Matthew R. Heffernan — Curriculum Vitae

Contact Information

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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: *Differentiating initial state models using Bayesian analysis*
Project description: *Quantifying the impact of different initial state models on final state observables via Bayesian analysis*

M.Sc. Project Title: *Toward a consistent calculation of the QCD transport coefficients*
Project Description: *Calculating microscopically-correct shear and bulk viscosities of Quark-Gluon Plasma in the relaxation time approximation*

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, 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

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 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, McGill Nuclear Theory Journal Club	Fall 2020
Organizing Committee Member, *McGill Physics Hackathon*	May 2018 - Present
Co-Organizer, *McGill Nuclear Theory Graduate Student Seminar*	November 2017 - April 2018
Vice President - Communications, *McGill Graduate Association of Physics Students (MGAPS)*	September 2017 - June 2019
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
Pandas, numpy, scipy, matplotlib, joblib, docopt, vegas, uncertainties, scikitlearn, 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)