Christian Koertje

Masters Graduate Student
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Goals/Research Interests

To apply my training in physics and mathematics to complex problems in interdisciplinary science. To understand the relationship between microscopic and macroscopic phenomena. Research interests include nonlinear dynamics and chaos, pattern formation, nonequilibrium statistical mechanics, and information processing.

Education

M.S. Systems Science, Binghamton University, SUNY (2023)

Specializations: Complex Systems Modeling and Simulation

Thesis: "Social Nucleation in Opinion Dynamics"

Supervisors: Hiroki Sayama and Sang Won Yoon

B.S. Physics with Honors, University of North Carolina Wilmington (2021)

Awards: Summa Cum Laude

Thesis: "Relativistic Dynamics: A Journey to the Center of a Black Hole"

Supervisor: Russell Herman

B.A. Mathematics, University of North Carolina Wilmington (2021)

Awards: Summa Cum Laude

Senior Project: "Nonlinear Dynamics of the Emden Fowler Equation"

Research Experience

Masters Research (2021 – 2023)

- **Thesis** Conducted original research in opinion formation dynamics with the goal of understanding the effect of global access to information. Under the supervision of Hiroki Sayama, I studied a nonlinear-nonlocal partial differential equation both numerically and analytically. Additions of population dynamics lead to spatio-temporal chaos in the self-organizing patterns.

- **RTSync Corp.** Research project assistant for a company by contributing to the mathematical foundations of the DEVS theory of modeling and simulation. Projects were funded by government agencies including the MDA and AFRL. This work was under the supervision of Sang Won Yoon at Binghamton University and Bernard Zeigler of RTSync.

    1. **DVAST** Developed discrete event simulation in C++ for the ADEVS simulator for testing DEVS-based distributed computing.
    2. **SimPA** Contributed to the developement of parallel process capabilities using DEVS-based modeling in Java and MS4 Me (proprietary simulation software developed by RTSync).

UNDERGRADUATE RESEARCH (2017 – 2021)

- **Thesis** Conducted exploratory research into the nonlinear dynamics of general relativity focusing on dynamics of black holes outside the event horizon and on the approach to the BKL singularity inside. This project involved familiarizing myself with techniques of differential geometry.
- **Complex Adaptive Systems Lab (CASL)** Aided in the study of pattern formation in coral reef ecosystems. Numerical studies were conducted by simulating a system of nonlinear partial differential equations in Python.

PRESENTATIONS

CONFERENCE TALKS

1. Koertje, C. & Sayama, H. (2022). Stability of opinion formation PDE model based on expanded non-local perception kernel, Northeast Regional Conference on Complex Systems.

AWARDS

1. **Adrian D. Hurst Mathematics Scholarship** (2020)
   Awarded to a rising junior, senior, or graduate student who has declared a major in mathematics or a student in a pre-engineering transfer program and is a full time student at UNCW.
2. **Douglas Smith Scholarship of Mathematics** (2019)
   This scholarship is merit-based and awarded annually to an undergraduate student who has declared a major in the Department of Mathematics and Statistics.

TEACHING EXPERIENCE

Tutoring, University of North Carolina Wilmington (2018 – 2021)

- UNCW University Learning Center as part of the math services. Provided help for students in Math and Physics classes.

- Courses tutored include: Introductory Analysis, Calculus 1 & 2, Multivariable Calculus, Differential Equations and Introductory Physics 1 & 2 (both with and without calculus).

Workshops Attended

ComSciCon-NY, Cornell University (2022)

- Attended a 2 day virtual workshop on science communication. This included mini symposiums on the differences in communication with different audiences such as collegues, general public, and science enthusiasts.

Physics in the Ground Beneath our Feet, Princeton University (2022)

- Attended a 3 day workshop focused on applications of nonlinear and statistical physics to environmental and geoscience. Learned about the field of soft-matter physics and the plethora of interesting projects in fluid dynamics, geomorphology, and climate science.

Extracurriculars

1. Member of the Society for Industrial and Applied Mathematics (SIAM) (2021–)
2. Member of Pi Mu Epsilon, the mathematics honors society (2021–)
3. Vice President of the Society of Physics Students at UNCW (2020 – 2021)
4. Member of the Society of Physics Students at UNCW (2019 – 2021)
5. Member of Sigma Pi Sigma, the physics honors society (2019–)
6. Member of the UNCW Math Club (2018 – 2021)

References

Hiroki Sayama, D.Sc., Binghamton University, SUNY

Position: Professor of Systems Science

Relationship: M.S. Supervisor

Email: sayama@binghamton.edu

Russell L. Herman, Ph.D., University of North Carolina Wilmington

Position: Professor of Physics and Mathematics

Relationship: Mentor and Honors Supervisor

Email: hermanr@uncw.edu

Phone: (910)-962-3722

Dylan McNamara, Ph.D., University of North Carolina Wilmington

Position: Professor of Physics and Physical Oceanography
Relationship: Mentor
Email: mcnamarad@uncw.edu
Phone: (910)-962-2588