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Canadian citizen

Charlotte L. Haley

Education

2009-2014 **PhD, Statistics**, *Queen's University (Canada)*,
Thesis: Nonparametric and Parametric Methods for Solar Oscillation Spectra.
Advisor: David J. Thomson

2008-2009 **MSc, Statistics**, *Queen's University (Canada)*,
Thesis: Statistical Analysis of Atrial Fibrillation Electrograms.
Advisors: David J. Thomson, Selim G. Akl, and Damian P. Redfearn

2004-2008 **BSc Hon Mathematics**, *Dalhousie University (Canada)*, Dean's List,
Thesis: On Wilson's Theorem.
Advisor: Karl Dilcher

Professional Appointments

2017-present **Assistant Computational Statistician**, *Argonne National Laboratory, Lemont, IL, USA*.

2014-2017 **Postdoctoral Appointment**, *Argonne National Laboratory, Lemont, IL, USA*, Supervisor: Mihai Anitescu.

Research Interests

Statistics and signal processing. Spatial statistics. Frequency domain analysis of time series and spatial datasets. Solar physics, geophysics, and power grid applications.

Publications

Refereed journal articles

[1] C. J. Geoga, C. L. Haley, A. Siegel, and M. Anitescu. "Frequency-wavenumber spectral analysis of spatiotemporal flows". *Journal of Fluid Mechanics* 848 (2018), pp. 545–559.

[2] C. L. Haley and M. Anitescu. "Optimal Bandwidth for Multitaper Spectrum Estimation". *IEEE Signal Processing Letters* 24 (11 2017), pp. 1558–2361. DOI: 10.1109/LSP.2017.2719943.

[3] C. L. Haley. "Mathematical physics: Glitches in time". *Nature* 532 (2016), pp. 450–451.

[4] K. A. Michael, C. L. Haley, A. Baranchuk, C. S. Simpson, H. Abdollah, and D. P. Redfearn. "Failed anti-tachycardia pacing can be used to differentiate atrial arrhythmias

from ventricular tachycardia in implantable cardioverter-defibrillators". *Europace* 17.1 (2015), pp. 78–83.

[5] R. Somani, K. Mohajer, C. L. Haley, C. S. Simpson, H. Abdollah, A. Baranchuk, D. P. Redfearn, and K. A. Michael. "The periprocedural use of dabigatran in patients undergoing left atrial ablation for atrial fibrillation". *Cardiovasc Ther.* 32.5 (2014), pp. 198–201.

[6] D. J. Thomson and C. L. Haley. "Spacing and shape of peaks in non-parametric spectrum estimates". *Proceedings of the Royal Society of London Series A* 470.2167 (2014), p. 20140101.

[7] C. L. Haley, Gula L. J., R. Miranda, A. Baranchuk, K. A. Michael, C. S. Simpson, H. Abdollah, A. J. West, S. G. Akl, and D. P. Redfearn. "Validation of a novel algorithm for quantification of fractionation in atrial fibrillation electrograms." *Europace* 15.3 (2013), pp. 447–452.

Publications in un-refereed conference proceedings

[8] C. L. Haley and M. Anitescu. "Cyclostationary models of solar irradiance". In: *Joint Statistical Meetings (JSM) Proceedings*. American Statistical Association. Seattle, WA, USA, 2015, pp. 1212–1225.

[9] C. L. Haley and D. J. Thomson. "On the temporal scales of solar modulation of galactic cosmic radiation". In: *JSM Proceedings*. American Statistical Association. Montreal, QC, Canada, 2013, pp. 3148–3162.

Recent Presentations

[1] C. L. Haley. *Adaptive Nonparametric Spectra for Kernel Learning*. University of Southern California, LA: Research Challenges, Opportunities at the interface of Machine Learning, and Uncertainty Quantification, June 2018.

[2] C. L. Haley. *Adaptive Nonparametric Spectra for Kernel Learning*. North Bethesda, MD: DOE ASCR Scientific Machine Learning Workshop, Jan. 2018.

[3] C. L. Haley. *Extremes, Gaussian Processes, and Spectral Models for Doppler Lidar Wind Speed*. Berkeley, CA: SAMSI Working Group on Spatiotemporal Statistical Extremes, May 2018.

[4] C. L. Haley. *Frequency Wavenumber analysis of Spatiotemporal Flow Structures*. Minneapolis, MN: Forecasting from Complexity Workshop, Institute for Mathematics and its Applications, Apr. 2018.

[5] C. L. Haley. *Quantification of Multiscale Second-order Flow Structures in the Wake of a Square Wall-mounted Cylinder under Two Inflow Scenarios*. New York City, NY: 13th World Congress on Computational Mechanics / 2nd Pan American Congress on Computational Mechanics, July 2018.

[6] C. L. Haley. *Spectral analysis for comparison of second-order flow structure in DNS simulations*. Glasgow, UK: 6th European Conference on Computational Mechanics (Solids, Structures and Coupled Problems), July 2018.

[7] C. L. Haley. *Spectral Methods for Kernel Learning*. Vancouver, BC: Joint Statistical Meetings, Aug. 2018.

[8] C. L. Haley. *Detection and estimation of oscillatory components in power networks*. Baltimore, MA: Joint Statistical Meetings, Aug. 2017.

[9] C. L. Haley. *On extreme values in vertical Doppler LIDAR wind speed*. Web: SAMSI, Oct. 2017.

[10] C. L. Haley. *On multitaper spatiotemporal spectrum estimation*. Lemont, IL: Laboratory for Advanced Numerical Simulations (LANS) Seminar, Feb. 2017.

[11] C. L. Haley. *On multitaper spatiotemporal spectrum estimation*. Chicago, IL: University of Chicago Dept of Statistics, Stein research group, Feb. 2017.

[12] C. L. Haley. *On multitaper spatiotemporal spectrum estimation*. Toronto, ON: University of Toronto, Jan. 2017.

[13] C. L. Haley. *Spectral analysis of spatiotemporal data*. Rockville, MA: Department of Energy Applied Mathematics Principal Investigators' Meeting, Sept. 2017.

[14] C. L. Haley. *Harmonic analysis of modern synchrophasor measurements*. Lemont, IL: Argonne M2ACS Research Group, Nov. 2016.

[15] C. L. Haley. *Optimal Bandwidth for Multitaper Spectrum Estimation*. Chicago, IL: Joint Statistical Meetings, Aug. 2016.

[16] C. L. Haley. *Cyclostationary models for solar irradiance*. Seattle, WA: Joint Statistical Meetings, Aug. 2015.

[17] C. L. Haley. *Propagation of solar oscillations to secondary cosmic rays*. Lemont, IL: Laboratory for Advanced Numerical Simulations (LANS) Seminar, Feb. 2015.

[18] C. L. Haley. *Two dimensional spatiotemporal spectrum estimation*. Chicago, IL: University of Chicago Dept. of Statistics, Stein research group, Apr. 2015.

[19] C. L. Haley. *A Comparison of Contemporary Metrics for the Identification of Complex Fractionated Electrograms*. Munich, DE: European Cardiac Arrhythmia Society, Apr. 2014.

[20] C. L. Haley. *A Lorentzian model for solar modes*. Chicago IL: STATMOS Annual Meeting, Sept. 2014.

[21] C. L. Haley. *Estimation and Detection of Individual Solar Oscillations*. Lemont, IL: Postdoctoral Research and Career Symposium, Oct. 2014.

[22] C. L. Haley. *Multivariate spectral analysis of 40 years of multidirectional muon observations*. Boston MA: Joint Statistical Meetings, Aug. 2014.

[23] C. L. Haley. *Propagation of solar oscillations to secondary cosmic rays*. San Francisco, Ca: American Geophysical Union, Dec. 2013.

[24] C. L. Haley. *Propagation of solar oscillations to secondary cosmic rays*. Waterloo On: Applied Mathematics, Modeling and Computational Science Conference, Aug. 2013.

[25] C. L. Haley. *Solar modal structure as observed by neutron monitors*. Kingston, ON: Division of Atmospheric and Space Physics Workshop, Feb. 2013.

[26] C. L. Haley. *Solar modal structure in the cosmic ray background*. Petit Rouge, Qc: Canadian Solar Workshop, Oct. 2013.

[27] C. L. Haley. *Spacing and shape of peaks in nonparametric spectrum estimates*. Montreal, Qc: Joint Statistical Meetings, Aug. 2013.

[28] C. L. Haley. *Spatial and Temporal Variability of Environmental Noise in Toronto*. Edmonton, AB: Statistical society of Canada Congress, Case Study Competition, May 2013.

Research Summary

Argonne National Laboratory, Chicago IL

Sept 2017-present **Spatiotemporal Statistics of Extremes**, Nonparametric spectral analysis of spatiotemporal Doppler LIDAR measurements and modeling using a Gaussian Process framework,
Collaborators: Mihai Anitescu, Chris Geoga, Michael L. Stein.
Talks: [7]

March 2016-Dec 2017 **Computational Fluid Dynamics Spectrum Estimation**, Development of higher dimensional multitaper spectrum estimation methods for the purpose of quantification of traveling vortices in turbulence,
Collaborators: Mihai Anitescu, Chris Geoga, Andrew Siegel.
Talks: [10, 11, 12, 4, 5, 6], Paper [1].

Feb 2015-present **Power Grid Interarea Oscillations**, Use of frequency domain methods for nonlinear and nonstationary time series to identify oscillatory signatures in phasor measurement unit (PMU) data,
Collaborators: Mihai Anitescu, David Schooley, Michael Fresh, Chris Geoga.
Paper: [2], Conferences: [14, 0]

Oct 2015-March 2017 **Bandwidth selection for Spectral Estimation of Time Series**, Development of multitaper spectrum estimation methods to choose the spectral bandwidth based on estimated mean squared error,
Collaborators: Mihai Anitescu.
Manuscript: [2], Conference: [15]

Sep 2014-Oct 2015 **Spatio-Temporal Statistics Research**, Characterization of the spatio-temporal cyclostationary covariance structure of solar irradiance measurements for the purpose of predicting solar inputs to the power grid,
Collaborators: Mihai Anitescu, Emil Constantinescu.
Conference Proceedings: [8]

Queen's University

2009-2014 **Statistics and Signal Processing**, *Advisor: David Thomson*, Research in spectrum analysis of cosmic ray time series with applications to solar physics & helioseismology.
Papers: [6, 9], Conferences: [22] & 6 others, and PhD thesis.

2008-2010 **Arrhythmia Research Office**, *Advisors: Damian Redfearn, Selim Akl*, Analyzed electrograms taken inside the human atrium during ablation therapy for atrial fibrillation (AF). Additional statistical analyses were done on (i) the side effects of Dabigatran vs Warfarin as an anticoagulant for AF patients and (ii) distribution of complex fractionated electrograms in the atria of paroxysmal vs persistent AF patients.
Papers: [7, 5, 4], Two conferences, and master's thesis.

Participation in Grants

2017 **DARPA Spectrum Sensing & Utilization**, *PI: Kaizhong Gao*, Not funded.

2017 **DOE MIMMCCs MACSER**, *PI: Mihai Anitescu*, Funded.

2016 **NSF NRT Proposal**, *PI: Lise Moyer*, Funded.

Honors & Awards

2013 **Queen Elizabeth II Graduate Scholarship in Science and Technology**,
Awarded to graduate students enrolled in science and technology disciplines.

2010-2011 **Ontario Graduate Scholarship**,
Merit-based scholarship awarded to a full-time graduate student in Ontario.

2011-2013 **Student Travel Awards**,
Statistical Society of Canada Congress (June 2011)
Applied Mathematics, Modeling and Computational Science Meeting (August 2013).

2009 & 2012 **R. Samuel Maclaughlan Scholarship**, *(Queen's)*,
Awarded to first class master's and doctoral students.

2008 **Ralph and Frances Jeffery Mathematics Scholarship**, *(Dalhousie)*,
Awarded to a graduating senior in honours mathematics.

Teaching Experience and Advising

Teaching

Fall 2011 **MTHE 224 Course Instructor**, *Queen's University*,
Primary instruction and curriculum development for a 13-week second year engineering mathematics course. Course material included ordinary differential equations and introductory statistics with tutorials and laboratory work in Matlab.

Spring 2011 **Teaching Apprenticeship**, *Queen's University*,
Lectured for 3 course hours in introductory Calculus.

2009-2013 **Math and Stats private tutor**,
Private tutoring in calculus, differential equations, introductory statistics, complex variables, real analysis, and others.

2010, 2013 **Tutorial leader**, *Queen's University: Differential Equations and Calculus*,
Did practice problems and exercises once weekly for a group of undergraduates.

2008-2013 **Teaching Assistant**, *Queen's University*,
Graded assignments, proctored exams, and assisted students at the math help desk.

Advising

2017-2018 **Jasmine Walker**, *Neuqua Valley High School*, Argonne Afro-Academic, Cultural, Technological and Scientific Olympics (ACT-SO) High School Research Program, Project: A Hurricane-Resistant Shelter.
Won gold in Architecture category, bronze in Engineering category, advanced to national level. Now an architectural engineering undergraduate at Purdue.

2016-2017 **Chris Geoga**, *B.Sc. Math & Stats, University of Chicago*, Predoctoral Appointee, Argonne National Lab, (i) Large-scale multitaper spectrum analysis implementation in Julia (ii) Detection & estimation of interarea oscillations in power networks (iii) Higher dimensional spectrum analysis.
Also advised by Mihai Anitescu

Summer 2014 **Paul Wilson**, *B.Sc. Math & Stats, Queen's University*, NSERC USRA, Project: Spectrum analysis of Solar Data.
Primarily advised by David J. Thomson

Summer 2013 **Julian Fortin**, *B.Eng. (Apple Math) Queen's University*, National Science and Engineering Research Council of Canada (NSERC) Undergraduate Summer Research Assistant (USRA), Project: Spectrum analysis of Proton Density at ACE.
Primarily advised by David J. Thomson

Workshops, Activities, & Continuing Education

2014-2015 **LANS Reading Group**,
Bayesian Data Analysis (Spring 2015) Image Processing (Fall 2014).

Spring 2015 **Gaussian Processes and Spatial Statistics**, *Audited*, U. Chicago, Prof M. Stein.

Jun 2015 **Statistical Society of Canada Congress**, *Attendee*, Dalhousie University.

Feb/2015 **Chicago Chapter American Statistical Association Meeting**, *Attendee*, Northwestern University.

Jan/2015 **Fields Institute**, *Big Data Program Opening Week*, Toronto ON, Canada.

Oct/2014 **Prospects in Applied Mathematics Meeting**, *Attendee*, University of Chicago, Chicago IL.

2008-2014 **Regular Presenter**,
Statistical Methods Seminar, Queen's Math Dept.
Parallel and Unconventional Computing Seminar, Queen's Computing Dept.

Ongoing **Online Technical Courses (MOOCs)**,
High Performance Computing, Machine Learning, Economics.

Recent Academic Service

Refereeing & Editing

April 2017 **Judge**, SIAM Student Paper Prize.

2015-present **Journal Referee**,
Earth & Space Science,
Canadian Journal of Statistics,
Computational Statistics & Data Analysis,
Nature,
IEEE Signal Processing Transactions,
IEEE Proceedings.

2010-present **Conference Abstract Reviewer, IEEE**,
e.g., i-CADER 2014, ICoSSEET 2014, ICNC 2014, IPCOST 2014.

2015-2016 **De Gruyter Nanospectroscopy**, *Language Editor*.

2012-2013 **Versita Open Access Publications**, *Language Editor*.

Conference Organization

2015 & 2016 **Laboratory for Applied Mathematics and Numerical Simulations (LANS) Summer Argonne Student Symposium (SASSy)**, *Symposium Organizer*, Organized a two day symposium in which ~ 20 students in the LANS group presented the results of their summer research.

Jun/2015-Dec/2016 **Seminar Coordinator**, Argonne LANS group, Maintained the website, coordinated speakers and refreshments.

Aug 2014 **Joint Statistical Meetings Contributed Session**, *Organizer*, Section on Physical and Engineering Sciences, Applied Spectrum Analysis.

Aug 2013 **AMMCS 2013 Minisymposium**, *Co-organizer*, Multitaper Spectrum Analysis.

Hiring Committees

2015-2016 **Argonne Mathematics & Computer Science Postdoc Hiring Committee**,
Interviewed eleven candidates at various levels from predoc to division director.

2011-2012 **Queen's Math & Stats Dept.**, *Tenure, Renewal and Promotions Committee*.

Diversity-Related

Apr 2018 **Science Speaks Chicago**, *Speaker & Poster Presenter - Asteroseismology*, Adler Planetarium.

2017 **Argonne ACT-SO High School Research Program**, *Volunteer*, Supervisor/Mentor.

April 2017 **Science Careers in Search of Women (SCSW) student luncheon**, *Volunteer*, Mentor.

2017 & 2018 **Introduce a Girl to Engineering Day**, *Volunteer*, Mentor.

2010-2013 **Mathemagics Math Camp for Girls**, *Volunteer*, Activity leader and Co-organizer.

Technical Proficiencies

Scientific Computing: Julia, Matlab, Python, R, Fortran, git, SQL, LaTeX

Web Dev.: HTML5, CSS3, JavaScript

Languages

English: Native Speaker

French: Advanced

German: Intermediate

Professional Memberships & Accreditation

- American Statistical Association (since 2013) Accredited Professional Statistician (PStat)