Antoine Allard
Curriculum Vitæ

Assistant Professor
Département de physique, de génie physique et d'optique
1045 avenue de la Médecine
Université Laval
Québec (Québec) G1V 0A6, Canada

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Academic Positions

Université Laval — Québec, Canada
Assistant Professor — 2018–present
- ⋆ Awarded the Sentinelle Nord Research Chair on the theoretical modeling of complex networks

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

[1] Percolation on random graphs: Modelling and analytical description

Santa Fe Institute Santa Fe, NM, USA
Complex Systems Summer School 2011

Université Laval Québec, Canada
M.Sc. in Physics 2006–2008
- Thesis Title: *Modélisation Mathématique en Epidémiologie 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
B.Sc. in Physics (Theoretical Physics option) 2003–2006
- ⋆ 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

Funding

- Sentinelle Nord Research Chair on the theoretical modeling of complex networks, *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

- 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

[2] Mathematical modelling in contact networks for epidemiology: Introduction of heterogenity in transmissibility.

Teaching

Université Laval — Québec, Canada
Teacher
- PHY-3000 Statistical Physics — Fall 2018
- PHY-2502 Nonlinear Dynamics, Chaos and Complexity — Winter 2019

Université Laval — Québec, Canada
Teaching Assistant
- PHY-3000 Statistical Physics — Fall 2013
  - ⋆ Nominated 2013 AESGUL Prize for "Staff member of the year" (elected by the undergraduate students)
- PHY-2502 Nonlinear Dynamics, Chaos and Complexity — Fall 2012
- PHY-3000 Statistical Physics — Fall 2010
- PHY-3000 Statistical Physics — Fall 2009
- PHY-1002 Mathematical Physics II — Fall 2007
- PHY-2502 Nonlinear Dynamics, Chaos and Complexity — Winter 2007
- PHY-1002 Mathematical Physics II — Fall 2006
  - ⋆ 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

Ph.D. students
- Charles Murphy (advisor) *Université Laval*, 2018–present

M.Sc. students
- Charles Murphy (co-advisor) *Université Laval*, 2016–2017

Bachelor's thesis
- Marta Cavero Lázaro (co-advisor) *Universitat Autònoma de Barcelona*, 2018

Organizing Activities

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

Program committee member

- 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 member

- Edward Laurence (PhD exam, *Université Laval*, 2017)
- Jaume Palmer Real (Master's thesis, *Universitat Autònoma de Barcelona*, 2017)
- Edward Laurence (PhD seminar, *Université Laval*, 2018)

Reviewer for the following 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 ONE
- Scientific Reports

Administrative Activities

Student Investment Fund — Université Laval
Board member — 2012–2013

Physics Graduate Student Union — Université Laval
Treasurer — 2011–2012

Physics Graduate Program Committee — Université Laval
Member — 2011–2012

Physics Professoral Assembly — Université Laval
Student representative — 2010–2012

Physics Undergraduate Student Union — Université Laval
Treasurer — 2004–2006

Publications and Presentations

Submitted manuscripts

- *Smeared phase transitions in percolation on real complex networks*, L. Hébert-Dufresne and **A. Allard** arXiv:1810.00735 (2018)
- *Percolation and the effective structure of complex networks*, **A. Allard** and L. Hébert-Dufresne arXiv:1804.09633 (2018)
- *Navigable maps of structural brain networks across species*, **A. Allard** and M. Á. Serrano arXiv:1801.06079 (2018)

Research publications[3] (refereed)

- *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**[4], B. M. Althouse[4], L. Hébert-Dufresne[4], and S. V. Scarpino[4] PLoS Pathog. 13, e1006633 (2017) [12]
- *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) [12]
- *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) [4]
- *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) [25]
  - ⋆ 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) [24]
  - ⋆ 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) [25]
  - ⋆ 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) [4]
- *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) [9]
- *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) [10]
  - ⋆ 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) [9]
- *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) [14]

[3] Known number of citations in brackets (according to `Google Scholar`).
[4] Equal contribution.

- *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) [9]

- *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]

- *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) [29]

- *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-Dufresne[4], **A. Allard**[4], J.-G. Young, and L. J. Dubé, Phys. Rev. E 88, 062820 (2013) [19]

- *Global efficiency of local immunization of complex networks*, L. Hébert-Dufresne[4], **A. Allard**[4], J.-G. Young[4], and L. J. Dubé, Sci. Rep. 3, 2171 (2013) [66]

- *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) [24]

- *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) [24]

- *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) [12]

- *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) [33]

- *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) [100]

- *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) [35]
  ⋆ 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) [175]
  ⋆ 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) [90]
  ⋆ Also in the *Virtual Journal of Biological Physics Research*, issue 7, vol. 17 (2009).

Other publications (refereed)

- *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

- *Des ponts d'Euler à la grippe aviaire: De l'abstraction mathématique à la réalité sociale des épidémies*[5], **A. Allard**, P.-A. Noël, and L. J. Dubé, Accromath 4 (winter-spring 2009)

Selected presentations

- *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

- *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

[5] From Euler bridges to avian flu: From mathematical abstraction to the social reality of epidemics.

- *Heterogeneous Bond Percolation on Complex Networks: Application to Epidemiology* (poster), Canadian Association of Physicists Congress, Québec City, 2008
  ⋆ Third place at the student competition.