MICHAEL GENNARI

Permanent Address
3660 Cemetery Road
Hamilton, ON L0R 1C0

mgennari@edu.uwaterloo.ca
(905) 975 – 8277

https://mgennari.github.io/

Current Address
5-195 Erb Street West
Waterloo, ON N2L 1V6

RESEARCH INTERESTS

Nuclear many-body problem, *ab initio* nuclear models (no-core shell model), low-energy quantum chromodynamics (QCD), chiral effective field theory, particle physics, machine learning

EDUCATION

Candidate for Bachelor of Science 2019 – *University of Waterloo, Waterloo ON 2014 - present*
Honours Co-operative Mathematical Physics
- **Relevant Courses:** Introduction to Particle Physics, Quantum Theory 2, Quantum Physics 3, Introduction to Groups, Introduction to Quantum Information Processing, Quantum Physics 2
- **Research Project:** Ongoing research project in machine learning and the nuclear many-body problem with Dr. Petr Navrátil and Dr. Roger Melko

SUMMARY OF QUALIFICATIONS

- First author of two manuscripts directly resulting from work on nuclear density in the no-core shell model and collaboration with Dr. Matteo Vorabbi at TRIUMF
- Research on nuclear density and applications to *ab initio* (first principles) theory completed under Dr. Petr Navrátil at TRIUMF
- Machine learning and its applications to the nuclear many-body problem being researched for an undergraduate research project with Dr. Petr Navrátil and Dr. Roger Melko
- Award from the Canadian Institute of Nuclear Physics (CINP) received for travel expenses from presenting work completed at TRIUMF
- Degree in mathematical physics contained a heavy focus on theoretical physics, with additional pursuit in pure mathematics and advanced quantum theory
- Proficiency as an educator achieved through direct tutoring and volunteering positions

PUBLICATIONS

Microscopic optical potentials derived from *ab initio* translationally invariant nonlocal one-body densities
Michael Gennari, Matteo Vorabbi, Angelo Calci, and Petr Navrátil. Phys. Rev. C 97, 034619 (2018).
Kinetic density from *ab initio* theory
Michael Gennari and Petr Navrátil. arXiv:1808.10537 (2018).

RESEARCH EXPERIENCE

TRIUMF, Theory Group – Vancouver, BC Canada
Researcher in Theoretical Nuclear Physics – January 2017 to present
Supervisor – Dr. Petr Navrátil

- Derived and implemented a translationally invariant (centre-of-mass free) nonlocal nuclear density in the no-core shell model (NCSM), to be used in improving predictions of nuclear reactions and comparisons with density functional theory (DFT)
- Produced accurate and more consistent optical potentials for nuclear reactions involving light nuclei from nonlocal nuclear density and a collaboration with Dr. Matteo Vorabbi at TRIUMF
- Analytic expression for the nuclear kinetic density, an input of DFT, derived from nonlocal nuclear density to view amplified effects of translational invariance and to allow communities to compare centre-of-mass removal techniques across different many-body methods
- Modern two- and three-nucleon chiral effective field theory interactions analyzed
- Natural nucleon orbitals and a related orthogonal transformation using the one-body density matrix being constructed to improve convergence of standard NCSM calculations of exotic nuclei

University of Waterloo, Department of Physics and Astronomy – Waterloo, ON Canada
Research Project in Machine Learning and the Many-Body Problem – September 2018 to present
Supervisor – Dr. Roger Melko and Dr. Petr Navrátil

- Training neural networks to improve infinite basis extrapolation results for nuclear properties, such as the ground state energy of exotic nuclear systems
- Using machine learning in conjunction with natural nucleon orbitals to further improve convergence trends in nuclear many-body calculations
- Novel techniques in extrapolating density matrices to select best nucleon orbitals under study

ACHIEVEMENTS

Student Travel Award from Canadian Institute of Nuclear Physics, 2018 – *University of Waterloo*
- Presented a research award of 500.00 CAD by the Canadian Institute of Nuclear Physics towards travel to the Canadian Undergraduate Physics Conference 2018 (CUPC)

President's Scholarship of Distinction, 2015 – *University of Waterloo*
- Presented an academic scholarship of 2000.00 CAD by the University of Waterloo

Dean's Honours List, 2015 – *University of Waterloo*
- Achieved status on the Dean's Honours list in 2015

Distinction in Science, 2014 – *Saltfleet District High School*
- Provided an academic scholarship of 400.00 CAD towards university education

Distinction in Mathematics, 2014 – *Saltfleet District High School*
- Provided an academic scholarship of 300.00 CAD towards university education