

Guillaume St-Onge

Ph.D. candidate in Physics studying Complex Systems

Département de physique, génie physique, et d'optique

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Research interests: Complex Networks, Dynamical Systems, Bayesian Inference, Contagions

Education

Degrees

Ph.D. in Physics, Université Laval 2018–2021 (expected)

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

M.Sc. in Physics, Université Laval 2015–2017

- Advisor: Louis J. Dubé
- Thesis title: *Propagation dynamics on random networks: characterization of the phase transition*
- **Honor board mention: Highest grade attributed unanimously by the jury**

B.Sc. in Physics, Theoretical physics concentration, Université Laval 2012–2015

- **Governor General's Academic Medal:** Highest academic standing, B.Sc. degree 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

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

*Awarded but declined

Other awards

- 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

14. [Social Confinement and Mesoscopic Localization of Epidemics on Networks](#)
G. St-Onge, V. Thibeault, A. Allard, L. J. Dubé, L. Hébert-Dufresne 2021
Phys. Rev. Lett. **126**, 098301
13. [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
12. [Inference, Model Selection, and the Combinatorics of Growing Trees](#)
G. T. Cantwell, G. St-Onge, J.-G. Young 2021
Phys. Rev. Lett. **126**, 038301
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. Math. Phys. Eng. Sci. **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
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 2018
Phys. Rev. E **97**, 022305
3. [Geometric evolution of complex networks with degree correlations](#)
C. Murphy, A. Allard, E. Laurence, G. St-Onge, L. J. Dubé 2018
Phys. Rev. E **97**, 032309
2. [Exact vectorial model for nonparaxial focusing by arbitrary axisymmetric surfaces](#)
D. Panneton, G. St-Onge, M. Piché, S. Thibault 2016
J. Opt. Soc. Am. **33**, 801
1. [Needles of light produced with a spherical mirror](#)
D. Panneton, G. St-Onge, M. Piché, S. Thibault 2015
Opt. Lett. **4**, 419

[†]Scientific communication prize

Preprints

- [Influential groups for seeding and sustaining hypergraph contagions](#)
G. St-Onge, I. Iacopini, V. Latora, A. Barrat, G. Petri, A. Allard, L. Hébert-Dufresne
arXiv:2105.07092
- [Universal nonlinear infection kernel from heterogeneous exposure on higher-order networks](#)
G. St-Onge, H. Sun, A. Allard, L. Hébert-Dufresne, G. Bianconi
arXiv:2006.05232
- [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-Lancialt, 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

- *Bursty exposure on higher-order networks leads to nonlinear infection kernels*
G. St-Onge, H. Sun, A. Allard, L. Hébert-Dufresne and G. Bianconi
 - [SIAM Conference on Applications of Dynamical Systems \(DS21\)](#), Portland (OR), USA 2021
 - [Fourth Northeast Regional Conference on Complex Systems](#), Buffalo (NY), USA 🏆 (best talk) 2021
- *Influence maximization in simplicial contagion*
G. St-Onge, I. Iacopini, G. Petri, A. Barrat, V. Latora and L. Hébert-Dufresne 2020
[14th International School and Conference on Network Science](#), Rome, Italy

- [Localization, bistability and optimal seeding of contagions on higher-order networks](#)
G. St-Onge, A. Allard, L. Hébert-Dufresne
Artificial Life Conference, Montreal (QC), Canada 2020
- [Mesoscopic localization of spreading processes on networks](#)
G. St-Onge, V. Thibault, L. Hébert-Dufresne, L. J. Dubé
14th International School and Conference on Network Science, Burlington (VT), USA 2019
- [SIS dynamics on time-varying random networks](#)
G. St-Onge, J.-G. Young, E. Laurence, C. Murphy, L. J. Dubé
Institute for Disease Modeling, Seattle (WA), USA 2017
- [Susceptible-infected-susceptible dynamics on the rewired configuration model](#)
G. St-Onge, J.-G. Young, E. Laurence, C. Murphy, L. J. Dubé
12th International School and Conference on Network Science, Indianapolis (IN), USA 2017
- [Co-evolution of Growth and Dynamics on Network](#)
G. St-Onge, E. Laurence, C. Murphy, J.-G. Young and L. J. Dubé
11th International School and Conference on Network Science, Seoul, Republic of Korea 2016
- [Modeling ultra-sharp needles of light using vector diffraction theory](#)
G. St-Onge, D. Panneton, M. Piché, S. Thibault
50th Canadian Undergraduate Physics Conference, Kingston (ON), Canada 2014

Service and leadership

Session chair: [SIAM Conference on Applications of Dynamical Systems \(DS21\)](#), CP4 – Dynamics 2021

Projects liaison: [Complex Networks Winter Workshop](#) 2019

Journal referee

- 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

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

- [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