Matthew R. Heffernan   Curriculum Vitae

CONTACT INFORMATION	3600 rue University Montréal, QC, Canada H3A 2T8	physics.mcgill.ca/∼heffernan/ heffernan@physics.mcgill.ca mrhheffernan.github.io

EDUCATION **McGill University**, Montréal, Quebec
Ph.D. Candidate Theoretical Physics, Nuclear Theory Group   *Expected* 2022
M.Sc. Theoretical Physics, Nuclear Theory Group   November 2018

The College of William & Mary, Williamsburg, Virginia
B.Sc. Physics (Hon.), Minor in German Studies, Cum Laude   May 2016

The University of St Andrews, St Andrews, Scotland
Visiting Undergraduate Student (Science)   September 2014 - May 2015

COLLABORATIONS JETSCAPE: Simulations and Distributed Computing   June 2019-Present

AWARDS NSERC Postgraduate Scholarship - Doctoral   May 2019 - May 2022
Physics Department Travel Award   March 2020
Dean's List (William & Mary)   Spring 2013, Fall 2015, Spring 2016
Timothy J Sullivan Scholar, The Worshipful Company of Drapers   2014 - 2015
Eagle Scout   December 2011

RESEARCH EXPERIENCE **Graduate Research Assistant**   September 2016 - Present
Physics Department, McGill University
Supervisor: Charles Gale
Ph.D. Project Title: *Toward realistic Bayesian constraints on the properties strongly-interacting matter in heavy ion collisions*
Project description: *Quantifying the properties of quark-gluon plasma using state-of-the-art physical models with Bayesian inference for the first time*

M.Sc. Project Title: *Toward a consistent calculation of the QCD transport coefficients*
Project Description: *Developing a microscopically-correct framework for calculating transport properties of a relativistic hadron gas*

Senior Honors Thesis   August 2015 - May 2016
Physics Department, College of William & Mary
Supervisor: André Walker-Loud
Project Title: *Quantifying the sensitivity of big bang nucleosynthesis to isospin breaking*
Project Description: *Testing for signs of beyond-Standard Model physics at Big Bang time through variation of Standard Model constants*

LERCIP Student   June 2015-August 2015
Thermal Energy Conversion Branch (LET), NASA Glenn Research Center
Supervisor: Maxwell Briggs
Project Title: *Stirling cycle analysis for nuclear space power applications*
Project Description: *Performing measurements and model optimization for new thermoelectric power generating systems in development for deep space exploration*

National Science Foundation (US) REU Student   June 2014 - August 2014

Cyclotron Institute, Texas A&M University
Supervisors: Ralf Rapp and Paul Hohler
Project Title: *Universal parametrization of thermal photon rates in hadronic matter*
Project Description: *Parametrization of thermal photon rates in hot and dense hadronic matter, extending to nonzero baryochemical potential and increasing accuracy*

PRIMARY PUBLICATIONS	**Matthew Heffernan**, *"How about that Bayes: Bayesian techniques and the simple pendulum."* [arXiv:physics.ed-ph 2104.08621], *under review.*

Matthew Heffernan, Sangyong Jeon, and Charles Gale
"Hadronic transport coefficients from the linear sigma model at finite temperature"
Phys. Rev. C **102** (2020) 3, 034906, [arXiv:2005.12793]

The Simulations and Distributed Computing Working Group (D. Everett, W. Ke, J.-F. Paquet, G. Vujanovic, S. A. Bass, L. Du, C. Gale, **M. Heffernan**, U. Heinz, D. Liyanage, M. Luzum, A. Majumder, M. McNelis, C. Shen, Y. Xu) and the JETSCAPE Collaboration
"Multi-system Bayesian constraints on the transport coefficients of QCD matter"
[arXiv:2011.01430]

The Simulations and Distributed Computing Working Group (D. Everett, W. Ke, J.-F. Paquet, G. Vujanovic, S. A. Bass, L. Du, C. Gale, **M. Heffernan**, U. Heinz, D. Liyanage, M. Luzum, A. Majumder, M. McNelis, C. Shen, Y. Xu) and the JETSCAPE Collaboration
"Phenomenological constraints on the transport properties of QCD matter with data-driven model averaging" [arXiv:2005.12793]

Matthew Heffernan, Projjwal Banerjee, and André Walker-Loud
"Quantifying the sensitivity of Big Bang Nucleosynthesis to isospin breaking with input from lattice QCD" [arXiv:1706.04991]

Matthew Heffernan, Paul Hohler, and Ralf Rapp
"Universal parametrization of thermal photon rates in hadronic matter"
Phys. Rev. C **91** (2015) 027902.

POSTERS & PRESENTATIONS	APS April Meeting (Virtual Talk)	April 2021
	Initial Stages 2021 (Virtual Talk)	Jan 2021
	Duke University QCD Group Seminar (Virtual Talk)	Apr 2020
	APS Division of Nuclear Physics Fall Meeting, Crystal City, VA (Talk)	Oct 2019
	NASA Glenn Research Center Summer Poster Session, Cleveland, OH	Aug 2015
	The University of St Andrews Physics Burn Conference, Glenesk, Scotland	Feb 2015
	The University of St Andrews School of Physics, St Andrews, Scotland	Oct 2014
	Texas A&M University Summer Symposium, College Station, TX	Aug 2014

TEACHING EXPERIENCE

Teaching Assistant (Course development), *McGill University Physics Department*

Physics 102: Introductory Physics - Electromagnetism　　　Winter 2021
  Assisted with Zoom lecture and tutorial management and provided real-time Q&A for students

Physics 101/131: Intro Physics - Mechanics/Mechanics and Waves　　Fall 2020
  Worked in a team to develop new labs for at-home learning with minimal resources and investment

Physics 102: Introductory Physics - Electromagnetism　　　Winter 2020
  Taught tutorials to classes of approx. 100 students and managed in-class mentors for problem solving
  Assisted professor in selection, working of problems written previously

Physics 102: Introductory Physics - Electromagnetism		Fall 2019

Undertook teaching training in preparation for teaching tutorial sessions

Physics 102: Introductory Physics - Electromagnetism   Winter 2019

Wrote a semester of questions and mentored students with in-class problem solving.

Delivered a lecture when the professor was traveling.

Produced YouTube video walkthroughts of course questions using a Lightboard

STEM Teaching Development Fellow, *McGill University*   Summer 2018 - Winter 2019

Teaching Assistant (Grading), *McGill University Physics Department*

Physics 203: Dynamics of Simple Systems	Fall 2017
Physics 102: Introductory Physics - Electromagnetism	Winter 2017, 2018
Physics 101: Introductory Physics - Mechanics	Fall 2016

ADDITIONAL TRAINING

Foundations of Teaching Science and Engineering
    École Polytechnique Fédérale de Lausanne via edX
Python Mega Course: Build 10 Real World Applications
    Udemy

COLLABORATION PUBLICATIONS

JETSCAPE Collaboration (C. Park et al.)
"Constraints on jet quenching from a multi-stage energy-loss approach" [arXiv:2009.02410]

JETSCAPE Collaboration (Y. Tachibana et al.)
"Hydrodynamic response to jets with a source based on causal diffusion" [arXiv:2002.12250]

JETSCAPE Collaboration (A. Kumar et al.)
"Jet quenching in a multi-stage Monte Carlo approach" [arXiv:2002.07124]

JETSCAPE Collaboration (G. Vujanovic et al.)
"Multi-stage evolution of heavy quarks in the quark-gluon plasma" [arXiv:2002.06643]

JETSCAPE Collaboration (J.-F. Paquet et al.)
"Revisiting Bayesian constraints on the transport coefficients of QCD" [arXiv:2002.05337]

DEPARTMENTAL ACTIVITIES

Introduction to Bayesian Inference in Physics Workshop Series,	Fall 2020
McGill Nuclear Theory Journal Club	
Organizing Committee Member,	May 2018 - Present
McGill Physics Hackathon	
Co-Organizer,	November 2017 - April 2018
McGill Nuclear Theory Graduate Student Seminar	
Vice President - Communications,	September 2017 - June 2019
McGill Graduate Association of Physics Students (MGAPS)	
Participant, *McGill Nuclear Theory Journal Club*	Oct 2016 – Present
Panelist, *"How to get into Graduate School for Physics"*	Oct 2016
Outreach, *William & Mary Society of Physics Students*	Sep 2015 – May 2016

SOCIETY MEMBERSHIPS

Canadian Association of Physicists, Graduate Student Member
American Physical Society, Graduate Student Member
National Eagle Scout Association, Life Member

SKILLS

Programming

Python 2 and 3	joblib, docopt, vegas, uncertainties,
Pandas, numpy, scipy, matplotlib,	scikit-learn, scikit-opt, seaborn,

glob, GPy, emcee, ptemcee, corner, openCV, flask, sqlalchemy, selenium

Version control: GitHub/mrhheffernan and Atlassian Bitbucket

Jupyter Notebook

LaTeX

Wolfram Mathematica

Linux/Unix operating systems (Slurm, PBS, GNU Parallel)

Doxygen documentation

Markdown

Bash

Julia

MATLAB

Teaching

Pedagogical development for flipping a premier introductory physics course at McGill

Lab report and exam marking

Preparing tutorials and leading student help sessions

Languages

English (Bilingual/Native Fluency)

Farsi (Near-Bilingual/Native Fluency)

German (Elementary Working Fluency)