## Curriculum Vitae, Nathan Thomas Carruth (盧天賜)

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#### Education

2015 - 2021	PhD, Mathematics, University of Toronto; thesis topic: Focussed Solutions to the Einstein Vacuum Equations (available online at https://hdl.handle.net/1807/104929).
2011 - 2015	Doctoral studies, Physics, University of California, Berkeley.
2010 - 2011	Master's of Advanced Study in Applied Mathematics, University of Cambridge; examinations passed with merit.
2009 - 2010	Master's of Science, Physics, Utah State University; thesis topic: Classical Foundations for a Quantum Theory of Time in a Two-dimensional Spacetime (available online at http://digitalcommons.usu.edu/etd/708/).
2004 - 2007	Bachelor's of Science, Mathematics and Physics, Utah State University, Summa Cum Laude.

#### **Research Experience**

2018 – present	Focussed solutions to the Einstein vacuum equations in polarised translational symmetry. Toronto and Tsinghua.
2021	Transcranial focused ultrasound. Sunnybrook Research Institute, Toronto.
2017 - 2018	Modelling seizures using Wilson-Cowan equations. Krembil Research Institute, Toronto.
2013 - 2015	Auroral plasma physics data extraction and analysis (supporting the NASA GREECE mission) and rheometry modelling of spacecraft antennas (supporting Parker Solar Probe mission). Space Sciences Lab, Berkeley.
2013 - 2017	(concurrently) Theoretical studies of scattering of radio waves by spherically stratified bodies (modelling Europan oceans). Berkeley and Toronto.
2009 - 2010	Identification of the group of conformal isometries and set of spacelike hypersurfaces of spacetimes conformally isometric to $\mathbb{R}^1 \times S^1$ . Utah State University.
2004 - 2007	Isometric embeddings of metric spaces in Banach and Hilbert spaces.

#### **Teaching Experience**

2021 – present Undergraduate mentor, Qiuzhen College, Tsinghua University (求真书院益友学者).

- Fall 2020Teacher's Assistant, Mathematics Department, University of Toronto. Provided<br/>office hour/discussion/lecture support and performed marking for undergraduate<br/>engineering ODE, third-year undergraduate PDE, and third-year introductory<br/>mathematical logic.
- Summer 2020 Lecturer, Mathematics Department, University of Toronto. Designed and taught third-year complex variables (MAT334). Work also included supervising TAs and one other instructor. Course website: http://www.math.toronto.edu/ncarruth/MAT334\_S20/.

Lecturer, Mathematics Department, University of Toronto. Taught first-year
calculus (MAT136). Work included substituting an additional section for two
weeks in the middle of term and managing an emergency transition to all-online
instruction due to the Covid-19 lockdown in the second half of the term.

- Summer 2019 Lecturer, Mathematics Department, University of Toronto. Taught a thirdyear introductory PDE course (APM346). Selected textbook, created syllabus, determined detailed course coverage, created homework assignments, quizzes, and tests, produced detailed course lecture notes as well as review notes on background material, and supervised TA work. Much of the material produced is on the course website: http://www.math.toronto.edu/ncarruth/APM346\_S19/.
- 2018 2019 Lecturer, Mathematics Department, University of Toronto, Mississauga. Taught first-year calculus (MAT135Y).
- 2017 2018 Teacher's Assistant, Mathematics Department, University of Toronto. Held office hours, taught discussion sections, marked exams, proofread homework problems, and evaluated test and problem set marking for second-year calculus courses (including MAT237). Also taught sections and marked tests for an introductory PDE course (APM346).
- 2016 2017 Lecturer, Mathematics Department, University of Toronto. Taught second-year calculus.
- 2015 2016 Teacher's Assistant, Mathematics Department, University of Toronto. Taught sections for first-year calculus courses; held office hours and marked tests for a second-year (theoretical) calculus course; and taught sections and marked tests for a (summer-term) introductory linear algebra course.
- 2011 2012 Graduate Student Instructor, University of California, Berkeley. Taught discussions and graded tests for a conceptual introduction to physics class, and taught discussions, conducted labs, and graded tests for an introductory physics class for life sciences majors.
- 2009 2010 Teacher's Assistant, Utah State University Physics Department. Supervised labs for introductory physics classes for life sciences majors.
- 2006 2007 Grader, Utah State University Mathematics Department. Graded student papers in upper-division undergraduate real analysis and linear algebra classes.

#### Service

2022 – present Content editor, ICCM Notices.

## Presentations

1. Highly localised gravitational waves in polarised translational symmetry. CMS 75th + 1 Anniversary Summer Meeting (on Zoom), June 7 2021.

# Papers

 Pulupa, M., Bale, S.D., Bonnell, J.W., Bowen, T.A., Carruth, N., Goetz, K., Gordon, D., Harvey, P.R., Maksimovic, M., Martínez-Oliveros, J.C., Moncuquet, M., Saint-Hilaire, P., Seitz, D., Sundkvist, D. The Solar Probe Plus Radio Frequency Spectrometer: Measurement requirements, analog design, and digital signal processing. Journal of Geophysical Research 122 (2017), 2836-2854. doi:10.1002/2016JA023345

## Preprints

1. Alexakis, S., Carruth, N. Squeezing a fixed amount of gravitational energy to arbitrarily small scales, in U(1) symmetry. arXiv:2205.05526.

#### Theses

2020	Focussed solutions to the Einstein vacuum equations. Doctoral thesis, University of Toronto. Available online at http://www.math.toronto.edu/ncarruth/Carruth_Nathan_T_20213_PhD_thesis.pdf.
2010	Classical foundations for a quantum theory of time in a two-dimensional space- time. Master's thesis, Utah State University. Available online at https://digitalcommons.usu.edu/etd/708/.

## Lecture notes

2020	Lecture notes for undergraduate complex variables. Available online at
	$http://www.math.toronto.edu/ncarruth/MAT334\_S20/notes/mat334\_comp.pdf.$
2019	Lecture notes for undergraduate applied partial differential equations. Available online at http://www.math.toronto.edu/ncarruth/APM346_S19/
	$notes/apm346\_comp.pdf.$

## Programming

C, T<sub>E</sub>X, SNOBOL, UNIX (ksh, sed, awk, X), 8086 assembly, IDL (data processing and analysis), Asymptote, MetaPost, METAFONT (see typescript of Goursat's Functions of a Complex Variable, available at http://www.math.toronto.edu/ncarruth/goursat/, for an example).

## Awards and Recognitions

2021 – present	Recipient of a Chinese government International Postdoctoral Exchange Talent- Introduction Program (博士后国际交流计划引进项目) grant
2021	Nominated for the CMS Blair Spearman Doctoral Prize and CAIMS Cecil Dis- sertation Award by the University of Toronto Mathematics Department
2010	David Peak Award, Utah State University Physics Department
2010	Offered Connaught Fellowship, University of Toronto; declined, pursuing studies at Cambridge instead
2010	Awarded US National Science Foundation Graduate Research Fellowship (held for five years, $2010 - 2015$ )
2007, 2009	Honorable Mention, National Science Foundation Graduate Research Fellowship competition

2005 - 2007	Outstanding Undergraduate Award, Mathematics Department, Utah State University (annually, each year)
2004 - 2007	Neville and Annie Hunsaker Scholarship, Mathematics Department, Utah State University
2004 - 2007	Undergraduate Research Fellowship, Utah State University

#### Other Experience

2009 - present	Served in various official and unofficial capacities in English- and Mandarin-
	speaking congregations of the Church of Jesus Christ of Latter-day Saints in the
	United States, England, Canada, and China (government-approved, English-
	speaking congregations only). Service included teaching classes as well as per-
	forming other pastoral and administrative duties.

- 2008 present Extensive experience in English-Mandarin and Mandarin-English interpretation, both simultaneous (meetings/conferences, including remote interpretation) and consecutive.
- 2007 2009 Served a voluntary full-time proselyting mission for the Church of Jesus Christ of Latter-day Saints among the Chinese population of the Toronto, Canada area. Learned to speak Mandarin and to read and write Chinese (traditional and simplified).

#### Languages

English (native), Mandarin (fluent), German (basic). Some acquaintance with Cantonese, Russian, French, Spanish, Hebrew (biblical), Enpinghua.