

# GUILLAUME ST-ONGE

## Postdoctoral Research Associate

Network Science Institute

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Mathematical Modeling | Computational Epidemiology | Complex Networks | Bayesian Inference

## ACADEMIC POSITIONS

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**Postdoctoral Research Associate** | Northeastern University 2022–present

- Advisor: Alessandro Vespignani
- Leading research on the modeling of wastewater surveillance at airports
- Contributing to work on ensemble forecast of COVID-19 and Influenza in the US
- Assisting in the supervision of Ph.D. students

## EDUCATION

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**Ph.D. in Physics** | Université Laval | [Honour List of the Faculty of Graduate and Postdoctoral Studies](#) 2018–2022

- Advisors: Antoine Allard and Laurent Hébert-Dufresne (co-advisor)
- Thesis title: *Contagion process on complex networks beyond pairwise interactions*

**M.Sc. in Physics** | Université Laval | [Honour List of the Faculty of Graduate and Postdoctoral Studies](#) 2015–2017

- Advisor: Louis J. Dubé
- Thesis title: *Propagation dynamics on random networks: characterization of the phase transition*

**B.Sc. in Physics** | Université Laval | [Governor General's Academic Medal for Highest Academic Standing](#) 2012–2015

## FUNDING AND AWARDS

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### 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

### 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

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\*Awarded but declined

## Awards

- 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

## TEACHING

- *Dynamical Processes in Complex Networks*, guest lecturer 2022, 2023  
Presentation title: Tutorial on probability generating functions
- *Statistical Physics*, teaching assistant 2016–2018, 2020  
Tasks: lectures and additional exercises, marking
- *Computational Physics*, teaching assistant 2016, 2018  
Tasks: guidance for student projects, marking
- *Mathematical Physics III*, teaching assistant 2014  
Tasks: lectures and additional exercises
- *Mathematical Physics I, II*, teaching assistant 2013  
Tasks: lectures and additional exercises
- **Book in preparation:** [CoSMOS: Complex Systems Modeling Open Sourcebooks](#)

## PUBLICATIONS AND PATENTS

### Articles published or accepted in a peer-reviewed journal

20. [Ensemble<sup>2</sup>: scenarios ensembling for communication and performance analysis](#)  
C. Bay, **G. St-Onge**, J. T. Davis, M. Chinazzi, E. Howerton, J. Lessler, M. C. Runge, K. Shea, S. Truelove, C. Viboud, A. Vespignani  
*Epidemics* 46, 100748 2024
19. [Nonlinear bias toward complex contagion in uncertain transmission settings](#)  
**G. St-Onge**, L. Hébert-Dufresne, A. Allard  
*Proc. Natl. Acad. Sci. U.S.A.* 121, e2312202121 2023
18. [Hierarchical team structure and multidimensional localization \(or siloing\) on networks](#)  
L. Hébert-Dufresne, **G. St-Onge**, J. Meluso, J. Bagrow, A. Allard  
*J. phys. Complex.* 4, 035002 2023
17. [Source-sink behavioural dynamics limit institutional evolution in a group-structured society](#)  
L. Hébert-Dufresne, T. M. Waring, **G. St-Onge**, M. T. Niles, L. K. Corlew, M. P. Dube, S. J. Miller, N. J. Gotelli, B. J. McGill  
*R. Soc. Open Sci.* 9, 211743 2022
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 2022
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](#)  
**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

<sup>†</sup>Scientific communication prize

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
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 and submitted manuscripts

- [Adaptive hypergraphs and the characteristic scale of higher-order contagions using generalized approximate master equations](#)  
G. Burgio, G. St-Onge, L. Hébert-Dufresne  
arXiv:2307.11268 | In review at Phys. Rev. Lett.
- [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

## CONFERENCE CONTRIBUTIONS AND INVITED LECTURES

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- *Establishing a wastewater global surveillance network at airports for early detection of emerging pathogens: A modeling study* 2023  
[Epidemics: 9th International Conference on Infectious Disease Dynamics](#), Bologna, Italy
- *Wastewater environmental Surveillance for Pandemic Preparedness (Roundtable discussion)* 2023  
[Grand Challenges Annual Meeting](#), Dakar, Senegal
- *Probability generating functions for epidemics on metapopulation networks* 2023
  - [Contagion on Complex Social Systems \(CCSS\)](#), Burlington (VT), USA
  - [International School and Conference on Network Science](#), Vienna, Austria
- *Quantifying population dynamics of complex contagions* 2023  
[International School and Conference on Network Science](#), Vienna, Austria
- *Navigating wastewater surveillance at airports with probability generating functions* 2023  
[NetPLACE](#), (virtual)
- *Indistinguishability of simple and complex contagions when transmission settings matter* 2023  
[Mathematical Institute, University of Oxford](#), Oxford, UK (virtual)
- *Confounders of interacting diseases* 2023  
[Dynamics of Interacting Contagions](#), Santa Fe (NM), USA
- *Reconstruction Of Product-Diffusion Cascades* 2022  
[Workshop on Network Dynamics and Choice Theory](#), Burlington (VT), USA
- *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 award)
- *Influence maximization in simplicial contagion* 2020  
[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  
[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  
[International School and Conference on Network Science](#), Indianapolis (IN), USA
- *Co-evolution of Growth and Dynamics on Network* 2016  
[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

## OTHER RELEVANT EXPERIENCES

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### 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

### Summer and winter schools

- [Summer Institute in Statistics and Modeling in Infectious Diseases](#), (virtual) 2022
- [Complex Systems Summer School](#), Santa Fe (NM), USA 2018
- [Complex Networks Winter Workshop](#), Québec (QC), Canada 2018

## SERVICE AND LEADERSHIP

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### Conferences and workshops

- School & Satellite co-chair: [International School and Conference on Network Science \(NetSci 2024\)](#) Present
- 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 (15): [Physical Review Letters](#), [Physical Review X](#), [Physical Review E](#), [Science Advances](#), [Nature Communications](#), [PLOS Computational Biology](#), [Journal of The Royal Society Interface](#), [Journal of Complex Networks](#), [Communications Physics](#), [Scientific Reports](#), [Chaos: An Interdisciplinary Journal of Nonlinear Science](#), [New Journal of Physics](#), [IMA Journal of Applied Mathematics](#), [Advances in Complex Systems](#), [PLOS One](#)
- Triage grading for [The Interdisciplinary Contest in Modeling \(ICM\)](#) 2022

### 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

## MEDIA COVERAGE

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- [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 AND SOFTWARE

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Programming languages & tools: Python (Jupyter · Pybind11 · Geopandas · Numba), C++, SQL, Bash,  $\LaTeX$ , Git

Selected packages (open-source):

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