

Lawrence Frolov

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EDUCATION:

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

COURSE WORK:

General Relativity, Topics in Mathematical Physics 1 & 2: General Relativity,
Theory of Functions of a Real Variable 1 & 2, Theory of Functions of a
Complex Variable 1, Abstract Algebra 1 & 2

RESEARCH:

w/ Samuel Leigh Under A. Shadi Tahvildar-Zadeh May 2020– Ongoing
“On the relativistic quantum mechanics of a photon between two electrons”
• Extended previous research on simulating photon-electron interactions by implementing contact boundary conditions
• Provided closed-form solutions for the multi-time wave functions given by a system of Dirac and transport equations for space-like configurations

w/ Samuel Leigh Under A. Shadi Tahvildar-Zadeh May 2021– Ongoing
“On the joint evolution of a scalar point charge and its field in one space dimension”
• Derived the force law for a scalar point charge via the weak law of energy conservation
• Proved the 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

UNDERGRUATE MENTORING:

Mathematical Adventures in One Dimensional Physics May 2021 – July 2021
May 2022 – July 2022
• Mentored a group of 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
• 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:

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
- Video Link: <https://youtu.be/Jux76aKDFTA>

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

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)

- Presented a talk based on research by Lawrence Frolov and Samuel Leigh which followed up on work done by Shadi Tahvildar-Zadeh, Michael Kiessling, and Mathias Lienert
- Provided closed-form solutions for the multi-time wave functions given by a system of Dirac and transport equations for space-like configurations

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

July 14th 2022

On the joint evolution of a scalar point charge and its field in one space dimension

- Presented a talk based on research by Lawrence Frolov and Samuel Leigh which followed up on work done by Shadi Tahvildar-Zadeh and Michael Kiessling
- 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