Alexandre G.R. Day – Curriculum Vitæ

Department of Physics • Boston University

Contact information

Personal website
agrday@bu.edu
Boston, MA
+617-460-1270
GitHub
Google Scholar

Areas of Specialization

Statistical physics • Machine Learning • High-performance computing

Education

2014 – present **Ph.D. candidate, Physics**, ***Supervisor*** : ***Prof. Pankaj Mehta***
Boston University, Boston, Massachusetts, U.S.A

2013 – 2014 **M.Sc., Physics**, ***Supervisor*** : ***Prof. Michel Gingras***
University of Waterloo, Waterloo, Ontario, Canada

2009 – 2012 **B.Sc., Physics**
University of Sherbrooke, Sherbrooke, Quebec, Canada

Core technical skills

Programming : C/C++ (6 years), Python (3 years), Mathematica (7 years), bash/shell script (7 years), Javascript/html/css (1 year).
Machine Learning Librairies : Advance use of Keras, TensorFlow and Scikit-Learn.
Data visualization : Interactive visualization (d3.js, Plotly) and high-quality figures.
Machine Learning Packages Author of HAL : Hierarchical Agglomerative Learning, a package for high-dimensional clustering and interpretation of real-world data.
Communication : Co-authored 10+ publications with 200+ citations and h-index$= 6$.

Honors & Awards

2017 MIT biophysic's retreat best poster award (poster title : Machine learning cell types)
2014 Boston University Dean's fellow (Boston University, $5000)
2014 – 2016 NSERC Postgraduate scholarship D (Boston University, $63000)
2013 – 2014 NSERC Alexander-Graham-Bell Scholarship (University of Waterloo, $17500)
2013 – 2014 President's Graduate Award (University of Waterloo, $5000)
2013 – 2014 Marie Curie Award (University of Waterloo, $5000)

2012 Paul Desmarais funds scholarship (Frankfurt Institute for Theoretical Physics, $3200)

2012 Ministry of Education scholarship (Frankfurt Institute for Theoretical Physics, $1000)

2011 & 2012 Dean's honor list, University of Sherbrooke

2010 NSERC undergraduate research scholarship (University of Sherbrooke, $4500)

2010 Condensed matter scholarship of Canada's research chair ($2000)

2009 Canadian Millennium Excellence scholarship (held at University of Sherbrooke, $4500)

Publications

2018 13. Hierarchical Agglomerative Learning. **A.G.R. Day** et al. *in preparation*

2018 12. Using unsupervised learning to study glassy transitions. **A.G.R. Day** et al. *in preparation*

2018 11. The glassy phase of quantum optimal control. **A.G.R. Day** et al. arXiv 1803.10856

2018 10. A high bias low variance introduction to machine learning for physicist. P. Mehta, M. Bukov, C.H. Wang, **A.G.R. Day** et al. arXiv 1803.08823

2017 9. Broken symmetry in a correlated quantum control landscape M. Bukov, **A.G.R. Day** et al. PRA **97** 052114

2017 8. Machine Learning Meets Quantum State Preparation . The Phase Diagram of Quantum Control, M. Bukov, **A.G.R. Day** et al. arXiv 1705.00565

2015 7. Thermal Order-by-Disorder at Criticality in xy Pyrochlore Magnets, B. Javanparast, **A.G.R. Day**, H. Zhihao, M.J.P. Gingras, PRB **91** 174424

2014 6. Bosonic Many-body Theory of Quantum Spin Ice, Z. Hao, **A.G.R. Day**, M.J.P. Gingras, PRB **90** 214430

2013 5. Phase Transition and Thermal Order-by-Disorder in the Pyrochlore Quantum Antiferromagnet $Er_2Ti_2O_7$: a High-Temperature Series Expansion Study, J. Oitmaa, R.R.P. Singh, B. Javanparast, **A.G.R. Day**, B.V. Bagheri, M.J.P. Gingras, PRB **88** 220404

2013 4. Resilience of d-wave superconductivity to nearest-neighbor repulsion, D. Sénéchal, **A.G.R. Day**, V. Bouliane, A.-M.S. Tremblay, PRB **87** 075123

2012 3. Vindication of $Yb_2Ti_2O_7$ as a Model Exchange Quantum Spin Ice, R. Applegate, N. R. Hayre, R. R. P. Singh, T. Lin, **A.G.R. Day**, M. J. P. Gingras, PRL **109** 097205

2012 2. Multivariate polynomial interpolation and meshfree differentiation via undetermined coefficients, J-M Belley, PE Belley, **A.G.R. Day**, Journal of Computational and Applied Mathematics Vol. **239**, p. 415-430

2012 1. Interpolation et estimation de dérivées en dimension d selon une approche lagrangienne, **A.G.R. Day**, CAMUS math journal vol. **2**

Invited talks, Presentations, Posters & Contributed talks

3/2018 Washington DC , **invited talk title** : *High-dimensional clustering for single-cell analysis and beyond*, **A.G.R. Day**, et al.

1/2018 Physics informed machine learning, Santa Fe NM , **poster title** : *Phases transitions in the quantum control problem*, **A.G.R. Day**, M. Bukov et al.

7/2017 MIT biophysics retreat , **poster title** : *Machine learning cell types*, **A.G.R. Day**, P. Mehta et al.

3/2017 American Physical Society March Meeting , **talk title** : *Discovering fine structure in big biological data*, **A.G.R. Day**, P. Mehta

12/2016 Winter school on quantitative biology, Trieste Italy, , **poster title** : *Discovering cell fates in "big" biological data*

02/2016 Physics informed Machine Learning, Sante Fe U.S.A., **poster title** : *Embedding universal computation in factor graphs : application to integer factorization*

7/2014 Highly frustrated magnetism conf., Cambridge U.K., **poster title** : *Analytical and numerical study of XXZ quantum spin ice*

7/2014 SCES, Grenoble, **talk title** : *What is special about strongly correlated superconductivity*, A.-M. S. Tremblay, Giovanni Sordi, Patrick Sémon, Kristjan Haule, David Sénéchal, **A.G.R. Day**, Vincent Bouliane

3/2014 American Physical Society March Meeting , **talk title** : *Resilience of d-wave superconductivity to nearest-neighbor repulsion*, **A.G.R. Day**, D. Sénéchal, V. Bouliane, A.-M.S. Tremblay

3/2014 American Physical Society March Meeting , **talk title** : *Thermal Order-by-Disorder at Criticality in XY Pyrochlore Magnets*, M.J.P. Gingras, B. Javanparast, **A.G.R. Day**, H. Zhihao

12/2013 University of Waterloo, Physics Journal club, **talk title** : *Gauge fields, mean-field theory and spin-liquids*

11/2013 University of Waterloo, Physics Journal club, **talk title** : *Spatial & internal symmetries in exact diagonalization*

University of Ottawa, **poster title** : *A search for quantum spin liquids candidates*,

01/2012 Undergraduate national poster competition (placed 3rd)

7/2010–10/2010 University of Sherbrooke, Mathematics Department, **talk title** : "d-dimensional Lagrangian interpolation"

Research Experience (prior to PhD)

2013 – 2014 **M.sc., University of Waterloo**

Supervisor : ***Prof. Michel Gingras***

Subject: *Condensed matter theory, quantum frustrated magnetism, quantum spin liquids*

Worked on various projects such as quantum and thermal order-by-disorder in $S = 1/2$ pyrochlore oxides, critical phenomena in $3D$ dipolar transverse field Ising model. My main project was the study of the $U(1)$ spin liquid phase of quantum spin ice (QSI). We develop the basic analytical formalism to deal with the "matter" sector of the emergent

gauge theory of QSI and obtained some of the expected experimental signatures of the
2012 possible $U(1)$ liquid phase of QSI. **Frankfurt Institute for Theoretical Physics**
Supervisor : ***Prof. Dirk H. Rischke***
Subject: *High-energy physics, relativistic fluids, quark-gluon plasmas*
Research internship in the field of high-energy physics. We studied the linear stability of some recently proposed first-order theories describing the dynamics of dissipative relativistic fluids that are suppose to represent accurately the thermalization process of quark-gluon plasmas for instance.

2011 **University of Waterloo**
Supervisor : ***Prof. Michel Gingras***
Subject: *Quantum magnetism, frustrated magnets, spin ice*
Research internship in the field of frustrated magnetism. Implementation of exact diagonalization methods with mean-field boundary conditions to simulate quantum spin models. This led to a collaboration with Prof. ***Prof. Rajiv Singh*** of UC Davis.

2011 **Université de Sherbrooke**
Supervisors : ***Prof. André-Marie S. Tremblay*** & ***Prof. David Sénéchal***
Subject: *Strongly correlated superconductivity, high-temperature superconductivity*
Research internship in the field of strongly correlated electrons. We studied the effect of the repulsive Coulomb interaction on d-wave superconductivity in the extended Hubbard model using cellular dynamical mean-field theory. We showed that retardation explains why, in doped Mott insulators, nearest-neighbor repulsive interactions are not as detrimental to d-wave Cooper-pairing as naively expected.

2010 **University of Sherbrooke**
Supervisor : ***Prof. Jean-Marc Belley***
Subject: *Numerical analysis, multi-dimensional interpolation algorithms*
We developed an efficient algorithm for noiseless data interpolation in arbitrary dimensions. I also wrote a review article on this subject for the Mathematics Department student journal.

Conferences & Workshops

1/2018 2nd edition of Physics informed machine learning, Santa Fe, NM, USA
12/2017 Neural information processing systems (NIPS), Long Beach, CA, USA
5/2017 Simons foundation meeting on the physics of living systems, New York
3/2017 American physical society March meeting, New Orleans, USA
12/2016 Winter school on quantitative biology, Trieste, Italy
02/2016 Physics informed Machine Learning, Santa Fe
07/2014 Highly frustrated magnetism conference, Cambridge
05/2014 Canadian Institute for Advanced Research annual conference, Montreal
11/2013 Workshop on Strongly Correlated Quantum Many-Body Systems, Waterloo
06/2013 Canadian Institute for Advanced Research annual conference, Vancouver
05/2013 4 Corners Southwest Ontario Condensed Matter Physics Symposium 2013, Waterloo

02/2012 Canadian Undergraduate Research conference (CARPCO), Ottawa

Professional associations

Member of the Canadian Association of Physicists
Member of the American Physical Society

Teaching experience

Fall 2013 Teaching assistant : PHYS 111L, Physics 1 Laboratory
Winter 2013 Teaching assistant : PHYS 121L, Physics 2 Laboratory
Summer 2015 Teaching fellow : PHYS 105, Physics 1&2 Laboratory

Spoken languages

Fluent in French and English