs. classification algorithms*" (June-July 2018)

Travaux Encadrés de Recherche (TER, micro-internships) at Univ. Paris-Saclay 2022-current
2 L3 students (2023-24): on the iso-configurational ensemble.
1 M1 student (2023-24): bibliographical project on Self-Supervised Learning (applied to molecule-related tasks)
2 M1 students (2023): co-supervised with Vincenzo Schimmenti, on an original research project.
3 groups of 2 M1 students (2023): GNN for glasses (reproducing the Deepmind's result of 2020)
1 L3 student (2022): Bibliographical project (ML)

PhD Support, ICTP-SISSA (Trieste) **2015-2016**
I co-supervised J.P. Jerico and Valerio Volpati (PhD students with M. Marsili) during our econophysics project (publication: "When does inequality freeze an economy?").

PUBLICATIONS My most notable works are [PCL22, LBD+20, JLR14] (they are important works *and* works in which I am either a leading author or leading supervisor).

Preprints

* References

[SPRL23] Vincenzo Maria Schimmenti, Giuseppe Petrillo, Alberto Rosso, and **François P Landes**. Assessing the predicting power of gps data for aftershocks forecasting. *arXiv preprint arXiv:2305.11183*, 2023. Submitted to *Seismological Research Letters*.

[PCL22] Francesco Saverio Pezzicoli, Guillaume Charpiat, and **François P Landes**. Se (3)-equivariant graph neural networks for learning glassy liquids representations. *arXiv preprint arXiv:2211.03226*, 2022. Submitted to *SciPost Physics*.

[JAB+23] Gerhard Jung, Rinske M Alkemade, Victor Bapst, Daniele Coslovich, Laura Filion, François P Landes, Andrea Liu, Francesco Saverio Pezzicoli, Hayato Shiba, Giovanni Volpe, et al. Roadmap on machine learning glassy liquids. *arXiv preprint arXiv:2311.14752*, 2023. Submitted to *Nature Reviews Physics*.

[CLB+23] Rahul N Chacko, François P Landes, Giulio Biroli, Olivier Dauchot, Andrea J Liu, and David R Reichman. Dynamical facilitation governs the equilibration dynamics of glasses. *arXiv preprint arXiv:2312.15069*, 2023. Submitted to *Physical Review X*.

[IBGD+20] Consortium ICUBAM, Laurent Bonnasse-Gahot, Maxime Dénès, Gabriel Dulac-Arnold, Sertan Girgin, François Husson, Valentin Iovene, Julie Josse, Antoine Kimmoun, **François Landes**, et al. Icubam: Icu bed availability monitoring and analysis in the grand est région of france during the covid-19 epidemic. *medRxiv*, pages 2020–05, 2020.

Books / Book chapters

* References

[ALBB21] Francesco Arceri, **François P Landes**, Ludovic Berthier, and Giulio Biroli. A statistical mechanics perspective on glasses and aging. *Encyclopedia of Complexity and Systems Science*, pages 1–68, 2021.

[Lan14] **François P Landes**. *Viscoelastic Interfaces Driven in Disordered Media: Applications to Friction*. PhD thesis, Springer Theses, 2014.

Journals

* References

[CLB+21] Rahul N Chacko, **François P Landes**, Giulio Biroli, Olivier Dauchot, Andrea J Liu, and David R Reichman. Elastoplasticity mediates dynamical heterogeneity below the mode coupling temperature. *Physical Review Letters*, 127(4):048002, 2021.

[PLLR20] Giuseppe Petrillo, Eugenio Lippiello, **François Landes**, and Alberto Rosso. The influence of the brittle-ductile transition zone on aftershock and foreshock occurrence. *Nat Commun 11, 3010 (2020). https://doi.org/10.1038/s41467-020-16811-7*, 2020.

[LBD+20] **François P Landes**, Giulio Biroli, Olivier Dauchot, Andrea J Liu, and David R Reichman. Attractive versus truncated repulsive supercooled liquids: The dynamics is encoded in the pair correlation function. *Physical Review E*, 101(1):010602, 2020.

[LPLR19] Eugenio Lippiello, Giuseppe Petrillo, **François Landes**, and Alberto Rosso. Fault heterogeneity and the connection between aftershocks and afterslip (short note). In *Bulletin of the Seismological Society of America*, volume 109, pages 1156–1163. GeoScienceWorld, 2019.

[PLL+16] Franco Pellegrini, **François P Landes**, Alessandro Laio, S Prestipino, and Erio Tosatti. Markov state modeling of sliding friction. *Physical Review E*, 94(5):053001, 2016.

[LL16] **François P Landes** and E Lippiello. Scaling laws in earthquake occurrence: Disorder, viscosity, and finite size effects in olami-feder-christensen models. *Physical Review E*, 93(5):051001–R, 2016.

[JLM+16] João Pedro Jerico, **François P Landes**, Matteo Marsili, Isaac Pérez Castillo, and Valerio Volpati. When does inequality freeze an economy? *Journal of Statistical Mechanics: Theory and Experiment*, 2016(7):073402, 2016.

[LRJ15] **François P Landes**, Alberto Rosso, and Eduardo Alberto Jagla. Frictional dynamics of viscoelastic solids driven on a rough surface. *Physical Review E*, 92(1):012407, 2015.

[JLR14] Eduardo Alberto Jagla, **François P Landes**, and Alberto Rosso. Viscoelastic effects in avalanche dynamics: A key to earthquake statistics. *Physical review letters*, 112(17):174301, 2014.

[LRJ12] **François Landes**, Alberto Rosso, and Eduardo Alberto Jagla. Tuning spreading and avalanche-size exponents in directed percolation with modified activation probabilities. *Physical Review E*, 86(4):041150, 2012.

Publications – Short explanation:

- During my PhD (2011-2014) I produced 3 publications of which I am a core author: [LRJ12, JLR14, LRJ15], and my PhD manuscript was published at Springer because it received the springer award [Lan14].
- During my Post-doc at ICTP (2014-2016), I produced 3 publications, [LL16, PLL+16, JLM+16], with 3 different groups (2 at ICTP, 1 in remote), on 3 different subjects. In [PLL+16] I did about as much work as the other Post-doc (first author).
- During my second Post-doc at ENS/UPenn (2016-2018) my main production was a single paper, [LBD+20], along with many ideas I kept for the future. During this Post-doc I was also able to help colleagues from previous works, as a side project [LPLR19].
- As a young MCF (2018-2020), I continued working with these colleagues as a side project [PLLR20] but my main research was on glasses, i.e. on the continuation of my second Post-doc [CLB+21] (in this one I helped train the Post-doc who replaced me – I left abruptly because of my MCF position). I participated in the update of a 10-years old review paper on glasses [ALBB21].
- More recently (2020-2023), I have focused on glasses, with the core result being with my second PhD student (2021-2024) [PCL22] (and others to come soon). My first PhD student (2020-2023) attacked many topics (there was covid and I had twins during his PhD), we have a single published work together [SPRL23].
- Others: During the first wave of Covid I helped out with data cleaning for the ICUBam project [IBGD+20].

Teaching & Related Activities

Details at: http://lptms.u-psud.fr/francois-landes/enseignement/ **2022-23**

Various teaching (L2 to M2) at Univ. Paris Sud **2018-current**

Teaching *Mathematics for CS students* (second year – L2).
Teaching introductory or more advanced Machine Learning courses (2nd year, then 3rd, 4th and 5th year students – L2 then L3,M1 and M2). **Much more details in my rapport d'activité**, on demand.
Note: since several years I teach the Lecture (CM) as well as the Tutorials (TD/TP) for all my classes, and often supervise several tutors, up to 6 groups. I've always produced my material myself, mostly from scratch, since courses were created or had to be largely re-deisgned when I took them.

Advanced Stat. Phys., ICTP (Trieste) **2014**
Contents: A few short exercise sessions/tutorials on Advanced Statistical Physics topics for the "Diploma Students" *(Masters program aimed at developing countries' students)*.

Stat. Phys. and Scalar Waves, Univ. Paris-Sud (Orsay) **2012-2014**
"Monitorat de thèse": Contents: Statistical Physics catch-up course (L3 level course for M1 students in the "Magistère de Physique d'Orsay); Scalar Waves for freshmen (L2 PMCP); Practical work sessions (Doppler Effect) for freshmen (L2 PMCP).

Python and C++ at IUT d'Orsay (Orsay) **2012**
"Monitorat de thèse": Freshmen at IUT d'Orsay (2 years of professional formation).
Contents: Python (for 1st year "DUT Mesures Physiques" students); C++ (for 1st year "IUT Informatique" students).

Reviewing

Since 2018, I have reviewed (I may have forgotten some):
Reviewer for ICLR: 2019, 2020, 2022, 2023 (between 6 and 3 papers each time)
Reviewer for TMLR since 2023 (1 paper)
Reviewer for other journals: Physical Review Research (1 paper), Nature Communications (1 paper), The Journal of Physical Chemistry Letters (1 paper), Journal of Chemical Theory and Computation (1 paper)

Other Community service

I am managing the **admissions in the M1/M2 of CS**, "AI track", since 2021-22. We receive about **500-1000 M1 applications and more than 300 M2 applications** every year (fortunately I am not the only one to read those, but I do a big share, between 1/3 and 1/4 of that). Besides reading many files, I handle the overall process and submit scholarships applications for the best students (with high success).
I was part of a COS (selection committee for an MCF position) (2020).
Nominated at the lab council, during the merger of LRI+LIMSI into LISN (2020).
Co-organization of the Weekly talk in the Simons Collaboration (Paris) (2017-2018).
Member of the Lab's Journal Club organizing committee (2013-2014).
Delegate for the students at the Lab Council (2013-2014).
Volunteer organizer of an artistic festival (2007-2008 and 2008-2009): Logistics.
Member of the school's theatre club (2007-2008).

Previous Experiences

Postdoctoral Fellow, Simons collaboration "cracking the glass problem" 2016 - 2018
with Andrea J. Liu (UPenn, Pennsylvania), David R. Reichman (Columbia, New York), Giulio Biroli (CEA IPhT, France) and Olivier Dauchot (ESPCI, France).
Physical location: Alternating between ENS/CEA, Paris and UPenn, Philadelphia, with short visits to Columbia, NYC.

(Independent) Postdoctoral Fellow, ICTP, Trieste, Italy **2014-2016**
Abdus Salaam International Center for Theoretical Physics.
Section: "*Condensed Matter and Statistical Physics*".

Ph.D. Thesis, LPTMS, Université Paris-Sud, Orsay **2011-2014**
Advisor: Alberto Rosso. (and active collaborations with E.A. Jagla)
Subject: "*Viscoelastic Interfaces Driven in Disordered Media and Applications to Friction*".
Defended Sept. 2014, received the **Springer Theses Award for outstanding theses** of Univ. Paris-Sud., 2014.

Two months internship at LPTMS, Orsay **2011**
At Laboratoire de Physique Théorique et Modèles Statistiques (LPTMS), supervisor Alberto Rosso (January-February). Fractional Brownian Motion (fBm): Development of a numerical tool to build fBm and comparison with a related (non-stationary) process.

Four months internship at Laboratoire MSC, Paris **2010**
At MSC (Matière et Systèmes Complexes), Supervisor Frédéric van Wijland (April-July). Kipnis Marchioro Presutti (KMP) Heat Transfer model: Out-of-equilibrium, finite temperature model. Study of the Matrix Ansatz method. Found the stationary solution near-equilibrium at second order.

Four months internship at the CSM group, Helsinki, Finland **2009**
At CSM (Complex Systems and Materials), supervisors Mikko Alava and Matti Peltömaki (April-July). Finding Groups in Directed Networks: by defining and minimizing a cost function.

Education

M.Sc. in Physics (M2), iCFP, ENS Ulm, Paris **2010-2011**
Specialization: "*Theoretical Physics*". Graduated with honors.

M.Sc. in Physics (M1), École Polytechnique, Palaiseau **2009-2010**
Specialization: " *Fundamental Interactions and Elementary Constituents*,
Excellence Scholarship.

B.Sc. and M.Sc., Ensta ParisTech, Paris **2007-2010**
B.Sc. in General Engineering (L3) and M.Sc. in Applied Mathematics (M2).
Third year specialization: " *Modelization and Simulations of Systems* ".

"Classes Prépa", Lycée Saint Louis, Paris **2005-2007**
Intensive courses for the preparation to the competitive exams for the *Grandes Écoles*.

Skills

Computer tools

- *fluent, everyday use (languages, important packages):*
  CUDA C, C/C++, Python/Cython/Numba, torch, sk-learn, LaTeX, Hoomd.
- *fluent, everyday use (tools):*
  Linux' bash, HPC clusters (PBS, Slurm), Inkscape, Mathematica.
- *Fair understanding:*
  Fortran, Maple, Matlab, HTML, GIMP, MPI.

Other Languages

- *French:* native.
- *English:* fluent (109/120 at the TOEFL in 2009).
- *Italian:* fair.
- *German, Spanish, Arabic:* a few notions.

Driving Licence: "Permis B"

Scientific Visits

Continuous visits to Andrea Liu, Philadelphia, PA, USA and David Reichman, New York City, NY, USA **2016-2018**
UPenn and Columbia (various times)
Ongoing collaboration on the dynamics of supercooled liquids and their connection to structure.

Visit to Eugenio Lippielo, Napoli, Italy **2017**
Second univeristy of Caserta (October)
Collaboration on minimal models for earthquakes description.

Visit to Matteo Palassini, Barcelona, Spain **2015**
Departomento di Fisica Theorica in UBC (April).
Collaboration on models of Electron Glasses.

Visit to Eduardo A. Jagla, Bariloche, Argentina **2013**
Grupo de Teoría de Sólidos in Centro Atomico (October).
Collaboration on Earthquake models.

Visit to Eduardo A. Jagla, Bariloche, Argentina **2011**
Grupo de Teoría de Sólidos in Centro Atomico (November).
Collaborations on Directed Percolation and Earthquake models.

Important Seminars & Conference

I do not include here the Lab's seminars I gave in front of small audiences, in my own lab or during my visits to other groups.

Worshop ML4Glasses (Paris, France) **November 2022**
Invited speaker: *SE(3)-equivariant GNNs for learning Glasses representations*

Understanding plastic deformation via artificial intelligence **March 2022**
(Lausanne/Online (event turned remote))
Invited speaker: *Asking the right question: relevance of the task of defining the task*
I was also **chairman** for a session.

Unifying Concepts in Glass Physics (Bristol, UK) **June 2018**
Poster: *Local Mobility/Local Structure Relationship: Cage-Jump detection and Machine Learning*

Data Challenge Day at Collège de France (Paris, France) **December 2018**
Presentation of a Challenge: *Solution of the Structure-Dynamics paradox in glass-forming liquids systems*

StatPhys 26 (Lyon, France) **July 2016**
Poster: *Markov State Modeling of Sliding Friction*

Statistical Physics of Materials (Aussois, France) **June 2016**
Short Presentation: *Magnitude-Area relationship: failures and success of spring-block models*

CECAM workshop – The flow of amorphous solids: from atomistic simulations to Earth Science applications) (Lyon, France) **June 2016**
Short Presentation: *Magnitude-Area relationship: failures and success of spring-block models*

Workshop on Accelerated High-Performance Computing in Computational Sciences

(ICTP, Trieste, Italy) **May 2015**
Short Presentation: *(CUDA simulation of) Electron Glasses: slow dynamics of a long-range interacting system*

Driven Disordered Systems 2014 (LiPhy, Grenoble, France) **Jun 2014**
Talk on: *Viscoelastic Interfaces Driven in Disordered Media and Applications to Friction.*

Funding, Awards & Scholarships

Springer Theses Award **2015**
Received the Springer Theses Award for outstanding theses of Univ. Paris-Sud. This prize is given to the top two best theses that were written in English and defended in Univ. Paris-Sud., Orsay in 2014.

Visitor in Bariloche **2011, 2013**
Part of two ECOS - Sud programs (Argentinian – European cooperation). Travel and daily costs covered.

Ph.D. Funding **2011-2014**
Grant from ED107: École Doctorale 107, *Physique Théorique de la région Parisienne.*

ICAM conference **2012**
Grant paying for the conference fees, travel costs and some daily expenses.

Master of Science (iCFP) **2010-2011**
Excellence scholarship at École Polytechnique: complete exemption from the fees.