

Lawrence Frolov

(201) 888-9852

110 Frelinghuysen Rd.
Piscataway, New Jersey 08854

laf230@math.rutgers.edu

<https://sites.math.rutgers.edu/~laf230/index.html>

EDUCATION: **Rutgers the State University of New Jersey**, New Brunswick, NJ
Doctor of Philosophy in Mathematics September 2021- Present
Bachelor of Science in Mathematics, Minor in Physics May 2021

TEACHING: **Rutgers the State University of New Jersey**, New Brunswick, NJ
Summer Instructor: Calc II for PHYS/ENG Summer 2024
Summer Instructor: Diff EQ for PHYS/ENG Summer 2023
Teaching Assistant September 2021- Present

RESEARCH: **“On the relativistic quantum mechanics of a photon between two electrons”**
Submitted to Letters in Mathematical Physics

- Extended previous research on simulating photon-electron interactions by implementing boundary conditions on regions of contact
- Proved L^2 convergence of approximating sequence associated with the infinite series of collision Feynman diagrams for three particle wavefunction

“Joint evolution of a massless scalar field and its point-charge in one space dimension”

Published in J. Math. Phys. 65, 062901 (2024)

- Derived a rigorous force law for a scalar point charge via the weak law of energy-momentum conservation
- Proved existence of global solution for the joint particle-field evolution
- Showed that the self-force that a scalar point charge exerts on itself is restoring, and that a perturbed particle returns towards rest asymptotically

SEMINAR

ORGANIZING: **Rutgers Graduate-Undergrad Seminar in Math-Phys** Sept 2022- Present

- Co-organizer of mathematical physics seminar aimed at graduate and undergraduate students
- Maintain [youtube channel](#) where recorded seminars are uploaded and freely available to the public.

UNDERGRUATE

MENTORING: **Mathematical Adventures in One Dimensional Physics** May 2021 – Present

- Mentored a total of 14 undergraduate researchers performing research under Professor A. Shadi Tahvildar-Zadeh, Rutgers U.
- Gave a series of lectures on ODES, PDEs, Probability Theory, and Quantum Mechanics to equip them with the tools needed to begin their research

Directed Reading Program on Differential Geometry May 2022 – July 2022

- Mentored a talented undergraduate as they read through chapters 1-12 of Lee’s “Smooth Manifolds” and chapters 1-6 of Lee’s “Riemannian Manifolds”

REU

COORDINATING: Graduate Coordinator of the [DIMACS REU](#)

May 2022 – August 2022

May 2024 – August 2024

- Facilitated housing and ensured participants arrived and departed safely
- Helped organize seminars, graduate panels, and other REU related events
- Planned fun stress relieving events for the participants such as movie nights and cooking lessons

Talks:

[Poster Presentation at GeLoMer24](#)

January 30th 2024

Joint evolution of a Lorentz covariant massless scalar field and its point source on $\mathbb{R}^{1,1}$

- Presented poster explaining how self-forces of point charges can be rigorously derived in 1-space dimension from the principle of energy-momentum conservation.

[Poster Presentation at SCGR23](#)

June 19th 2023

Joint evolution of a Lorentz covariant massless scalar field and its point source on $\mathbb{R}^{1,1}$

- Presented poster explaining how self-forces of point charges can be rigorously derived in 1-space dimension from the principle of energy-momentum conservation.

Rutgers Research Group in Mathematical Physics

October 27th 2022

[On the joint evolution of scalar-electric point charges and their fields in one space dimension](#)

- Rigorously derived the interaction forces between scalar-electric point charges from the principle of energy-momentum conservation.

Rutgers Research Group in Mathematical Physics

July 28th 2022

[On the joint evolution of a scalar point charge and its field in one space dimension](#)

- Rigorously derived the force which acts on the scalar point charge and proved well-posedness of the joint evolution problem for sufficiently small incoming radiation
- Showed that the self-force that a scalar point charge exerts on itself is restoring, and that a perturbed particle returns towards rest asymptotically

Rutgers Research Group in Mathematical Physics

July 29th 2021

An introduction to relativistic vectors and spinors (with Samuel Leigh)

- Motivated the transformation laws of relativistic vectors by analyzing Maxwell's equations
- Generalized these concepts to spinors and explained their connection to quantum physics

Rutgers Research Group in Mathematical Physics

March 25th 2021

[On the quantum mechanics of a photon between two electrons in one space dimension](#) (with Samuel Leigh)

- Provided closed-form solutions for the multi-time wave functions given by a system of Dirac and transport equations for space-like configurations

Joint Mathematics Meeting

January 8th 2021

[On the relativistic Q.M of N-body electron-photon systems in 1+1 dimensions](#)

(with Samuel Leigh and Marcus McLaurin)

- Provided an explanation of how the three body wavefunction propagates in time, and how this propagation leads to particle bounces with the introduction of contact boundaries
- Based on research done by Lawrence Frolov, Samuel Leigh, Marcus McLaurin, Shadi Tahvildar-Zadeh, Adriana Scanteianu, and Xiangyue Wang

Rutgers Research Group in Mathematical Physics

August 6th 2020

[A Relativistic Quantum Mechanical Model of Compton Scattering](#) (with Samuel Leigh)

- Presented a talk based on research done by Shadi Tahvildar-Zadeh, Michael Kiessling, and Mathias Lienert
- Explained how Compton Scattering naturally arises from multi-time electron-photon wave-functions with contact boundaries

References Available Upon Request
U.S. Citizen