

Guillaume St-Onge

Postdoctoral Research Associate

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Research interests: Complex Networks, Dynamical Systems, Mathematical & Computational Modeling, Contagions

Academic positions

Postdoctoral Research Associate, Northeastern University

2022–present

Education

Degrees

Ph.D. in Physics, Université Laval

2018–2022

- Advisors: Antoine Allard and Laurent Hébert-Dufresne (co-advisor)
- Thesis title: *Contagion process on complex networks beyond pairwise interactions*
- The thesis is part of the [Honour List of the Faculty of Graduate and Postdoctoral Studies](#)

M.Sc. in Physics, Université Laval

2015–2017

- Advisor: Louis J. Dubé
- Thesis title: *Propagation dynamics on random networks: characterization of the phase transition*
- The thesis is part of the [Honour List of the Faculty of Graduate and Postdoctoral Studies](#)

B.Sc. in Physics, Theoretical physics concentration, Université Laval

2012–2015

- [Governor General's Academic Medal](#) for Highest Academic Standing 2016

Summer and winter schools

- [Complex Systems Summer School](#), Santa Fe (NM), USA 2018
- [Complex Networks Winter Workshop](#), Québec (QC), Canada 2018

Scholarships and honors

Postdoctoral research

- [FRQNT: Postdoctoral Research Fellowship](#) (\$110 000) June 2022–June 2024

Graduate research

- [NSERC: Doctoral Scholarship – Alexander Graham Bell Canada](#) (\$105 000) Jan. 2018–Dec. 2020
- [FRQNT: Doctoral Scholarship*](#) (\$60 000) Jan. 2018–Dec. 2020
- [NSERC: Master Scholarship – Alexander Graham Bell Canada](#) (\$17 500) Sept. 2015–Aug. 2016
- [FRQNT: Master Scholarship](#) (\$30 000) Sept. 2015–Aug. 2017
- [Desjardins Foundation: Master Scholarship*](#) (\$3 000) Oct. 2015

*Awarded but declined

Internship research

- [FRQNT: International Internship Program](#) (\$7 500) 2020
- [NSERC: Michael Smith Foreign Study Supplements](#) (\$6 000) 2019
- [NSERC: Undergraduate Student Research Award](#) (\$4 500, Awarded 3 times) 2013, 2014, 2015

Other awards

- Prize to highlight publications by students, [CIMMUL](#) 2021
- Best oral presentation, [Fourth Northeast Regional Conference on Complex Systems](#) 2021
- [Concours d'expression scientifique Pierre Amiot[†]](#) (3rd place), Université Laval 2017
- Student merit award–Direction mention, Université Laval 2015
- Pedagogue of the year, Physics Students Association, Université Laval 2014

Publications and patents

Articles published or accepted in a peer-reviewed journal

17. [Source-sink behavioural dynamics limit institutional evolution in a group-structured society](#)
L. Hébert-Dufresne, T. M. Waring, **G. St-Onge**, et al.
R. Soc. Open Sci. **9**, 211743
16. [Influential groups for seeding and sustaining nonlinear contagion in heterogeneous hypergraphs](#)
G. St-Onge, I. Iacopini, V. Latora, A. Barrat, G. Petri, A. Allard, L. Hébert-Dufresne
Commun. Phys. **5**, 25 2021
15. [Universal Nonlinear Infection Kernel from Heterogeneous Exposure on Higher-Order Networks](#)
G. St-Onge, H. Sun, A. Allard, L. Hébert-Dufresne, G. Bianconi
Phys. Rev. Lett. **127**, 158301 2021
14. [Social Confinement and Mesoscopic Localization of Epidemics on Networks](#) 🏆 (CIMMUL)
G. St-Onge, V. Thibeault, A. Allard, L. J. Dubé, L. Hébert-Dufresne
Phys. Rev. Lett. **126**, 098301 2021
13. [Inference, Model Selection, and the Combinatorics of Growing Trees](#)
G. T. Cantwell, **G. St-Onge**, J.-G. Young
Phys. Rev. Lett. **126**, 038301 2021
12. [Master equation analysis of mesoscopic localization in contagion dynamics on higher-order networks](#)
G. St-Onge, V. Thibeault, A. Allard, L. J. Dubé, L. Hébert-Dufresne
Phys. Rev. E **103**, 032301 2021
11. [Localization, epidemic transitions, and unpredictability of multistrain epidemics with an underlying genotype network](#)
B. J. M. Blake, **G. St-Onge**, L. Hébert-Dufresne
PLOS Comput. Biol. **17**, e1008606 2021
10. [Threefold way to the dimension reduction of dynamics on networks: an application to synchronization](#)
V. Thibeault, **G. St-Onge**, L. J. Dubé, P. Desrosiers
Phys. Rev. Research **2**, 043215 2020
9. [Network comparison and the within-ensemble graph distance](#)
H. Hartle, B. Klein, S. McCabe, A. Daniels, **G. St-Onge**, C. Murphy, L. Hébert-Dufresne
Proc. R. Soc. A **476**, 20190744 2020
8. [Thresholding normally distributed data creates complex networks](#)
G. T. Cantwell, Y. Liu, B. F. Maier, A. C. Schwarze, C. A. Serván, J. Snyder, **G. St-Onge**
Phys. Rev. E **101**, 062302 2020
7. [Phase transition in the recoverability of network history](#)
J.-G. Young, **G. St-Onge**, E. Laurence, C. Murphy, L. Hébert-Dufresne, P. Desrosiers
Phys. Rev. X **9**, 041056 2019

[†]Scientific communication prize

6. *Efficient sampling of spreading processes on complex networks using a composition and rejection algorithm*
G. St-Onge, J.-G. Young, L. Hébert-Dufresne, L. J. Dubé
 Comput. Phys. Commun. **240**, 30 2019
5. *Universality of the stochastic block model*
 J.-G. Young, **G. St-Onge**, P. Desrosiers, L. J. Dubé
 Phys. Rev. E **98**, 032309 2018
4. *Phase transition of the susceptible-infected-susceptible dynamics on time-varying configuration model networks*
G. St-Onge, J.-G. Young, E. Laurence, C. Murphy, L. J. Dubé
 Phys. Rev. E **97**, 022305 2018
3. *Geometric evolution of complex networks with degree correlations*
 C. Murphy, A. Allard, E. Laurence, **G. St-Onge**, L. J. Dubé
 Phys. Rev. E **97**, 032309 2018
2. *Exact vectorial model for nonparaxial focusing by arbitrary axisymmetric surfaces*
 D. Panneton, **G. St-Onge**, M. Piché, S. Thibault
 J. Opt. Soc. Am. **33**, 801 2016
1. *Needles of light produced with a spherical mirror*
 D. Panneton, **G. St-Onge**, M. Piché, S. Thibault
 Opt. Lett. **4**, 419 2015

Preprints

- *Heterogeneous transmission in groups induces a superlinear force of infection*
G. St-Onge, L. Hébert-Dufresne, A. Allard
 arXiv:2302.13358
- *Hierarchical team structure and multidimensional localization (or siloing) on networks*
 L. Hébert-Dufresne, **G. St-Onge**, J. Meluso, J. Bagrow, A. Allard
 arXiv:2203.00745
- *Detecting structural perturbations from time series with deep learning*
 E. Laurence, C. Murphy, **G. St-Onge**, X. Roy-Pomerleau, V. Thibeault
 arXiv:2006.05232

Patents

- *Hybrid nanocomposite materials, laser scanning system and use thereof in volumetric image projection*,
 C. Allen, S. Thibault, A. Talbot-Lanciault, P. Blais, **G. St-Onge**, P. Desaulniers 2017
 CA Patent No. 2983656

Other research experiences

Internships

Vermont Complex System Center, Burlington (VT), USA

- **Visiting graduate student**, group of Prof. Laurent Hébert-Dufresne 2019-2020
 Project: *Temporal reconstruction of networks with message-passing*

Université Laval, Québec (QC), Canada

- **Undergraduate research assistant**, group of Prof. Louis J. Dubé 2015
 Project: *Statistical physics of complex networks*
- **Undergraduate research assistant**, group of Prof. Michel Piché 2014
 Project: *Highly focused laser beam modeling*
- **Undergraduate research assistant**, group of Prof. Claudine Allen 2013
 Project: *Development of an optical system for biodetection*

Workshops

- *Detecting structural perturbations from time series*, Université Laval, Québec (QC), Canada 2019
- *Network Reconstruction & Graph Distances*, Northeastern University, Boston (MA), USA 2019
- *Network Archaeology*, Université Laval, Québec (QC), Canada 2016

Teaching

- PHY-3500: *Computational Physics*, teaching assistant 2016, 2018
Tasks: guidance for student projects, marking
- PHY-3000: *Statistical Physics*, teaching assistant 2016–2018, 2020
Tasks: lectures, marking

Conference contributions and invited lectures

- *Nonlinear infection rate to compress mechanistic epidemic models* 2022
[Fourth Northeast Regional Conference on Complex Systems](#), Buffalo (NY), USA
- *Influential groups in hypergraph contagions* 2022
[Max Planck Institute for Mathematics in the Sciences](#), Leipzig, Germany
- *Bursty exposure on higher-order networks leads to nonlinear infection kernels* 2021
 - [Networks 2021: A Joint Sunbelt and NetSci Conference](#), Bloomington (IN), USA
 - [SIAM Conference on Applications of Dynamical Systems \(DS21\)](#), Portland (OR), USA
 - [Fourth Northeast Regional Conference on Complex Systems](#), Buffalo (NY), USA 🏆 (best talk)
- *Influence maximization in simplicial contagion* 2020
[14th International School and Conference on Network Science](#), Rome, Italy
- *Localization, bistability and optimal seeding of contagions on higher-order networks* 2020
[Artificial Life Conference](#), Montreal (QC), Canada
- *Mesoscopic localization of spreading processes on networks* 2019
[14th International School and Conference on Network Science](#), Burlington (VT), USA
- *SIS dynamics on time-varying random networks* 2017
[Institute for Disease Modeling](#), Seattle (WA), USA
- *Susceptible-infected-susceptible dynamics on the rewired configuration model* 2017
[12th International School and Conference on Network Science](#), Indianapolis (IN), USA
- *Co-evolution of Growth and Dynamics on Network* 2016
[11th International School and Conference on Network Science](#), Seoul, Republic of Korea
- *Modeling ultra-sharp needles of light using vector diffraction theory* 2014
[50th Canadian Undergraduate Physics Conference](#), Kingston (ON), Canada

Service and leadership

Conferences and workshops

- Program committee: [Northeast Regional Conference on Complex Systems \(NERCCS\)](#) 2022
- Session chair: [Networks 2021: A Joint Sunbelt and NetSci Conference](#), S14 – Epidemiology 2021
- Session chair: [SIAM Conference on Applications of Dynamical Systems \(DS21\)](#), CP4 – Dynamics 2021
- Projects liaison: [Complex Networks Winter Workshop](#) 2019

Reviewer

- Journals (12): [Physical Review Letters](#), [Physical Review X](#), [Physical Review E](#), [Nature Communications](#), [PLOS Computational Biology](#), [Journal of The Royal Society Interface](#), [Journal of Complex Networks](#), [Scientific Reports](#), [Chaos: An Interdisciplinary Journal of Nonlinear Science](#), [New Journal of Physics](#), [IMA Journal of Applied Mathematics](#), [Advances in Complex Systems](#)
- Triage grading for [The Interdisciplinary Contest in Modeling \(ICM\)](#) 2022

Mentoring

- Internship mentor for an undergraduate student research 2018
- Mentor for Physique mathématique III (undergraduate course) 2014
- Mentor for Physique mathématique I, II (undergraduate courses) 2013

Volunteering


- La Coupe de Science (youth science contest) 2016
- Festival de Sciences et Génies (science festival) 2015
- Les Jeux photoniques (youth science contest) 2012–2014

Miscellaneous

Media coverage

- *Mathematical model offers new insights into spread of epidemics*, phys.org 2021
- *To find the right network model, compare all possible histories*, phys.org 2021
- *How large a gathering is too large during the coronavirus pandemic?*, Science News 2020

Computer skills

Programming languages and tools: C++, Python, Bash, CSS, HTML, \LaTeX , Linux , Git, Jupyter Notebook, Pybind11

Selected packages (open-source):

- **SamplableSet**: implementation of sets which can be randomly sampled efficiently (C++/Python)
- **spreading_CR**: stochastic simulation algorithm for contagion processes (C++/Python)
- **fasttr**: uniform sampler for the temporal reconstruction of growing trees (C++/Python)

Languages

- French–native speaker
- English–fluent (spoken and written); 117/120 on the TOEFL test
- German–elementary