
Personal Information

- Status: Born June 16, 1966, in Bourg-en-Bresse, France. French Nationality, one child.
- Country: France (residence and professional activity)
- Languages: *French* (mother language), *English* (fluent), *Spanish* (intermediate), *German* (school)
- URL: perso.ens-lyon.fr/patrice.abry/

Career

- 2023-present: CNRS, Directeur de Recherche, Classe Exceptionnelle (Research Director, outstanding class)
- 2009-2023: CNRS, Directeur de Recherche 1 (Research Director, first class)
- 2005-2009: CNRS, Directeur de Recherche 2 (Research Director, second class)
- 1995-2005: CNRS, Chargé de Recherche (Research Associate)
- 1991-1995: *Professeur agrégé* (highest teaching degree for High School in French educational system)

Academic Positions

- 2021-present: Head of the **COMPLEX SYSTEM INSTITUTE** at ENS Lyon.
- 2021-2022: Head of the **CHALLENGE AND DATA COLLECTIONS** Committee, IEEE SPS.
- 2004-2020: Head of **SISYPH** research team, Physics Laboratory, Ecole Normale Supérieure Lyon

Education and Diploma

- 2001: **Habilitation à Diriger les Recherches** (PhD Advisor Authorization) Lyon I University, ENS Lyon
- 1994: **PhD** – Statistical Signal Processing and Physics Lyon I University
- 1991: **Diplôme d'Etudes Approfondies** (former name of Master 2) Lyon I University
- 1989: **Agrégation** in Physical Sciences
– (ranked 4/47 out of more than 600 candidates) *Agrégation is the highest diploma for pre-university teaching and practically a prestigious nation-wide competition, hence a highly distinctive award at the Master level*
- 1986-90: **Normalien Student** Ecole Normale Supérieure (ENS) de Cachan
one of the three ENS, amongst the top “Grandes Écoles” in the French educational system
Nation-wide numerus clausus admission procedure: 32 positions available, for \simeq 600 candidates

Honors

- 2023: EURASIP Fellow, elected, “*contributions to scale-free temporal and spatial dynamics modelling and analysis in signals and images*”.
- 2020: Prix *Michel Monpetit*, Académie des Sciences, Institut de France.
- 2011: IEEE Fellow, elected
“*contributions to the theory of fractal and multifractal analysis in signal and image processing*”
- 2007: Invited Lecture at the French Academy of Sciences: [.pdf](#)
- 2007: Young Research Team Award, *Del Duca Foundation, French Academy of Sciences, Institut de France*

Awards

- 2019: Best Paper Awards, *Passive and Active Measurement Conference*. (ACM), Chile with R. Fontugne (Japan), K. Fukuda (Japan), E. Bautista (Mexico).
- 2016: Best Paper Award, *European Signal Processing Conference*. (EURASIP), Budapest joint work on Multifractal Bayesian Inference, with H. Wendt, S. Combrexelle, J.-Y. Tournet, S. Mac Laughlin.
- 2013: Best Paper Award *IEEE Int. Sympos. Computer-Based Medical Syst.* (CBMS), Porto, Portugal with J. Spilka, V. Chudacek (CZ), M. Doret (HFME, Lyon).
- 2000: EURASIP (EUROPEAN ASSOCIATION FOR SIGNAL PROCESSING) Best Paper Award, 2000
- 1994: Best PhD Thesis in Automatic and Signal Processing for Years 1993 and 1994, granted jointly by CNRS (National Council for Scientific Research), AFCET (French Association for Automatic) and the French Ministry of Education, Research and Technology

Scientific Productions

- **Patent:** *Real-Time Estimation of Long Range Dependent Parameters*, AU1998PP01692 (05.02.1999)
- **Reproducible science:** (Shareware list and downloadable MATLAB toolboxes [here](#))
Wavelet based analysis of scaling phenomena **Synthesis of multivariate time series**
Wavelet Leader Multifractal Analysis **Products of random matrices for time series synthesis**
Fractal Connectivity **Critical Moment Estimator**
- **Scientific Publications:** 1 book as author, 2 books as editor, 114 articles in international journals, 23 book chapters, 170 articles in international conference proceedings, [full list](#)
H-factors 31 / 35 / 59 — Total Citations 4097 / 5425 / 13107 (ISI / Scopus / GoogleScholar: 07.04.2023)
- **Software Protection:**
 - **Sketch Multiresolution Traffic Analysis** (*Analyse du trafic par sketch-multirésolution*) (13/08/2007) registered at French Software Protection Agency (*Agence pour la Protection des Programmes*) by CNRS and ENS Lyon. *Inventors:* P. Abry, P. Borgnat, G. Dewaele.

Recent research Grants (PI)

- **OptiMoCSI 2023-2026, PI, ANR Grant:** Optimisation and Monte Carlo Sampling Intertwined
- **MultiFracs 2016-2021, PI, ANR Grant:** Multivariate MultiFractal Analysis for Neurosciences
- **FETUSES 2014-2017, PI, ANR Grant:** Intrapartum Fetal Heart Rate Monitoring
- **AMATIS 2012-2015, co-PI, ANR Grant:** MultiFractal Analysis

Recent research Grants (member)

- **DARLING :** 2019-2022, ANR, Graph Signal Processing for Neurosciences
- **GRAPHSIP :** 2015-2017, ANR, Graph Signal Processing
- **MATCHA :** 2015-2016, PICS CNRS-JSPS (France-Japon), Multiscale analysis for clinical Heart rate variability assessment
- **VELINNOV :** 2013-2015, ANR "Sociétés innovantes", Les vélos en libre service automatisé. Un système sociotechnique innovant et ses appropriations sociales
- **SCHUBERT :** 2010-2012, ANR, SScaling in HUMAN Brain

National & International Research Commissions of Trust and Administration

- 2021-present: CoNRS (Comité National de la Recherche Scientifique Hiring Committee, CID53, INSHS),
- 2021-present: Chair of the **COMPLEX SYSTEMS INSTITUTE**, Lyon, France.
- 2016-2021: CoNRS (Comité National de la Recherche Scientifique Hiring Committee, Section7, INS2I)
- 2014-2019: Ecole Normale Supérieure Lyon, Scientific Council Member
- 2011 CNRS, INSIS, France : scientific advisor
- 2004-2020 Chair of the SISyPh Research Team **SIGNAUX SYSTÈMES & PHYSIQUE** Physics Dept. ENS Lyon (18 personnes: 10 permanents, 9 PhDs et PostDocs, 300 kEuros/year),
- 2004-2020: Physics Dept. ENS Lyon, Laboratory Council Member
- 2001-2007 Scientific Evaluator for the European Commission, Research Directorates General - ISTC
- 2006-present: HDR (Habilitation à Diriger les Recherches) Committee, member or chair: 7
- 1998-present: PhD Committee, member or chair: 25 in France, 8 abroad (Belgium, Switzerland, Portugal, India, Argentina)

National & International Research Animation & Activities

- 2021-2022: Chair of **CHALLENGE AND DATA COLLECTIONS** Committee, IEEE SPS.
- 2019-present: Co-Chair of the Programm Committee **COLLOQUE GRETSI**.
- 2016-2019: EURASIP **Theoretical and Methodological Trends in Signal Processing** : member
- 2014-2019: IEEE-SPS Signal processing Theory and Method (**SPTM**): member
- 2004-2010 Associate Editor for *IEEE Transactions on Signal Processing*
- 2005-2010 Associate Editor for *EURASIP Signal Processing*
- 2004-2010 IEEE-SPS Signal processing Theory and Method (**SPTM**): member

Organizer of International Conferences and Guest Editor

Conference Chairman:

- Eusipco 2024 2019. European Signal Processing Conference, 5Lyon, August 2024), *700 participants*, [.www](#)
- SPaM 2022. 4th Signal Processing and Monitoring in Labour Workshop (Munich, July 2022), *100 participants*, [.www](#)
- SPaM 2019. 3rd Signal Processing and Monitoring in Labour Workshop (Porto, Octobre 2019), *80 participants*, [.www](#)
- SPaM 2017. 2nd Signal Processing and Monitoring in Labour Workshop (Oxford, octobre 2017), *70 participants*, [.www](#)
- SPaM 2015. Conceptor and chairman of the 1st Signal Processing and Monitoring in Labour Workshop (Lyon, F, 17-19 mars 2015), *70 participants*, [.www](#)
- GRETSI (Lyon, F, 2015) *500 participants*, [.www](#)
- Multifractal Analysis: From Theory to Applications and Back (BIRS, Banff, Canada, 2014) *50 participants*, [.www](#)
- Complexity in Physics (Lyon, F, 2009) *120 participants*, [.www](#)

Conference Organizing Committee: IEEE Statistical Signal Processing (Madison, WI, USA, 2007)

Conference Program Committee: IEEE ICASSP (2014-2019, 2004-2010), GRETSI (French-speaking Signal Proc. Conf., 2005-2017); EUSIPCO (2006); SPIE Wavelet Applications in Industrial Processing (2003-2007); Self-Similarity and Applications (2002-2006)

Guest Editor: – *IEEE Signal Proc. Mag.*, Special Issue "Signal Processing for Art Investigation" (2014) [.www](#)
– *Signal Proc.*, Special Issue "Image Processing for Digital Art Work" (2013) [.www](#)

Conference Special Sessions: SSP'16, EUSIPCO'15, ASILOMAR'14, EMBC Minisymposium *Complexity in Biomedical Signals* (Japan, 2013) [.www](#); GRETSI, *Sensor Networks* (F, 2009); GRETSI, *Signal Processing and Internet Traffic* (Belgium, 2005)

Reviewer: Internat. Journals (Math./Statistics, Signal/Image Processing, Applications (Internet, Biomedicals,...)) and major Internat. Conferences (ICASSP, SSP, EUSIPCO, EMBC, GRETSI)

— Teaching Activities —

- **Statistical Signal Processing; Data Analysis** Physics Department, ENS Lyon
Contribution to creation of all courses on *Statistical Signal Processing* and *Data Analysis* currently given
3 courses of 12h (per year in last 10 years)

— Mentoring: Supervision of Graduate Students and Postdoctoral Fellows —

- **9 Post-Doctoral Researchers:** **J. Lengyel** (Bulgarie, *Multifractality for Geography*, 2021-2023), **R. Leonar-duzzi** (Argentina, *Univariate Multifractal*, 2015), **J. Spilka** (CZ, 2014, *Fetal HRV*), **G. Lozenguez** (F, 2013-14, *Bike-Share System*), **J. Hamonier** (F, 2013-14, *Multifractal Math.*), **V. Chudacek** (CZ, 2013, *Fetal HRV*), **H. Helgason** (Island, 2009-10, *Stat. Signal Proces.*), **B. Vedel** (F, 2008, *Multifractal Math.*) **G. Dewaele** (F, 2007, *Internet*).
- **14 PhD Students:** **Victor Sechaud** (France, *Equivariant Learning*, 09/2026), **Léo Davy** (France, *Optimization and anisotropic selfsimilarity*, 09/2025), **Juliana Du** (France, *Optimization for Covid Monitoring*, 09/2025), **Charles-Gérard Lucas** (France, *aMultivariate selfsimilarity*, 10/2023), **B. Pascal** (France, *Optimization*, 09/2020, Post-Doc), **E. Bautista** (Mexico, *Network and Graph*, 08/2019), **J. Frecon** (F, *Optimization*, 11/2016), **G. Michau** (France-Australia, *Network Transportation*, 07/2016), **R. Leonarduzzi** (Argentina, *Scale Invariance*, 11/2014: now PostDoc in France), **A. Costard** (F, *Conditional dependences*, 11/2014: now in Industry), **F. Angeletti** (F, *Statistical Physics*, 2012: now PostDoc in South Africa), **H. Wendt** (Austria, *Multifractal*, 2008: now CNRS Research Associate, Toulouse University), **B. Lashermes** (F, *Hydrodynamic turbulence*, 2005: now High School teacher, by choice), **P. Chainais** (F, *Infinitely-divisible cascades*, 2001: now Associate Professor, Lille University).

— Invited Lectures —

- 3 General Audience Lectures:** i) “Fetal heart Rate and Machine Learning”, Academy Savoie, [.www](#) (F, 2016)
ii) Conferences “Fractales”, Cité des Sciences et de l’Industrie, Paris, France [.www](#) (F, 2008)
iii) “Advances in Information Sciences by their authors”, French Academy of Sciences [.pdf](#) (F, 2007)
- 5 Keynote Lectures:** i) 8th International Workshop on BioSignal Interpretation (BSI) [.www](#) (Japan, 2016)
ii) VI Latin American Conference on Biomedical Engineering (CLAIB) [.www](#) (ARG, 2014)
iii) XIV Reunion de Trabajo en Procesamiento de la Informacion y Control (RPIC) [.www](#) (ARG, 2011)
iv) Asian Internet Engineering Conference (AINTEC) [.www](#) (Thailand, 2009)
v) 4th Workshop on Traffic Monitoring and Analysis [.www](#) (Spain, 2009)
- 1 Tutorial Lecture:** IEEE Int. Conf. Acoust. Speech Sig. Proc. (3h, high selection, hot topics) [.pdf](#) (CZ, 2011)
- 10 Invited Lectures in Special Sessions:** i) 1st Signal processing and Monitoring in labour Workshop (ENS-Lyon, France, 2015, [.www](#)); ii) Scale-free Dynamics and Networks in Neurosciences (CRM, Montreal, Canada, 2013, [.www](#)); iii) power-laws (Complex Systems Institute, Lyon, France, 2013, [.www](#)); iv) Long-Range Dependence, Self-Similarity and Heavy Tails (Research Triangle Park, NC, USA, 2012, [.www](#)); v) Mathematics: Muse, Maker, and Measure of the Arts (BIRS, Banff, Canada, 2011, [.www](#)); vi) Int. Conf. Probability and Mathematical Statistics (Lithuania, 2010); vii) Conf. Analysis and its Applications (Indian Institute of Science, India, 2009); viii) New Mathematical Frontiers in Network Multi-Resolution Analysis (IPAM, UCLA, USA, 2008); ix) Wavelet Theory and Applications (National University of Singapore, 2008); x) Int. Symp. on Applications in the Internet (Japan, 2007);
- 3 Summer School Lectures:** i) New Trends in Applied Harmonic Analysis (Mar del Plata. Argentina, 2013, [.www](#)); ii) Indian Institute of Science (India, 2009); iii) Signals, Images and Complex Systems (France, 2008, [.www](#)); iv) Taller sobre Multifractalidad y Autosimilaridad (Caracas, Venezuela, 2005).
- 5 Secondary Education Conferences:**

— Scientific Mediation - Science & Society activities —

- 5 interviews (written press, radio et local TV, in French)
- **IA for heatwave prediction**, [A131], 2023.
- **The Conversation 2022:** Estimating the time-space evolution of the Covid19 pandemic ?
- **La covid-19: regards et questions interdisciplinaires :** Design in 2021 of a series on interdisciplinary wide audience seminars dedicated to "scientific reactions to the pandemic19 at the service of the society" [Program & replays](#)
- **Comment mieux estimer l'évolution spatio-temporelle de la pandémie ?** Invited contribution to France Culture scientific talks "La Méthode Scientifique" 25/03/2021. [.www](#)
- **L’algorithme qui fiabilise le taux de reproduction du covid 19 :** Interview and published note on Covid19 pandemic assessment in the *Innovateurs* columns, journal Les Échos 25/112020. [.www](#)

- **Comment mieux estimer l'évolution du taux de reproduction de la covid-19 ?** CNRS (INP & INS2I) Communication (6/11/2020). [.www](#)
- **Le couloir du temps : la science au service du patrimoine :** CNRS/RATP Fresco, "The corridor of time: science for cultural heritage", exhibition in "Montparnasse" subway station, Paris, Fall 2015. [.www](#)
- **Art phtography paper identification via MultiFractal Analysis:** Communications CNRS (INP & INS2I) Communications (17/11/2014). [.www](#)
- **Secondary school Conferences en Collèges et Lycées :** on a regular basis.

Scientific Leadership and International Research Expeditions For references [Xx], see [publication list](#)

Arts, Sciences & Society (2022-present): In a period where the relations between science and society are questioned by citizens, where problems and challenges that contemporaneous societies must face and address are always more complex and call for the coordinated elaboration of interdisciplinary scientific researches, we have designed a Art & Science co-creation project where four teams of artists and scientists self-decided to undertake co-creations related to challenges pertaining to subject as different as IA, chronicle neural pains, dynamics or science and society relations. A workshop will be organized in november 2024, where the observation of interdisciplinary processes at work will be discussed, followed by an 3-month exhibition of the created artworks, open to non-expert audience.

Covid19 Pandemic assessment (2020-present): In the context of Covid19 lockdowns, aiming both to maintain contacts between young and senior scientists and to reroute research programs at the service of the society, we have organized an interdisciplinary (mathematics, physics, signal processing, geography, philosophy,...) research program dedicated to assessing, on scientifically grounded bases, the time-space evolution of the Covid19-pandemic intensity across the world. This lead to a PhD thesis and to the a french ANR research Grant (Opti-MoCSI) [A111,A123,A127,A130].

Invariance d'échelle multivariée (2017-2021): In the age of data deluge, where a large number of signals are available for the analysis of the same system (e.g. brain activity, climate, etc.), a critical limitation of scale invariance lies in the fact that only univariate analysis models and tools are available. We are currently exploring almost uncharted territory, that of multivariate multifractal analysis ([A106], [A101]) and of multivariate selfsimilarity ((A96), [A97]). Avec S. Jaffard, H. Wendt, G. Didier (USA).

Cybersecurity and Robust Internet traffic characterization(2007-14): Internet traffic is widely variable by nature, and a recurrent issue consists in discriminating anomalous (and aggressive) changes from wild yet legitimate fluctuations. While numerous works made attempts to create references by comparing against past or synthetic traffic, we proposed to let the traffic design its own real-time reference by incorporating random-projections (or sketches) into statistical analysis that create, from one single traffic, a collection of surrogate traffic with statistical properties equivalent to those of the background legitimate traffic. This gave birth to highly cited articles in the top international journals and conferences of the field ([A41,P6]: 51/64/134, [C62]: 30/59/161, [C52]: -/57/125, [A42]: 13/19/45), and numerous invited lectures (AINTEC2009, TMA2009). (Coll. K. Fukuda, Nat. Inst. Info., K. Cho, Internet Initiative Japan, Tokyo, Japan; CNRS-WIDE Grant)

Intrapartum Fetal Heart Rate Variability (2010-16): We showed that scale invariance for Intrapartum Fetal HRV characterization permits to decrease the number of false alarms in fetal acidosis detection and thus of unnecessary operative deliveries (cesarean sections) ([A45,P9]: 22/23/26, [A50]: 10/9/15). This yield an invited talk in a Special Session at EMBC2013, a keynote lecture at BSI2016, and received a Conference Best Paper Award at CBMS2013 [C89]). (Coll. M. Doret, M.D., Academic Hospital, F; ANR Grant FETUSES 2012-14)

Wavelet-leader multifractal analysis (2007-16): Multifractal analysis constitutes a useful, yet theoretical, extension of self-similarity, to model scale invariance. We proposed a theoretically well-grounded, efficient and simple to use tool, the wavelet leaders, to actually implement multifractal analysis. The well-cited corresponding article ([A30,P1]: 76/85/128) and [open-access toolbox](#) have renewed the theoretical understanding and practical use of multifractal analysis, with notable successes in image processing ([A39,P2]: 44/50/86) and other applications, e.g., hydrodynamic turbulence ([A23,P7]: 36/35/50). MATLAB INC.Â has contacted us and now decided to include our Wavelet Leaders in its [Wavelet Toolbox Matlab 2016B release](#). (Coll. S. Jaffard, Math., Paris, F; H. Wendt, Signal Proc., Toulouse, F; V. Pipiras, Math., UNC, USA; ANR Grant AMATIS, 2011-15).

Internet Traffic Long Memory Measurement (1998-2008): with D. Veitch (Melbourne Univ., Australia). Work at the origin of the program evidencing long memory in Internet traffic traces, collected across different continents and networks, leading to massively cited publications. [A5], [A14], [A18]

Wavelet and Self-Similarity (1995-99): with D. Veitch (Melbourne University, AUS), V. Pipiras (U. North Carolina, USA). *Wavelet Hurst parameter estimator massively quoted and used in applications* [B1], [A8]

Wavelet Design (1992-96): with P. Flandrin (ENS Lyon, F), A. Aldroubi (Van der Bilt Univ, USA) [A7], [Book](#) [A3], [A7]