

G. Todd Springer

Department of Physics
Illinois Institute of Technology
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Citizenship: USA and Canada

Education

University of Minnesota – Twin Cities

Degree: Ph.D. in physics

Thesis: *“Hydrodynamics of Strongly Coupled
Nonconformal Fluids from Gauge/Gravity Duality”*

Advisor: Prof. Joseph I Kapusta

Carleton College

Degree: B.A. in physics *magna cum laude* with distinction in major

Academic Appointments

Teaching Professor

Illinois Institute of Technology – Chicago, Illinois
Department of Physics

2026 - Present

Associate Teaching Professor

Illinois Institute of Technology – Chicago, Illinois
Department of Physics

2021 – 2026

Assistant Professor – Limited Term Faculty

Toronto Metropolitan University – Toronto, Ontario
(Formerly known as Ryerson University)
Department of Physics

2016 – 2020

Visiting Assistant Professor

Colgate University – Hamilton, New York
Department of Physics and Astronomy

2013 – 2016

Postdoctoral Researcher

University of Illinois, Chicago
Department of Physics
Supervisor: Prof. Mikhail Stephanov

2011 – 2013

Postdoctoral Fellow

McGill University – Montréal, Québec
Department of Physics
Supervisor: Prof. Sangyong Jeon

2009 – 2011

Non-Academic Appointments

Associate Editor

American Journal of Physics
A publication of the American Association of Physics Teachers

2020 – Present

Awards and Honors

Bauer Family Excellence in Undergraduate Teaching Award	Office of the Provost, Illinois Institute of Technology	2026
Dean's Teaching Award	Faculty of Science, Toronto Metropolitan University	2019
Aneesur Rahman Prize	School of Physics and Astronomy, University of Minnesota	2009
Doctoral Dissertation Fellowship	School of Physics and Astronomy, University of Minnesota	2008-2009
W. H. Wetzel Fellowship	School of Physics and Astronomy, University of Minnesota	2006
Outstanding Teaching Assistant	School of Physics and Astronomy, University of Minnesota	2006

Teaching Experience

Primary Instructor / Lecturer (in order of course level)

<u>CORE104A – Fundamental Quests in Science</u> (For non-science majors. Concepts in particle physics, cosmology, fusion, scientific method).	Colgate University 1 semester
<u>PCS107 – The Natural Context</u> (Algebra based course for first year architecture students, mechanics, statics, energy transfer)	Toronto Metropolitan 3 semesters
<u>PHYS200 – Energy, Waves, Materials, and Forces</u> (Algebra based course for non-science majors),	Illinois Tech 4 semesters
<u>PCS120 – Physics I</u> (Algebra based course for first year science students, mechanics, electric and gravitational fields)	Toronto Metropolitan 1 semester
<u>Physics 111/112 - Fundamentals of Physics I and II</u> (Mechanics, thermodynamics, fluid dynamics, electricity and magnetism, optics, waves, modern physics. Algebra based course for life science majors)	Colgate University 2 semesters (each)
<u>PCS211 – Physics: Mechanics</u> (Calculus based mechanics for first year engineering students. Emphasis on 3D vectors, statics and dynamics)	Toronto Metropolitan 4 semesters
<u>PHYS123 – General Physics I : Mechanics</u> (Calculus based mechanics for first year students. Kinematics, dynamics, and conservation laws)	Illinois Tech 5 semesters
<u>PCS125 – Waves and Fields</u>	Toronto Metropolitan

(Calculus based Oscillations, Waves, Electromagnetism for first year engineering students.)	2 semesters
<u>Physics 131 - Atoms and Waves</u> (Introductory course on 20 th century physics)	Colgate University 1 semester
<u>PCS224 – Solid State Physics</u> (For second year electrical engineering students. Electrostatics, p-n junction, optical devices, MOSFET)	Toronto Metropolitan 5 semesters
<u>PCS335 – Thermal and Statistical Physics</u> (For third year physics majors. Laws of thermodynamics, engines, quantum statistical physics)	Toronto Metropolitan 5 semesters
<u>Physics 202/203/204 - Mathematical Methods for Physics</u> (Complex variables, Fourier analysis, differential equations)	Colgate University 2 semesters
<u>PCS521/PCS622 - Mathematical Physics</u> (For 2 nd year physics majors. Differential equations, complex variables, numerical methods, MATLAB, Fourier analysis)	Toronto Metropolitan 2 semesters (each)
<u>PHYS405/406 – Fundamentals of Quantum Mechanics</u> (2 semester course for 3rd/4th year physics majors Solution to Schrodinger's equation, hydrogen atom, angular momentum, matrix mechanics, perturbation theory).	Illinois Tech 4 semesters (each)
<u>Physics 456 - General Relativity and Cosmology</u> (For 4 th year physics majors. Special/general relativity and cosmological applications)	Colgate University 1 semester

Co-Lecturer

<u>Physics 673 - Quantum field theory II</u> (non-Abelian gauge theories, quantum chromodynamics, deep inelastic scattering and parton evolution).	McGill University ½ semester
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Laboratory/Recitation instructor

<u>Physics 111/112 - Fundamentals of Physics I and II</u>	Colgate University 2 semesters
<u>Physics 131 - Atoms and Waves</u>	Colgate University 3 semesters

Several semesters of teaching laboratory and recitation sections as a graduate TA.

Evidence of effective teaching

Average normalized gains (g) in Force Concept Inventory (FCI) and Conceptual Survey in Electricity and Magnetism (CSEM) assessments.

Mechanics - Fall 2013 (29 students):	g = 0.47
Mechanics - Fall 2014 (70 students):	g = 0.44
Electricity and Magnetism - Spring 2016 (65 students):	g = 0.35
Mechanics – Spring 2022 (43 students)	g = 0.41
Mechanics – Spring 2023 (79 students)	g = 0.31

Mechanics – Spring 2024 (68 students)
Mechanics – Spring 2025 (59 students)

g = 0.31
g = 0.31

The normalized “Hake” gain is a measure of conceptual learning in introductory physics courses. Students in courses employing interactive engagement techniques have significantly higher scores (0.48 ± 0.14) as compared to traditional lecture (0.23 ± 0.04)
Hake, Am. J. Phys. 66,64–74 (1998)

Research and Publications

Statistics (as of Fall 2026)

Citations: 234

h-Index: 8

i10 Index: 7

List of Publications/Preprints

Conserved Charge Susceptibilities in a Chemically Frozen Hadronic Gas
arXiv:1508.02409, 2015, (with J. Ang'ong'a*)

Hydrodynamics of charge fluctuations and balance functions
Phys. Rev. C **89**, 064901 (2014), (with B. Ling and M. Stephanov),
Editor's Suggestion in Phys. Rev. C.

Hydrodynamic fluctuations and two-point correlations
Nucl. Phys. A **904-905**, 1027c-1030c (2013)
Proceedings of the XXIII International Conference on Ultrarelativistic Nucleus-Nucleus
Collisions, (with M. Stephanov)

Bulk correlation functions in single and multi-scalar gravity duals
Phys Rev. D **82**, 126011 (2010), (with C. Gale and S. Jeon)

Shear spectral sum rule in a non-conformal gravity dual
Phys Rev. D **82**, 106005 (2010), (with C. Gale, S. Jeon and S.H. Lee)

Potentials for soft wall AdS/QCD
Phys. Rev. D **81**, 086009 (2010), (with J. I. Kapusta)

Second order hydrodynamics for a special class of gravity duals
Phys. Rev. D **79**, 086003 (2009), (single author)

Sound mode hydrodynamics from bulk scalar fields
Phys. Rev. D **79**, 046003 (2009) , (single author)

Shear transport coefficients from gauge/gravity correspondence
Phys. Rev. D **78**, 066017 (2008) (with J. I. Kapusta)

Cosmological black hole formation due to QCD and electroweak phase transitions
arXiv [0706.1111] (2007) (with J. I. Kapusta)

*Undergraduate student author

Presentations

Developing a Mathematical Methods Course with an Integrated Computation Lab Conference: AAPT Summer Meeting	July 2020
Thermodynamics of Hadron gas Invited Talk: A symposium on Light, Color, and Dense Matter	June 2017
Hydrodynamic Fluctuations and Correlations Colloquium: SUNY Geneseo (Geneseo, NY)	May 2013
International Conference: “Quark Matter 2012” (Washington DC) Selected as one of the seven best posters overall	Aug. 2012
“Symposium on Contemporary Subatomic Physics” (McGill University: Montréal, QC, Invited Talk)	Jun. 2012
Sum Rules and Two-Point Correlation Functions “INT Summer School on the Applications of String Theory” (Institute for Nuclear Theory: Seattle, WA)	Jul. 2011
Conference: “Strong and Electroweak Matter” (McGill University: Montréal, QC)	Jul. 2010
Potentials and AdS/QCD Conference: Canadian Assn. of Physicists Congress 2010 (University of Toronto: Toronto, ON)	Jun. 2010
Gauge/Gravity Duality and Hydrodynamics Workshop: “Nearly Perfect Fluids” (Duke University, NC)	Apr. 2009
Seminar: University of Maryland (College Park, MD)	Feb. 2009
Seminar: Perimeter Institute for Theoretical Physics (Waterloo, ON)	Dec. 2008
Workshop: “AdS/CFT, Condensed Matter, and QCD” (McGill University: Montreal, QC)	Oct. 2008
Seminar: Institute for Nuclear Theory (University of Washington: Seattle, WA)	May 2008
Primordial Black Holes and QCD/Electroweak Phase Transitions Workshop: “The Dark Side of the Universe” (University of Minnesota: Minneapolis, MN)	Jun. 2007
Workshop: “Black Holes VI” (White Point, Nova Scotia; Sponsored by University of New Brunswick)	May 2007
Conference: April Meeting of The American Physical Society (Dallas, TX)	Apr. 2006

Mentoring and Service

Mentoring and Directed Study

- Mentored Anna Leckman ('19) in a 1 credit course on introductory cosmology and relativity at Toronto Metropolitan University
- Senior capstone projects (Colgate University)
 - Jackson Ang'ong'a ('15), "Thermodynamics of the Hadron Gas Phase of the Early Universe"
 - Arjun Bhuptani ('16), "The Effect of Viscosity on the Expansion of the Universe."
 - Gary Mucci, ('16) "Signatures of Thermal Fluctuations in the Cosmic Microwave Background"
 - Brad Miles ('16) "Baryon number fluctuations from a Hadron-Resonance gas model including chemical freeze-out"
- Mentored Lindsay Dimarchi ('16) in an independent ½ credit course on introductory cosmology at Colgate University.
- Member of the Supervisory Committee for Richa Tuteja's M.Sc. project at Toronto Metropolitan University.

Lab Development

- Member of an 8-person "Virtual Lab Task Force" to address the issue of moving laboratory activities online in the midst of the COVID-19 crisis.
- Member of a 3-person committee to create and implement new introductory labs at Toronto Metropolitan University.
- Developed two new introductory labs at Colgate University – one on the subject of kinematical motion (using Tracker video analysis) and one covering geometrical optics
- Developed three new introductory labs at Toronto Metropolitan University – Video Analysis of Kinematics, Electric Potential, Conservation of Momentum.
- Created and implemented an online system for the submission and marking of lab reports at Toronto Metropolitan University.
- Created specific marking rubrics for each experiment to enhance grading consistency at Toronto Metropolitan University.

Department/Faculty/University Service

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| • Core Curriculum Assessment Committee Member | 2024-present |
| • Departmental Assessment Committee Chair | 2024-present |
| • Physics Department Outreach Committee Member | 2024-present |
| • Undergraduate Advisor | 2023-present |
| • Undergraduate Curriculum Committee | 2019-2020 |
| • Undergraduate Scholarship and Awards Committee | 2018-2020 |
| • Undergraduate Research Opportunities Review Committee | 2019 |
| • Undergraduate Interdisciplinary Research Opportunities Review Committee | 2019 |
| • Seminar Organizer (McGill University) | 2011 – 2013 |
| • Journal Club Organizer (UIC) | 2010 – 2011 |

Service to the Physics Community

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| Associate Editor – American Journal of Physics | 2020 – Present |
| Co-organizer of Regional and International Bridge Building Contests for high school students | 2023 – Present |
| Referee – Physical Review C and D | 2009 – Present |

References

Professor Pedro Goldman
Professor Tetyana Antimirova
Professor Beth Parks
Professor Mikhail Stephanov
Professor Joseph Kapusta

Toronto Metropolitan University
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Colgate University
University of Illinois, Chicago
University of Minnesota