

Antoine Allard

Curriculum Vitæ

Assistant Professor
Département de physique, de génie physique et d'optique
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ACADEMIC POSITIONS

- Université Laval** Québec, Canada
Assistant Professor 2018–present
- ★ Sentinelle Nord Research Chair on Applications and Theory of Network Analysis
 - Co-leader of the [Dynamica Research Group](#) on the structure and the dynamics of complex systems
 - Member of the [Centre Interdisciplinaire en Modélisation Mathématique de l'Université Laval \(CIMMUL\)](#)
- Universitat de Barcelona** Barcelona, Spain
Postdoctoral Fellow 2018
- ★ Awarded the Juan de la Cierva – Incorporación postdoctoral fellowship
- Centre de Recerca Matemàtica** Bellaterra, Spain
Senior Research Fellow 2017
- Universitat de Barcelona** Barcelona, Spain
Postdoctoral Fellow 2014–2016
- ★ Awarded the Fonds de recherche du Québec – Nature et Technologies postdoctoral fellowship
- University of British Columbia Centre for Disease Control** Vancouver, Canada
Research Assistant 2006–2007
- Université Laval** Québec, Canada
Undergraduate Research Assistant 2006
- Supervisor: Louis J. Dubé, Nonlinear Dynamics Group
 - ★ Natural Sciences and Engineering Research Council of Canada Undergraduate Student Research Award
- Centre de Recherche de l'Hôtel-Dieu de Québec** Québec, Canada
Undergraduate Research Assistant 2005
- Supervisor: Luc Beaulieu, Radio Oncology Department
 - ★ Natural Sciences and Engineering Research Council of Canada Undergraduate Student Research Award
- Université Laval** Québec, Canada
Undergraduate Research Assistant 2004
- Supervisor: Gilles Joncas, Astrophysics Group

EDUCATION

- Université Laval** Québec, Canada
Ph.D. in Physics 2009–2014
- Thesis Title: *Percolation sur graphes aléatoires: Modélisation et description analytique*¹
 - Advisor: Louis J. Dubé
 - ★ Awarded the CIHR Frederick Banting and Charles Best Canada Graduate Scholarship
 - ★ Thesis added to the Board of Honour for receiving the highest overall mark

¹Percolation on random graphs: Modelling and analytical description

Santa Fe Institute
Complex Systems Summer School

Santa Fe, NM, USA
2011

Université Laval

Québec, Canada
2006–2008

M.Sc. in Physics

- Thesis Title: *Modélisation Mathématique en Épidémiologie par Réseaux de Contacts: Introduction de l'Hétérogénéité dans la Transmissibilité*²
- Advisor: Louis J. Dubé
- ★ Thesis added to the Board of Honour for receiving the highest overall mark

Université Laval

Québec, Canada
2003–2006

B.Sc. in Physics (Theoretical Physics option)

- ★ Rouge et Or Distinction for excellence in academic undergraduate results
- ★ Nominated 2003 AESGUL Prize for “Student of the year” (chosen by the peers)

FUNDING AND AWARDS

Grants

- Discovery Grant, *Natural Sciences and Engineering Research Council of Canada* (NSERC), 2019–2024
- Sentinelle Nord Research Chair on Applications and Theory of Network Analysis, *Université Laval*. 2018–2023

Fellowships

- Juan de la Cierva – Incorporación (postdoctoral fellowship), *Ministerio de Economía, Industria y Competitividad de España*, 2017–2019
- Postdoctoral Fellowship, *Fonds de recherche du Québec – Nature et Technologies* (FRQNT), 2014–2016
- Frederick Banting and Charles Best Canada Graduate Scholarships - Doctoral Awards, *Canadian Institutes of Health Research* (CIHR), 2009–2012
- Doctoral Research Scholarship, *Fonds de recherche du Québec – Nature et Technologies* (FRQ-NT), 2008 (declined)
- Doctoral Research Scholarship, *Fondation de l'Université Laval*, 2008 (declined)
- Undergraduate Student Research Award, *Natural Sciences and Engineering Research Council of Canada* (NSERC), 2006
- Undergraduate Student Research Award, *Natural Sciences and Engineering Research Council of Canada* (NSERC), 2005

Other Recognitions

- 2019 AESGUL Prize for “Teacher of the year” (elected by the undergraduate students), 2019
- Board of Honour for a Ph.D.'s Thesis (highest distinction), Faculty of Graduate Studies, Université Laval, 2014
- Nominated 2013 AESGUL Prize for “Staff member of the year” as the Teaching Assistant of PHY-3000 Statistical Physics (elected by the undergraduate students), 2014
- Board of Honour for a Master's Thesis (highest distinction), Faculty of Graduate Studies, Université Laval, 2009
- Third Place at the Student Competition (Poster Presentation), Congress of the Canadian Association of Physicists, Quebec City, 2008
- 2006 AESGUL Prize for “Staff member of the year” as the Teaching Assistant of PHY-1002 Mathematical Physics II (elected by the undergraduate students), 2007
- Rouge et Or Distinction for excellence in academic undergraduate results, 2006
- Nominated 2003 AESGUL Prize for “Student of the year” (chosen by the peers), 2004

²Mathematical modelling in contact networks for epidemiology: Introduction of heterogeneity in transmissibility.

TEACHING

Université Laval

Québec, Canada

Teacher

- PHY-7053 Theory of Complex Systems and Networks 2020
- PHY-3500 Computational Physics 2020
- PHY-2502 Nonlinear Dynamics, Chaos and Complexity 2019
- PHY-7008 Deep Learning: Theory and applications 2019
- PHY-3000 Statistical Physics 2018–2019
- ★ Awarded 2019 AESGUL Prize for “Teacher of the year” (elected by the undergraduate students)

Université Laval

Québec, Canada

Teaching Assistant

- PHY-3000 Statistical Physics 2009, 2010, 2013
- ★ Nominated 2013 AESGUL Prize for “Staff member of the year” (elected by the undergraduate students)
- PHY-2502 Nonlinear Dynamics, Chaos and Complexity 2007, 2012
- PHY-1002 Mathematical Physics II 2006, 2007
- ★ Awarded 2006 AESGUL Prize for “Staff member of the year” (elected by the undergraduate students)

St. Anthony's RC Girls School/Hetton School

Sunderland, United Kingdom

Foreign Language Assistant

2008–2009

MENTORING

Postdoctoral researchers

- Ilhem Bouderbala, *Université Laval*, Winter 2020
- Marina Vegué Llorente, *Université Laval*, 2020–present

Ph.D. students

- Vincent Thibeault, *Université Laval*, 2019–present
- Charles Murphy, *Université Laval*, 2018–present

M.Sc. students

- Olivier Ribordy, *Université Laval*, Summer 2021
- Simon Lizotte, *Université Laval*, Summer 2020
- François Thibault, *Université Laval*, Summer 2020
- Béatrice Désy, *Université Laval*, 2019–present
- Francis Normand³, *Université Laval*, 2019–present
- Charles Murphy³, *Université Laval*, 2016–2017

B.Sc. interns

- Simon Lizotte, *Université Laval*, Winter 2020
- François Thibault, *Université Laval*, Winter 2020
- Olivier Ribordy, *Université Laval*, Summer 2019
- François Thibault, *Université Laval*, Summer 2019

Bachelor's thesis

- Marta Caveró Lázaro³, *Universitat Autònoma de Barcelona*, 2018

³Acting/acted as co-advisor.

ORGANIZING ACTIVITIES

Complex Networks Winter Workshop (CNWW)

Québec, Canada

Co-director

December 2019

- In collaboration with [Sentinelle Nord](#) and the [Vermont Complex Systems Center](#)

International School and Conference on Network Science (NetSci 2019)

Burlington VT, USA

School, Poster Session, and Satellite Co-chair

May 2019

- Organized by the [Vermont Complex Systems Center](#)

Complex Networks Winter Workshop (CNWW)

Québec, Canada

Co-director

December 2018

- In collaboration with [Sentinelle Nord](#), the [Vermont Complex Systems Center](#) and the [Network Science Institute](#)

Contagion & Networks (ContNet2018)

Paris, France

Co-organizer

June 2018

- Satellite symposium of the International School and Conference on Network Science (NetSci 2018)
- In collaboration with B. M. Althouse, L. Hébert-Dufresne and S. V. Scarpino

Contagion & Networks (ContNet2017)

Indianapolis IN, USA

Co-organizer

June 2017

- Satellite symposium of the International School and Conference on Network Science (NetSci 2017)
- In collaboration with B. M. Althouse, L. Hébert-Dufresne and S. V. Scarpino

REVIEWING ACTIVITIES

Grant review

- Discovery Grant, *Natural Sciences and Engineering Research Council of Canada*, 2019

Program committee

- 11th International Conference on Complex Networks (CompleNet 2020)
- 8th International Conference on Complex Networks and their Applications (Complex Networks 2019)
- 10th Conference on Network Modeling and Analysis (MARAMI 2019)
- International School and Conference on Network Science (NetSci 2019)
- 7th International Conference on Complex Networks and their Applications (Complex Networks 2018)
- International School and Conference on Network Science (NetSci 2018)
- 6th International Conference on Complex Networks and their Applications (Complex Networks 2017)
- Mapping Complexity: Foundations and Applications of Network Geometry workshop (MACFANG-17)
- 5th International Workshop on Complex Networks and their Applications (Complex Networks 2016)

Thesis jury

- Xavier Roy-Pomerleau (Master's thesis, *Université Laval*, 2020)
- Vincent Thibeault (Master's thesis, *Université Laval*, 2020)
- Guillaume St-Onge (PhD exam, *Université Laval*, 2019)
- Edward Laurence (PhD seminar, *Université Laval*, 2018)
- Edward Laurence (PhD exam, *Université Laval*, 2017)
- Jaume Palmer Real (Master's thesis, *Universitat Autònoma de Barcelona*, 2017)

Scholarships

- Larkin Kerwin undergraduate scholarship, *Université Laval*, 2019

Scientific journals

- Applied Network Science
- Bioinformatics
- Discrete Dynamics in Nature and Society
- Europhysics Letters
- IEEE's Transactions on Network Science and Engineering
- Nature Communications
- Physica A
- Physical Review E
- Physical Review Letters
- Physical Review X
- PLOS Computational Biology
- PLOS ONE
- Scientific Reports

ADMINISTRATIVE ACTIVITIES

| | |
|---|-------------------------------|
| Selection committee for the recruitment of a new professor at the Physics Department Committee member | Université Laval 2020 |
| Student Investment Fund Board member | Université Laval 2012–2013 |
| Physics Graduate Student Union Treasurer | Université Laval 2011–2012 |
| Physics Graduate Program Committee Member | Université Laval 2011–2012 |
| Physics Professoral Assembly Student representative | Université Laval 2010–2012 |
| Physics Undergraduate Student Union Treasurer | Université Laval 2004–2006 |

PUBLICATIONS AND PRESENTATIONS

Submitted manuscripts

- *On the accuracy of message-passing approaches to percolation in complex networks*, **A. Allard** and L. Hébert-Dufresne, [arXiv:1906.10377](#) (2019)
- *Geometric renormalization unravels self-similarity of the multiscale human connectome*, M. Zheng, **A. Allard**, Patric Hagmann and M. Á. Serrano, [arXiv:1904.11793](#) (2019)

Research publications⁴ (refereed)

- *Navigable maps of structural brain networks across species*, **A. Allard** and M. Á. Serrano, *PLOS Comput. Biol.* **16**, [e1007584](#) (2020) [7]

⁴Known number of citations in brackets (according to [Google Scholar](#)).

- *Mercator: uncovering faithful hyperbolic embeddings of complex networks*, G. García-Pérez⁵, **A. Allard**⁵, M. Á. Serrano and M. Boguñá, [New J. Phys. 21, 123033 \(2019\)](#) [1]
- *Smeared phase transitions in percolation on real complex networks*, L. Hébert-Dufresne and **A. Allard**, [Phys. Rev. Research 1, 013009 \(2019\)](#) [1]
- *Percolation and the effective structure of complex networks*, **A. Allard** and L. Hébert-Dufresne, [Phys. Rev. X 9, 011023 \(2019\)](#) [3]
- *Geometric evolution of complex networks with degree correlations*, C. Murphy, **A. Allard**, E. Laurence, G. St-Onge, and L. J. Dubé, [Phys. Rev. E 97, 032309 \(2018\)](#) [2]
- *The risk of sustained sexual transmission of Zika is underestimated*, **A. Allard**⁵, B. M. Althouse⁵, L. Hébert-Dufresne⁵, and S. V. Scarpino⁵, [PLoS Pathog. 13, e1006633 \(2017\)](#) [39]
- *Asymmetric percolation drives a double transition in sexual contact networks*, **A. Allard**, B. M. Althouse, S. V. Scarpino, and L. Hébert-Dufresne, [Proc. Natl. Acad. Sci. USA 114, 8969–8973 \(2017\)](#) [18]
- *Strategic tradeoffs in competitor dynamics on adaptive networks*, L. Hébert-Dufresne, **A. Allard**, P.-A. Noël, J.-G. Young, and E. Libby, [Sci. Rep. 7, 7576 \(2017\)](#) [5]
- *The geometric nature of weights in real complex networks*, **A. Allard**, M. Á. Serrano, G. García-Pérez, and M. Boguñá, [Nat. Commun. 8, 14103 \(2017\)](#) [46]
 - ★ Featured in [Nature Physics' Research highlights](#).
 - ★ Featured in [Nature Communications' Web collection on complex systems](#).
- *The effect of a prudent adaptive behaviour on disease transmission*, S. V. Scarpino, **A. Allard**, and L. Hébert-Dufresne, [Nature Phys. 12, 1042–1046 \(2016\)](#) [36]
 - ★ Featured in [Nature Physics' News & Views](#).
 - ★ In the top 5% of all research outputs scored by [Altmetric](#) (media coverage).
- *The hidden hyperbolic geometry of international trade: World Trade Atlas 1870–2013*, G. García-Pérez, M. Boguñá, **A. Allard**, and M. Á. Serrano, [Sci. Rep. 6, 33441 \(2016\)](#) [39]
 - ★ Featured in the section [Economía](#) of the newspaper [El Periódico](#).
- *Growing networks of overlapping communities with internal structure*, J.-G. Young, L. Hébert-Dufresne, **A. Allard**, and L. J. Dubé, [Phys. Rev. E 94, 022317 \(2016\)](#) [7]
- *Multi-scale structure and topological anomaly detection via a new network statistic: The onion decomposition*, L. Hébert-Dufresne, J. Grochow, and **A. Allard**, [Sci. Rep. 6, 31708 \(2016\)](#) [15]
- *Constrained growth of complex scale-independent systems*, L. Hébert-Dufresne, **A. Allard**, J.-G. Young, and L. J. Dubé, [Phys. Rev. E 93, 032304 \(2016\)](#) [12]
 - ★ Featured in the *Editors' Suggestions* section of [Phys. Rev. E](#).
- *Complex networks as an emerging property of hierarchical preferential attachment*, L. Hébert-Dufresne, E. Laurence, **A. Allard**, J.-G. Young, and L. J. Dubé, [Phys. Rev. E 92, 062809 \(2015\)](#) [11]
- *General and exact approach to percolation on random graphs*, **A. Allard**, L. Hébert-Dufresne, J.-G. Young, and L. J. Dubé, [Phys. Rev. E 92, 062807 \(2015\)](#) [18]
- *A shadowing problem in the detection of overlapping communities: Lifting the resolution limit through a cascading procedure*, J.-G. Young, **A. Allard**, L. Hébert-Dufresne, and L. J. Dubé, [PLOS ONE 10, e0140133 \(2015\)](#) [10]
- *Spreading dynamics on complex networks: a general stochastic approach*, P.-A. Noël, **A. Allard**, L. Hébert-Dufresne, V. Marceau, and L. J. Dubé, [J. Math. Biol. 69, 1627–1660 \(2014\)](#) [10]

⁵Equal contribution.

- *A system-level model for the microbial regulatory genome*, A. N. Brooks, D. J. Reiss, **A. Allard**, W.-J. Wu, D. M. Salvanha, C. L. Plaisier, S. Chandrasekaran, M. Pan, A. Kaur, and N. S. Baliga, *Mol. Syst. Biol.* **10**, 740 (2014) [40]
- *Coexistence of phases and the observability of random graphs*, **A. Allard**, L. Hébert-Dufresne, J.-G. Young, and L. J. Dubé, *Phys. Rev. E* **89**, 022801 (2014) [4]
 ★ Featured in the *Editors' Suggestions* section of Phys. Rev. E.
- *Percolation on random networks with arbitrary k -core structure*, L. Hébert-Dufresne⁵, **A. Allard**⁵, J.-G. Young, and L. J. Dubé, *Phys. Rev. E* **88**, 062820 (2013) [23]
- *Global efficiency of local immunization of complex networks*, L. Hébert-Dufresne⁵, **A. Allard**⁵, J.-G. Young⁵, and L. J. Dubé, *Sci. Rep.* **3**, 2171 (2013) [87]
- *Bond percolation on a class of correlated and clustered random graphs*, **A. Allard**, L. Hébert-Dufresne, P.-A. Noël, V. Marceau, and L. J. Dubé, *J. Phys. A* **45**, 405005 (2012) [25]
- *Exact solution of bond percolation on small arbitrary graphs*, **A. Allard**, L. Hébert-Dufresne, P.-A. Noël, V. Marceau, and L. J. Dubé, *EPL* **98**, 16001 (2012) [8]
- *Propagation on networks: An exact alternative perspective*, P.-A. Noël, **A. Allard**, L. Hébert-Dufresne, V. Marceau, and L. J. Dubé, *Phys. Rev. E* **85**, 031118 (2012) [22]
- *Structural preferential attachment: Stochastic process for the growth of scale-free, modular and self-similar systems*, L. Hébert-Dufresne, **A. Allard**, V. Marceau, P.-A. Noël, and L. J. Dubé, *Phys. Rev. E* **85**, 026108 (2012) [15]
- *Structural preferential attachment: Network organization beyond the link*, L. Hébert-Dufresne, **A. Allard**, V. Marceau, P.-A. Noël, and L. J. Dubé, *Phys. Rev. Lett.* **107**, 158702 (2011) [34]
- *Modeling the dynamical interaction between epidemics on overlay networks*, V. Marceau, P.-A. Noël, L. Hébert-Dufresne, **A. Allard**, and L. J. Dubé, *Phys. Rev. E* **84**, 026105 (2011) [119]
- *Propagation dynamics on networks featuring complex topologies*, L. Hébert-Dufresne, P.-A. Noël, V. Marceau, **A. Allard**, and L. J. Dubé, *Phys. Rev. E* **82**, 036115 (2010) [39]
 ★ Also in the *Virtual Journal of Biological Physics Research*, issue 7, vol. 20 (2010).
- *Adaptive networks: Coevolution of disease and topology*, V. Marceau, P.-A. Noël, L. Hébert-Dufresne, **A. Allard**, and L. J. Dubé, *Phys. Rev. E* **82**, 036116 (2010) [189]
 ★ Also in the *Virtual Journal of Biological Physics Research*, issue 7, vol. 20 (2010).
- *Heterogeneous bond percolation on multitype networks with an application to epidemic dynamics*, **A. Allard**, P.-A. Noël, L. J. Dubé, and B. Pourbohloul, *Phys. Rev. E* **79**, 036113 (2009) [99]
 ★ Also in the *Virtual Journal of Biological Physics Research*, issue 7, vol. 17 (2009).

Book chapters

- *A new approach to international trade from Network Geometry: The World Trade Atlas 1870-2013*, G. García-Pérez, M. Boguñá, **A. Allard**, and M. Á. Serrano, in *Networks of International Trade and Investment: Understanding globalization through the lens of network analysis*, S. Gorgoni, A. Amighini, and M. Smith (Eds.), Vernon Press, pp. 71–112 (2018) ISBN:978-1-62273-065-0
- *The Social Zombie: Modelling undead outbreaks on social networks*, L. Hébert-Dufresne, P.-A. Noël, V. Marceau, **A. Allard**, and L. J. Dubé, in *Mathematical Modelling of Zombies*, R. Smith? (Ed.), University of Ottawa Press, pp. 149–170 (2014) ISBN:978-0-77662-210-1

Scientific outreach

- *Des ponts d'Euler à la grippe aviaire: De l'abstraction mathématique à la réalité sociale des épidémies*⁶, A. Allard, P.-A. Noël, and L. J. Dubé, *Accromath* 4 (winter-spring 2009)

Selected presentations⁷

- *Deep learning of dynamical epidemic processes on complex networks* (oral), Vermont Complex Systems Center, University of Vermont, Burlington, 2019
- *Deep learning of dynamical epidemic processes on complex networks* (oral), Universitat de Barcelona Institute of Complex Systems, Barcelona, 2019
- *Chaire de recherche Sentinelle Nord en modélisation mathématique des systèmes et des réseaux complexes* (oral), Official inauguration of the latest Sentinelle Nord research chairs, Lévis, 2019
- *An introduction to the methodologies for studying complex networks* (oral), Scientific retreat of the thematic project 1 (TP1) – Sentinelle Nord, Forêt Montmorency, Québec, 2019
- *Three tales about percolation on real complex networks* (oral), International Conference on Complex Networks, Tarragona, Spain, 2019
- *Modeling with Random Networks* (oral, Joint talk with L. Hébert-Dufresne), Complex Networks Winter Workshop, Québec, Québec, 2018
- *Les réseaux complexes: un paradigme unificateur et transformateur pour comprendre la relation dynamique/structure des systèmes complexes* (oral), Centre de recherche CERVO, Québec, Québec, 2018
- *Les réseaux complexes: un paradigme unificateur et transformateur pour comprendre la relation dynamique/structure des systèmes complexes* (oral), Institut de biologie intégrative et des systèmes, Université Laval, Québec, Québec, 2018
- *The hyperbolic brain: A geometric approach to network neuroscience* (oral), Sentinelle Nord Annual Meeting, Québec, Québec, 2018
- *Double epidemic threshold and the potential of the Zika virus as a sustained STI* (oral), BIFI International Conference, Zaragoza, Spain, 2018
- *The effective navigable geometry of the brain* (oral), Mapping Complexity: Foundations and Applications of Network Geometry workshop (MACFANG-17), Barcelona, Spain, 2017
- *The effective navigable geometry of the brain* (oral), International School and Conference on Network Science, Indianapolis, Indiana, 2017
- *Towards an effective structure of complex networks and its contributions to epidemiology and neuroscience* (oral), Network Science Institute, Boston, Massachusetts, 2017
- *The geometric nature of weights in real complex networks* (oral), Conference on Complex Systems (CCS 2016), Amsterdam, The Netherlands, 2016
- *The hidden geometry of complex weighted networks* (oral), 8th International Conference on Discrete Models of Complex Systems (Summer Solstice 2016), Aveiro, Portugal, 2016
- *Unveiling the hidden geometry of weighted networks* (oral), International School and Conference on Network Science (TOPONETS15), Zaragoza, Spain, 2015
- *Exploring the hidden metric space of complex networks* (oral), Santa Fe Institute, Santa Fe, New Mexico, 2015

⁶From Euler bridges to avian flu: From mathematical abstraction to the social reality of epidemics.

⁷Invited presentations are denoted with a filled circle.

- *Percolation on clustered and correlated random graphs: General formalism and applications* (poster), International School and Conference on Network Science, Copenhagen, Denmark, 2013
- *Bond and site percolation on clustered and correlated random graphs* (oral), Joint CRM-Imperial College School and Workshop in Complex Systems, Barcelona, Spain, 2013
- *Unveiling hidden communities through cascading detection on network structures* (oral), 2nd International Conference on Complex Sciences, Santa Fe, New Mexico, 2012
- *Exact solution of bond percolation on small arbitrary graphs* (oral), International School and Conference on Network Science, Evanston, Illinois, 2012
- *Using network organization to hinder propagation in structured populations* (poster), International School and Conference on Network Science, Evanston, Illinois, 2012
- *Multitype modular networks as a model of clustered social networks* (poster), International School and Conference on Network Science, Boston & Cambridge, Massachusetts, 2010
- *Heterogeneous Bond Percolation on Complex Networks: Application to Epidemiology* (poster), Canadian Association of Physicists Congress, Québec City, 2008
 - ★ Third place at the student competition.