

# Guillaume St-Onge

Postdoctoral Research Associate

Network Science Institute

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

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## Academic positions

Postdoctoral Research Associate, Northeastern University 2022–present

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## 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

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## Scholarships and honors

### Graduate research scholarships

- [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

### Internship research grants

- [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

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\*Awarded but declined

## 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*<sup>†</sup> (3rd place), Université Laval 2017
- Student merit award–Direction mention, Université Laval 2015
- Pedagogue of the year, Physics Students Association, Université Laval 2014

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## 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 2021  
Phys. Rev. Lett. **127**, 158301
14. [Social Confinement and Mesoscopic Localization of Epidemics on Networks](#) 🏆 (CIMMUL)  
**G. St-Onge**, V. Thibeault, A. Allard, L. J. Dubé, L. Hébert-Dufresne 2021  
Phys. Rev. Lett. **126**, 098301
13. [Inference, Model Selection, and the Combinatorics of Growing Trees](#)  
G. T. Cantwell, **G. St-Onge**, J.-G. Young 2021  
Phys. Rev. Lett. **126**, 038301
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 2021  
Phys. Rev. E **103**, 032301
11. [Localization, epidemic transitions, and unpredictability of multistrain epidemics with an underlying genotype network](#)  
B. J. M. Blake, **G. St-Onge**, L. Hébert-Dufresne 2021  
PLOS Comput. Biol. **17**, e1008606
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 2020  
Phys. Rev. Research **2**, 043215
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 2020  
Proc. R. Soc. A **476**, 20190744
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** 2020  
Phys. Rev. E **101**, 062302
7. [Phase transition in the recoverability of network history](#)  
J.-G. Young, **G. St-Onge**, E. Laurence, C. Murphy, L. Hébert-Dufresne, P. Desrosiers 2019  
Phys. Rev. X **9**, 041056
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 2019  
Comput. Phys. Commun. **240**, 30
5. [Universality of the stochastic block model](#)  
J.-G. Young, **G. St-Onge**, P. Desrosiers, L. J. Dubé 2018  
Phys. Rev. E **98**, 032309

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<sup>†</sup>Scientific communication prize

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

- *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  
CA Patent No. 2983656 2017

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## Other research experiences

### Internships

Vermont Complex System Center, Burlington (VT), USA

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

Université Laval, Québec (QC), Canada

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

### 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

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## 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
- *Mesosopic 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 (9): Physical Review Letters, Physical Review E, Nature Communications, PLOS Computational Biology, Scientific Reports, Journal of Complex Networks, Chaos: An Interdisciplinary Journal of Nonlinear Science, New Journal of Physics, IMA Journal of Applied Mathematics
- 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


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## 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, L<sup>A</sup>T<sub>E</sub>X, 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