

# Antoine Allard

## Curriculum Vitæ

Departament de Física de la Matèria Condensada &  
UB Institute of Complex Systems (UBICS)  
Carrer de Martí i Franquès, 1  
Universitat de Barcelona  
08028 Barcelona, Spain

Office : 4.29  
Email : antoine.allard.1@gmail.com  
W3 : antoineallard.info

## EDUCATION

**Ph.D. in Physics**, *Université Laval*, 2009–2014

- Thesis Title: *Percolation sur graphes aléatoires: Modélisation et description analytique*<sup>1</sup>
- Thesis added to the Board of Honour for receiving the highest overall mark

**M.Sc. in Physics**, *Université Laval*, 2006–2008

- Thesis Title: *Modélisation Mathématique en Epidémiologie par Réseaux de Contacts: Introduction de l'Hétérogénéité dans la Transmissibilité*<sup>2</sup>
- Thesis added to the Board of Honour for receiving the highest overall mark

**B.Sc. in Physics** (Theoretical Physics option), *Université Laval*, 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)

**Complex Systems Summer School**, *Santa Fe Institute*, 2011

## RESEARCH AND TEACHING EXPERIENCE

### Research

**FRQ-NT Postdoctoral Fellow**, *Universitat de Barcelona*, 2014–present

**Ph.D. Candidate**, *Université Laval*, 2009–2014

**Master Student**, *Université Laval*, 2006–2008

**Research Assistant**, Division of Mathematical Modeling, *University of British Columbia Centre for Disease Control*, Vancouver, Canada, 2006–2007

**Undergraduate Research Assistant**, Nonlinear Dynamics Group, *Université Laval*, 2006

**Undergraduate Research Assistant**, Radio Oncology Department, *Centre de Recherche de l'Hôtel-Dieu de Québec*, 2005

**Undergraduate Research Assistant**, Astrophysics Group, *Université Laval*, 2004

### Teaching

**Teaching Assistant**, PHY-3000 Statistical Physics, *Université Laval*, 2009, 2010 and 2013

- Nominated 2013 AESGUL Prize for “Staff member of the year” (elected by the undergraduate students)

**Teaching Assistant**, PHY-2502 Nonlinear Dynamics, Chaos and Complexity, *Université Laval*, 2007 and 2012

**Foreign Language Assistant**, *St. Anthony's RC Girls School/Hetton School*, Sunderland, United Kingdom, 2008–2009

**Teaching Assistant**, PHY-1002 Mathematical Physics II, *Université Laval*, 2006 and 2007

- Awarded 2006 AESGUL Prize for “Staff member of the year” (elected by the undergraduate students)

### Supervision

**Co-advisor** of Charles Murphy's master's thesis (PhD advisor: L. J Dubé), *Université Laval*, 2016–2017

<sup>1</sup>Percolation on random graphs: Modelling and analytical description

<sup>2</sup>Mathematical modelling in contact networks for epidemiology: Introduction of heterogeneity in transmissibility.

## AWARDS

### *Fellowships*

**Postdoctoral Fellowship**, *Fonds de recherche du Québec – Nature et Technologies* (FRQ-NT), 2014

**Frederick Banting and Charles Best Canada Graduate Scholarships - Doctoral Awards**, *Canadian Institutes of Health Research* (CIHR), 2008

**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

## OTHER ACTIVITIES, SKILLS AND INTERESTS

### *Involvement and Volunteerism*

**Reviewer** for Physical Review Letters, Physical Review E, Scientific Reports, PLOS ONE, Discrete Dynamics in Nature and Society, 2013–present

**Board member** of the Student Investment Fund, 2012–2013

**Treasurer**, Graduate Physics Student Union, 2011–2012

**Student representative** at the Physics Professoral Assembly, 2010–2012

**Member** of the Physics Graduate Program Committee, 2009–2011

**Treasurer**, Undergraduate Physics Student Union, 2004–2006

### *Skills*

**Languages** : French (native language), English (full professional proficiency), Spanish (intermediate level) and Catalan (beginner level)

**Computers** : C++, Python, Matlab/GNU Octave, Mathematica, L<sup>A</sup>T<sub>E</sub>X, GNU/Linux, R

### *Interests*

**Sports and Outdoors**: running, cycling, camping, hiking, skiing

**Music**: upright bass and acoustic guitar

**Travel**: East Africa (2007), Europe (2005, 2008–2010, 2013–2016), Western Canada (2000, 2006–2007), USA (2011–2016)

***Manuscripts in preparation***

- *Effective structure of complex networks*, **A. Allard**, and L. Hébert-Dufresne
- *Spatial organisation of connectome across species*, **A. Allard**, M. Á. Serrano, and M. Boguñá
- *Directed networks in hidden metric space*, **A. Allard**, M. Á. Serrano, G. García-Pérez, and M. Boguñá

***Submitted manuscripts***

- *The geometric nature of weights in real complex networks*, **A. Allard**, M. Á. Serrano, G. García-Pérez, and M. Boguñá, arxiv:1601.03891 Under review at Nature Communications.
- *Strategic tradeoffs in competitor dynamics on adaptive networks*, L. Hébert-Dufresne, **A. Allard**, J.-G. Young and E. Libby arxiv:1607.04632 Under review at Science Advances.

***Research publications***<sup>3</sup> (refereed)

- *The hidden hyperbolic geometry of international trade: World Trade Atlas 1870-2013*, G. García-Pérez, M. Boguñá, **A. Allard**, and M. Á. Serrano, arxiv:1512.02233 To appear in Scientific Reports.
- *Growing networks of overlapping communities with internal structure*, J.-G. Young, L. Hébert-Dufresne, **A. Allard**, L. J. Dubé, Phys. Rev. E 94, 022317 (2016) [0]
- *Multi-scale structure and topological anomaly detection via a new network statistic: The onion decomposition*, L. Hébert-Dufresne, J. Grochow, and **A. Allard**, Scientific Reports 6, 31708 (2016) [0]
- *The effect of a prudent adaptive behaviour on disease transmission*, S. V. Scarpino, **A. Allard**, and L. Hébert-Dufresne, Nature Physics (2016) [1]
- *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)<sup>4</sup> [5]
- *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) [2]
- *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) [4]
- *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) [6]
- *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) [16]
- *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)<sup>4</sup> [3]
- *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. (2014) [7]
- *Percolation on random networks with arbitrary  $k$ -core structure*, L. Hébert-Dufresne<sup>5</sup>, **A. Allard**<sup>5</sup>, J.-G. Young, and L. J. Dubé, Phys. Rev. E 88, 062820 (2013) [14]

<sup>3</sup>Known number of citations in brackets (obtained with Google Scholar).

<sup>4</sup>Selected by the editors and referees to appear in the *Editors' Suggestions* section of Phys. Rev. E.

<sup>5</sup>Equal contribution.

- *Global efficiency of local immunization of complex networks*, L. Hébert-Dufresne<sup>5</sup>, **A. Allard**<sup>5</sup>, J.-G. Young<sup>5</sup>, and L. J. Dubé, *Sci. Rep.* 3, 2171 (2013) [40]
- *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) [20]
- *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) [5]
- *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) [18]
- *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) [8]
- *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) [24]
- *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) [67]
- *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)<sup>6</sup> [125]
- *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)<sup>6</sup> [33]
- *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)<sup>7</sup> [70]

#### **Other publications** (refereed)

- *The Social Zombie: Modelling undead outbreaks on social networks*, L. Hébert-Dufresne, P.-A. Noël, V. Marceau, **A. Allard**, and L. J. Dubé, R. Smith? (Ed.), University of Ottawa Press (2014)
- *Des ponts d'Euler à la grippe aviaire: De l'abstraction mathématique à la réalité sociale des épidémies*<sup>8</sup>, **A. Allard**, P.-A. Noël, and L. J. Dubé, *Accromath* 4 (winter-spring 2009)

#### **Selected presentations** (presenter underlined)

- *The geometric nature of weights in real complex networks* (oral), **A. Allard**, M. Á. Serrano, G. García-Pérez, and M. Boguñá, Conference on Complex Systems (CCS 2016), Amsterdam, The Netherlands, 2016
- *The hidden geometry of complex weighted networks* (oral), **A. Allard**, M. Á. Serrano, G. García-Pérez, and M. Boguñá, 8th International Conference on Discrete Models of Complex Systems (Summer Solstice 2016), Aveiro, Portugal, 2016
- *Unveiling the hidden geometry of weighted networks* (oral), **A. Allard**, G. García-Pérez, M. Á. Serrano, and M. Boguñá, International School and Conference on Network Science (TOPONETS15), Zaragoza, Spain, 2015
- *Exploring the hidden metric space of complex networks* (oral), **A. Allard**, Santa Fe Institute, Santa Fe, New Mexico, 2015

<sup>6</sup>Also in the *Virtual Journal of Biological Physics Research*, issue 7, vol. 20 (2010).

<sup>7</sup>Also in the *Virtual Journal of Biological Physics Research*, issue 7, vol. 17 (2009).

<sup>8</sup>From Euler bridges to avian flu: From mathematical abstraction to the social reality of epidemics.

- *Percolation on clustered and correlated random graphs: General formalism and applications* (poster), A. Allard, L. Hébert-Dufresne, J.-G. Young, and L. J. Dubé, International School and Conference on Network Science, Copenhagen, Denmark, 2013
- *Hard-core random networks as an effective model of bond percolation on real networks* (oral), L. Hébert-Dufresne, A. Allard, J.-G. Young, and L. J. Dubé, International School and Conference on Network Science, Copenhagen, Denmark, 2013
- *Bond and site percolation on clustered and correlated random graphs* (oral), A. Allard, L. Hébert-Dufresne, J.-G. Young, and L. J. Dubé, Joint CRM-Imperial College School and Workshop in Complex Systems, Barcelona, Spain, 2013
- *Unveiling hidden communities through cascading detection on network structures* (oral), J.-G. Young, A. Allard, L. Hébert-Dufresne, and L. J. Dubé, 2nd International Conference on Complex Sciences, Santa Fe, New Mexico, 2012
- *Exact solution of bond percolation on small arbitrary graphs* (oral), A. Allard, L. Hébert-Dufresne, P.-A. Noël, V. Marceau, and L. J. Dubé, International School and Conference on Network Science, Evanston, Illinois, 2012
- *Using network organization to hinder propagation in structured populations* (poster), L. Hébert-Dufresne, A. Allard, J.-G. Young, and L. J. Dubé, International School and Conference on Network Science, Evanston, Illinois, 2012
- *Multitype modular networks as a model of clustered social networks* (poster), A. Allard, P.-A. Noël, L. Hébert-Dufresne, V. Marceau, and L. J. Dubé, International School and Conference on Network Science, Boston & Cambridge, Massachusetts, 2010
- *Time evolution of epidemics on complex networks* (poster), P.-A. Noël, A. Allard & L. J. Dubé, SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, 2009
- *Heterogeneous Bond Percolation on Complex Networks: Application to Epidemiology* (poster), A. Allard, P.-A. Noël, L. J. Dubé & B. Pourbohloul, Canadian Association of Physicists Congress, Québec City, 2008  
(**Third place at the student competition**)
- *Modélisation d'un implant radioactif à haut débit utilisé en curiethérapie à l'aide de GEANT4*<sup>9</sup> (poster), A. Allard, J.-F. Carrier & L. Beaulieu, Centre de Recherche de l'Hôtel-Dieu de Québec's Scientific Day, Québec City, 2005

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<sup>9</sup>High-dose rate brachytherapy implant modelling using GEANT4.