# Arnaudon Alexis
*Research Associate*

*Avenue des Alpes, 44*
*1006 Lausanne*
*Suisse*
✆ *(+41)788480083*
✉ *alexis.arnaudon@epfl.ch*

## Education

2019–  **Research Associate**, *EPFL*, Lausanne.
Blue Brain Project, Neuromathematics in the Cells section, Supervision: Lida Kanari and Werner van Geit .Director Prof. Henry Markram

2017–2019  **Research Associate**, *Imperial College London*, London.
Centre For Mathematics For Precision Healthcare, Director: Prof M. Barahona, Supervision: Prof. Sophia Yaliraki

2013–2017  **PhD**, *Imperial College London*, London.
Phd in applied mathematics, Supervision: Darryl D. Holm.

2011–2013  **MSc**, *Ecole Polytechnique Federale de Lausanne*, Lausanne.
Master in physics, minor in Mathematics.

2007–2011  **BSc**, *Ecole Polytechnique Federale de Lausanne*, Lausanne.
Bachelor in physics.

## Teaching

- 2 co-supervision of Master students at EPFL
- 3 co-supervision of Master students at Imperial College London
- One current co-supervised PhD student at Imperial College London
- Teaching Assistant at EPFL for 1st and 2nd years of Mathematics and Physics classes for engineers.

## Awards

2018  Yael Dowker Prize - Best Maths PhD Thesis 2017

2016  Doris Chen Merit Award, *Imperial College award for late stage outstanding students.*

2013  Roth PhD Studentship

## Other

- Founder of the Imperial College Maths Helpdesk initiative. *A platform connecting young researchers across departments with mathematicians to foster collaborations, funded by the vice-provost of research.*

## References

- Prof. Darryl Holm, Department of Mathematics, Imperial College London, UK. Email: d.holm@imperial.ac.uk
- Prof. Tudor Ratiu, School of Mathematics, Shanghai Jiao Tong University, Shanghai, China. Email: tudor.ratiu@epfl.ch
- Prof. Mauricio Barahona, Department of Mathematics, Imperial College London, UK. Email: m.barahona@imperial.ac.uk
- Prof. Stefan Sommer, Department of Computing, University of Copenhagen, UK. Email: sommer@di.ku.dk
- Prof. Sophia Yaliraki, Department of Chemistry, Imperial College London, UK. Email: s.yaliraki@imperial.ac.uk

## Languages

French   Mother tongue
English   Fluent

## Computer skills

Languages   Python, LaTex, (C/C++)
Systems   MAC/LINUX

## Publications

Alexis Arnaudon et al. "Connecting Hodge and Sakaguchi-Kuramoto through a mathematical framework for coupled oscillators on simplicial complexes". In: *Communications Physics* 15.1 (2022), pp. 1–12.

Alexis Arnaudon et al. "Diffusion bridges for stochastic Hamiltonian systems and shape evolutions". In: *SIAM Journal on Imaging Sciences* 15.1 (2022), pp. 293–323.

Lida Kanari et al. "Computational synthesis of cortical dendritic morphologies". In: *Cell Reports* 39.1 (2022), p. 110586.

Robert Peach, Alexis Arnaudon, and Mauricio Barahona. "Relative, local and global dimension in complex networks". In: *Nature Communications* 13.1 (2022), pp. 1–11.

Michael W. Reimann et al. "Modeling and Simulation of Rat Non-Barrel Somatosensory Cortex. Part I: Modeling Anatomy". In: *bioRxiv preprint: biorxiv:2022.08.11.503144* (2022).

Dhruv Saxena et al. "Sensitivity and spectral control of network lasers". In: *Nature Communications* 13.1 (2022), p. 6493.

Alexis Arnaudon, Darryl Holm, and Stefan Sommer. "Stochastic Shape Analysis". In: *Handbook of Mathematical Models and Algorithms in Computer Vision and Imaging: Mathematical Imaging and Vision* (2021), pp. 1–24.

Alessandro Barp et al. "A unifying and canonical description of measure-preserving diffusions". In: *arXiv preprint arXiv:2105.02845* (2021).

Alexander Christgau, Alexis Arnaudon, and Stefan Sommer. "Moment evolution equations and moment matching for stochastic image EPDiff". In: *arXiv preprint arXiv:2110.03337, in revision in JMIV* (2021).

Adam Gosztolai and Alexis Arnaudon. "Unfolding the multiscale structure of networks with dynamical Ollivier-Ricci curvature". In: *Nature Communication* 2.4561 (2021).

Robert L Peach et al. "HCGA: Highly comparative graph analysis for network phenotyping". In: *Patterns* 2.4 (2021), p. 100227.

Eleftherios Zisis et al. "Digital Reconstruction of the Neuro-Glia-Vascular Architecture." In: (2021).

Rauan Akylzhanov and Alexis Arnaudon. "Contractions of group representations via geometric quantization". In: *Letters in Mathematical Physics* 110.1 (2020), pp. 43–59.

Alexis Arnaudon, Darryl D Holm, and Stefan Sommer. "Stochastic metamorphosis with template uncertainties". In: *Mathematics Of Shapes And Applications*. 2020, pp. 75–96.

Alexis Arnaudon, Robert L Peach, and Mauricio Barahona. "Scale-dependent measure of network centrality from diffusion dynamics". In: *Physical Review Research* 2.3 (2020), p. 033104.

Robert L Peach, Alexis Arnaudon, and Mauricio Barahona. "Semi-supervised classification on graphs using explicit diffusion dynamics". In: *Foundations of Data Science* 2.1 (2020), p. 19.

Alexis Arnaudon, Alessandro Barp, and So Takao. "Irreversible Langevin MCMC on lie groups". In: *International Conference on Geometric Science of Information*. Springer, Cham. 2019, pp. 171–179.

Alexis Arnaudon, Darryl D Holm, and Stefan Sommer. "A geometric framework for stochastic shape analysis". In: *Foundations of Computational Mathematics* 19.3 (2019), pp. 653–701.

Alexis Arnaudon and So Takao. "Networks of coadjoint orbits: from geometric to statistical mechanics". In: *Journal of Geometric Mechanics* 11.4 (2019), p. 447.

Andreas Bock, Alexis Arnaudon, and Colin Cotter. "Selective metamorphosis for growth modelling with applications to landmarks". In: *International Conference on Geometric Science of Information*. Springer, Cham. 2019, pp. 39–48.

Line Kühnel, Stefan Sommer, and Alexis Arnaudon. "Differential geometry and stochastic dynamics with deep learning numerics". In: *Applied Mathematics and Computation* 356 (2019), pp. 411–437.

Alexis Arnaudon. "Structure preserving noise and dissipation in the Toda lattice". In: *Journal of Physics A: Mathematical and Theoretical* 51.21 (2018), p. 214001.

Alexis Arnaudon, Alex L De Castro, and Darryl D Holm. "Noise and dissipation on coadjoint orbits". In: *Journal of Nonlinear Science* 28.1 (2018), pp. 91–145.

Alexis Arnaudon, Nader Ganaba, and Darryl Holm. "The Stochastic Energy-Casimir Method". In: *Comptes Rendus Mecanique* (2018).

Alexis Arnaudon, Darryl Holm, and Stefan Sommer. "String methods for stochastic image and shape matching". In: *Journal of Mathematical Imaging and Vision* 60.6 (2018), pp. 953–967.

Alexis Arnaudon, Marco Castrillón López, and Darryl D Holm. "Un-reduction in field theory". In: *Letters in Mathematical Physics* 108.1 (2018), pp. 225–247.

Line Kühnel et al. "Stochastic image deformation in frequency domain and parameter estimation using moment evolutions". In: *arXiv preprint arXiv:1812.05537* (2018).

Manickam Saravanan and Alexis Arnaudon. "Engineering solitons and breathers in a deformed ferromagnet: Effect of localised inhomogeneities". In: *Physics Letters A* 382.37 (2018), pp. 2638–2644.

Alexis Arnaudon and John D Gibbon. "Integrability of the hyperbolic reduced Maxwell-Bloch equations for strongly correlated Bose-Einstein condensates". In: *Physical Review A* 96.1 (2017), p. 013610.

Alexis Arnaudon, Darryl D Holm, and Rossen I Ivanov. "G-Strands on symmetric spaces". In: *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences* 473.2199 (2017), p. 20160795.

Alexis Arnaudon et al. "A Stochastic Large Deformation Model for Computational Anatomy". In: *Information Processing in Medical Imaging*. 2017, pp. 571–582.

Stefan Sommer et al. "Bridge Simulation and Metric Estimation on Landmark Manifolds". In: *MFCA2017* (2017).

Alexis Arnaudon. "On a deformation of the nonlinear Schrödinger equation". In: *Journal of Physics A: Mathematical and Theoretical* 49.12 (2016), p. 125202.

Alexis Arnaudon. "On a Lagrangian reduction and a deformation of completely integrable systems". In: *Journal of Nonlinear Science* 26.5 (2016), pp. 1133–1160.

Yves Revaz et al. "Computational issues in chemo-dynamical modelling of the formation and evolution of galaxies". In: *Astronomy & Astrophysics* 588 (2016), A21.

A Arnaudon, M Castrillón López, and DD Holm. "Covariant un-reduction for curve matching". In: *MFCA2015*. 2015.

Alexis Arnaudon. "The stochastic integrable AKNS hierarchy". In: *arXiv preprint arXiv:1511.07080* (2015).

Alexis Arnaudon, Alex L De Castro, and Darryl D Holm. "Noise and dissipation in rigid body motion". In: *Workshop Classic and Stochastic Geometric Mechanics*. Springer, Cham. 2015, pp. 1–12.

## Oral presentations/posters

- FENS Forum 2022, Paris, 9-14 July 2022 (poster)
- Physics of Living systems, EPFL, 18 March 2022
- Society for Neuroscience 2021 Annual Meeting, November 8-11 2021, Chicago, (online poster)
- Organization for Computational Neurosciences Meeting, 30 June-2 July 2021, (two online poster)
- Complexity seminar, Imperial College London, 21 January 2021, (online)
- Systems Neuroscience and Complexity seminar, 24 September 2020, Sydney (online)
- COXIC, Oxford, 21 May 2019
- GFS follow on: Mathematics of form in active and inactive media,Cambridge, 25th March 2019 to 29th March 2019
- Satellite meeting at CCS18: Extracting and analysing networks from spatio-temporal data, Thesalloniki, 26 September 2018
- Shape Analysis, Stochastic Mechanics and Optimal Transport, Banff, Canada, 9-14 September 2018
- From Stochastic Geometric Mechanics to Mass Transportation Problems, Lisboa, 3-6 September 2018
- Graph Theory and Physics, Imperial College London, 30 May 2018
- Developments in Healthcare imaging, Turing Gateway to Mathematics, University of Cambridge, 2 May 2018
- Shape analysis and computational anatomy, Newton Institute, University of Cambridge, 13-17 November 2017
- Integrable Systems Seminars, University of Leeds, 3 November 2017
- Classic and Stochastic Approaches to Mathematical Fluid Dynamics, Imperial College London, 2-6 October 2017
- Seminar, Dublin Institute of Technology, Dublin, 21 October 2016
- Seminar Københavns Universitet, Copenhagen, 20 June 2016
- AGM Meeting on Symmetry and Shape Analysis, Imperial College London, 29 April 2016
- Noncommutative Analysis and Partial Differential Equations , Imperial College London, 11-15 April 2016
- Mathematical Physics Seminar, Imperial College London, 23 March 2016
- 10th International Young Researchers Workshop on Geometry, Mechanics and Control, Institut Henri Poincar , France, 13-15 January 2016
- Mathematical physics seminar,University of Kent, 30 October 2015
- Waves, Solitons and Turbulence in Optical Systems, Berlin, 12-14 October 2015
- 5th MICCAI workshop on Mathematical Foundations of Computational Anatomy, Munich, 9 October 2015
- 14th Mathematics in Technical and Natural Sciences, 2015, Zakopane, Poland, 18-24 September 2015

- Workshop Classic and Stochastic Geometric Mechanics, Part of the semester Geometric Mechanics, Variational and Stochastic Methods, EPFL, Switzerland, 08-11 June 2015
- 9th International Young Researchers Workshop on Geometry, Mechanics and Control, University of Zaragoza, 21 January 2015
- AGM network meeting, Symmetry and Shape Analysis, Imperial College London, 13 June 2014
- AGM Network meeting, Geometric Fluid Dynamics, University of Surrey, 16 May 2014