Curriculum Vitae

Personal Data

Name	Kam To Billy Sievers (formerly KTB Chan)
Residence	Hamilton, Ontario, Canada
Nationality	Citizen of Hong Kong SAR, Permanent Resident of Canada
Email Address	sieversktb@mcmaster.ca or ktbsievers@gmail.com

Education

current	**Doctor of Philosophy, Dept. of Physics and Astronomy**, McMaster University.
2023	**Master of Science in Physics**, Memorial University of Newfoundland, GPA: 4.0/4.0
2020	**Bachelor of Science (First Class Honours) in Physics.**, University of Calgary, GPA: 3.6/4.0

Research Interests

Quantum gravity, black holes, black hole thermodynamics, AdS/CFT correspondence, black hole mergers (numerical simulations and analytical approximations), numerical spectral analysis, finite difference techniques, Monte-Carlo techniques.

Publications

[1] K. T. B. Sievers, L. Newhook, S. Muth, I. Booth, R. A. Hennigar, H. K. Kunduri, Marginally Outer Trapped Tori in Black Hole Spacetimes. Submitted to Phys. Rev. D. arXiv:2312.00769 [gr-qc] (2023).

[2] I. Booth, K. T. B. Chan, R. A. Hennigar, H. Kunduri, and S. Muth, Exotic marginally outer trapped surfaces in rotating spacetimes of any dimension, Class. Quant. Grav. 40, 095010 (2023), arXiv:2210.15685 [gr-qc].

[3] R. A. Hennigar, K. T. B. Chan, L. Newhook, and I. Booth, Interior marginally outer trapped surfaces of spherically symmetric black holes, Phys. Rev. D 105, 044024 (2022), arXiv:2111.09373 [gr-qc].

Scholarships & Academic Awards

2023 – 2026	**NSERC PGS-D Award**, held at McMaster University, **$21 000 CAD** per year.
2023 – 2027	**Graduate & Research Scholarship**, McMaster University, **$16 000 CAD** per year. Includes ∼$12 000 CAD earned in Teaching Assistantship.
2021 – 2022	**Fellow of the School of Graduate Studies**, Memorial University, Awarded to the top 10% of graduate students on academic merit.
2020 – 2022	**SGS Baseline Funding**, Memorial University, **$6 500 CAD** per year.
2016, 2017, 2018, 2019	**International Entrance Scholarship**, University of Calgary, **$15 000 CAD** per year.

Selected Coursework

McMaster University: Adv. Quantum Mechanics I&II (Intro. to QFT), Asymptotic Analysis.

Memorial University: Quantum Information and Computing, Differential Manifolds & Riemannian Geometry, Advanced General Relativity, Group Theory.

University of Calgary: Advanced Classical Mechanics, Electrodynamics, Computational Physics I, II, &III

Above listed graduate-level courses were credited towards Ph.D., M.Sc., and B.Sc. programs, respectively.

Research Experience

2023 – current	**Graduate Research Assistant**, Theoretical Physics Group, McMaster University Supervisor: Dr. Hari Kunduri
2020 – 2023	**Graduate Research Assistant**, Gravity Group, Memorial University Supervisor: Dr. Ivan Booth Associates and Mentors: Dr. Robie A. Hennigar, Dr. Hari Kunduri Project Information: The investigation of self-intersecting marginally outer-trapped surfaces continues with projects that test the phenomenon with regards to black holes with different parameters, such as charge or rotation. Roles: My roles involved finding numerical solutions to problems posed by the project, contributing to the authorship of publications [1] and [2], the mentorship of undergraduate students in the research group, and dissemination of the group's results through conference and invited seminar presentations.
2019 – 2020	**Undergraduate Honours student**, University of Calgary Supervisor: Dr. Sean Stotyn, University of Calgary

Theses

2023	**Masters Thesis** Title: Self-Intersecting Marginally Outer-Trapped Surfaces in Black Holes Supervisor: Ivan Booth, Memorial University of Newfoundland Synopsis: Self-intersecting marginally outer-trapped surfaces (MOTSs) play a key role in binary black hole mergers [Pook-Kolb, Birnholtz, Krishnan, Schnetter]. With the same phenomenon appearing inside the Schwarzschild black hole [Booth, Hennigar, Mondal], extending the investigation to black holes with inner horizons yields exotic correlations between the intersecting-behaviour and the stability of the inner horizon. Parts of this work have been published.
2020	**Undergraduate Honours Thesis** Title: Near Horizon Geometries as Tangent Spacetimes and their Relation to Extremal Black Hole Entropy Supervisor: Sean Stotyn, University of Calgary Synopsis: Continuing from Stotyn's *A Tale of Two Horizons* (2015), the goal is to investigate the Ginsparg-Perry limiting procedure and show that near horizon geometries are tangent spacetimes whose global properties are a misrepresentation of the parent spacetime. This work is will be drafted together with extended works for publication.

Employment History

2023 – current	**Graduate Teaching Assistant** Employer: Dept. of Physics and Astronomy, McMaster University.
2020 – 2022	**Graduate Teaching Assistant** Employer: Dept. of Physics and Physical Oceanography, Memorial University. Courses: Introductory Physics I & II (lab staff member, Fall 2021 & Winter 2022), General Physics I (remote lab staff member, Winter 2021), Physics of Device Materials (remote marker, Fall 2020). Description: One of six staff members leading and marking weekly laboratory sessions for approximately 200 students across four sessions. Marked assignments and assembled assignment answer keys.
2017 – 2020; 2022 – 2023	**Tutor, Instructor and Instructors' Team-Lead** Employer: MathPro Learning Centre, 23-41 Chelsea St NW, Calgary AB. Description: Employed for one-on-one tutoring of high school mathematics and physics, developed and managed an extracurricular coding camp.
2020	**Undergraduate Teaching Assistant** Employer: Dept. of Physics and Astronomy, University of Calgary. Courses: Introductory Electromagnetism, and Thermal Physics (lab instructor, Winter 2020); Modern Physics (assignment and assessment marker, Winter 2020). Description: One of two laboratory instructors for an introductory physics lab section, answering questions and marking lab reports for a section of approximately 20 students. Also fulfilled marking duties for a major-stream modern physics course.

Students Mentored

Students were funded and entrusted to by Ivan Booth.

- **Liam Newhook** (B.Sc. Physics) – summer intern 2021 & 2022, honours thesis 2021-2022, manuscript publication [1], Memorial University of Newfoundland.

- **Zachary K. Hoyles** (B.Sc. Physics) – summer intern 2022, Memorial University of Newfoundland.

Computer Skills

Python:	Computational Physics courses have covered the implementation of numerical methods and data handling in Jupyter notebooks. Notable topics include machine learning, finite difference methods, discrete Fourier analysis, and Monte-Carlo techniques. These skills were vital assets in the development of [1-3].
Others:	Mathematica 13 (RGTensor), Maple 2021 (GRTensorIII), LaTeX, Java, MATLAB.

Affiliations, Leadership, and Community Service

Classical and Quantum Gravity (CQG) (2023),
Referee – served as a co-reviewer in the peer-review process

McMaster Astronomy & Physics Student Association (MAPSA), (2023 – current)
Condensed Matter High-Energy and Theory Representative

Canadian Association of Physicists (May 2021 – current), *Graduate-student member*

Rothney Astrophysical Observatory, University of Calgary (2016-2019, 2022-2023)
Volunteer – telescope operator during open-house nights.

Graduate Physics Society, Memorial University (2020-2022)
Member – involved in most society activities.

Dept. of Physics and Astronomy, University of Calgary (2016-2019)
Volunteer – involved yearly in the department's outreach event *Rollercoasterology*.
Club executive – VP Events (2017-2018) of the Physics & Astronomy Students' Association (PASA).

Conferences, Symposia, & Seminars

Year	
2023	Title: Self-intersecting surfaces in black holes
	Type: Conference talk (∼15mins)
	at **8th Annual PHAS symposium**, University of Calgary, Canada.
	at **Theory Canada 15**, Mount Allison University, Canada.
	at **Canadian Association of Physicists Congress 2023**, UNB, Canada.
2022	Title: Self-intersecting marginally outer trapped surfaces in black holes
	Type: Seminar (∼1 hr)
	at **Max Plank Institute for Gravitational Physics Seminar**, AEI Hannover, Germany.
	at **Relativity Seminar of the Institute of Theoretical Physics**, recording available (link),
	Charles University, Czech Republic.
	at **Institut de Ciències del Cosmos**, University of Barcelona, Spain.
	at **Dept. of Physics and Physical Oceanography M.Sc. Seminar**,
	Memorial University, Canada.
	Type: Conference Talk (∼15 mins)
	at **Canadian-Cuban-American-Mexican 2022 Conference**. Awarded: Feedback award
	at **Canadian Association of Physicists Congress 2022**, McMaster University, Canada.
	at **Atlantic General Relativity Meeting 2022**, Memorial University, Canada.
	Awarded: B.Sc./M.Sc. Student Talk – 2nd Place.
2021	Title: The many MOTS of the Schwarzschild spacetime
	Type: Conference Talk (∼15 mins)
	at **Canadian Association of Physicists Virtual Congress 2021**, Canada.
	at **Atlantic General Relativity Meeting 2021 (online)**, Bishop's University, Canada.
	at **Canadian Student & Postdoc Conference on Gravity**, Memorial University, Canada.
	Awarded: Best M.Sc. Student Talk – 1st Place.

Travel

Spain: Hosted by Dr. Robie A. Hennigar at the Institut de Ciències del Cosmos, University of Barcelona, I was invited to give a seminar talk on the results of [1].

Czech Republic: Hosted by Dr. David Kubiznak at the Institute of Theoretical Physics, Charles University, I was invited to give a seminar talk on the results of [1].

Germany: Hosted by Dr. Daniel Pook-Kolb at the Max Plank Institute for Gravitational Physics, AEI Hannover, I was invited to give a seminar talk on the results of [1].

Languages

Fluent in English, basic knowledge of Cantonese and Thai.