Jeffrey D. Carlson (he/him)

jeffrey.carlson@tufts.edu

Positions	**Universidade Estadual de Campinas** (UNICAMP) (April 2024–May 2024)
	Visiting scholarship
	Tufts University (January 2023–August 2023)
	Visiting scholarship
	Imperial College London (January 2021–December 2022)
	Research fellowship
	Fields Institute (Spring 2020)
	Western University (Fall 2019)
	Joint postdoctoral fellowship
	University of Toronto (2016–2019)
	Postdoctoral fellowship
	Universidade de São Paulo (USP) (2015–2016)
	Pós-Doutorado de Excelência
	funded through **IMPA** (o Instituto Nacional de Matemática Pura e Aplicada)
	and **CAPES** (a Coordenação de Aperfeiçoamento de Pessoal de Nível Superior)

Education	**Tufts University**
	Ph.D. in Mathematics (2015)
	Advisor: Loring W. Tu
	Dissertation: *On the equivariant cohomology of homogeneous spaces*

Citizenship	United States

Interests	Equivariant topology: cobordism, K-theory, and Borel cohomology
	Topology and geometry of group actions on manifolds
	A_∞-algebras
	Symplectic geometry
	Galois cohomology
	Low-dimensional topology and surface dynamics

Funding	Heilbronn Focused Research Grant: *Koszulity and formality in Galois cohomology*

Invited research visits	National Center for Theoretical Sciences at National Taiwan University (April–May 2017)

Selected invited conference talks	*[To be announced]*, Workshop on Toric Topology, **Fields Institute, Toronto** (Aug. 2024)
	The topology of Gelfand–Zeitlin fibers, Workshop on Lie Groups, Singular Spaces, and Higher Structures, **Fields Institute, Toronto** (Jan. 2023)
	The topology of Gelfand–Zeitlin fibers, AMS Special Session on Integrable Systems and Symplectic Group Actions, **Joint Mathematics Meetings, Boston** (Jan. 2023)
	The topology of Gelfand–Zeitlin fibers, Gone Fishing 2020–2022, **Georgia Southern University, Savannah, Georgia** /online (Apr. 2022)
	Multiplicative collapse in the Eilenberg–Moore spectral sequence, **Transpennine Topology Triangle, UK**/online (Dec. 2020)

The cohomology of Gelfand–Zeitlin fibers,
International Conference: Topology and Geometry of Group Actions, **Higher School of Economics, Moscow**/online (Nov. 2020)

Realization of torus representations as fixed-point data,
Workshop on Polyhedral Products in Homotopy Theory, **Fields Institute, Toronto** (Jan. 2020)

Local integration in equivariant cobordism theory,   "Topology" session,
The equivariant K-theory of a cohomogeneity-one action,
                    "Equivariant methods in differential and algebraic geometry" session,
Canadian Mathematical Society Summer Meeting, Regina, Saskatchewan (June 2019)

The equivariant cohomology and K-theory of a cohomogeneity-one action,
Algebraic Topology, Combinatorics, and Mathematical Physics, on the occasion of Victor Buchstaber's 75th birthday, **Steklov Institute** and **Skolkovo Technical Institute, Moscow** (May 2018)

Equivariant formality beyond Hamiltonian actions,
Mathematical Congress of the Americas, Montreal (July 2017)

Equivariant formality in rational cohomology and K-theory,
Conference on Geometry in Algebra and Algebra in Geometry,
Universidade de São Paulo (Nov. 2015)

Selected invited seminar talks

A topologia da fibra de Gelfand–Zeitlin,
Seminário de Geometria, **Universidade Estadual de Campinas (Unicamp), SP, Brazil** (May 2024)

Biquotients and a product on the two-sided bar construction,
International Polyhedral Products Seminar, **Princeton**/online (Oct. 2023)

Products on Tor,
Algebraic topology seminar, **University of Warwick** (Mar. 2023)

The topology of Gelfand–Zeitlin fibers,
Interactions between symplectic geometry, combinatorics, and number theory seminar,
Universität zu Köln/Philipps-**Universität Marburg**/online (Nov. 2022)

The topology of Gelfand–Zeitlin fibers,
Topology seminar, Heinrich-Heine-**Universität Düsseldorf** (Oct. 2022)

Equivariant formality of isotropy actions and products of spheres,
Geometry, topology, and group theory seminar, Westfälische Wilhelms-**Universität Münster** (Oct. 2022)

The topology of the Gelfand–Zeitlin fiber,
International Polyhedral Products Seminar, **Princeton**/online (Apr. 2022)

The topology of the Gelfand–Zeitlin fiber,
Symplectic Monday, **IBS Center for Geometry and Physics, Pohang, Korea**/online (Dec. 2021)

The topology of the Gelfand–Zeitlin fiber,
London Geometry and Topology Seminar, **Imperial College London** (Dec. 2021)

Products on Tor, homogeneous spaces, and Borel cohomology,
Topology seminar, **University of Rochester**/online (Nov. 2021)

The topology of the Gelfand–Zeitlin fiber,
Differential geometry and topology seminar, **University of Cambridge** (Nov. 2021)

Biquotients and a product on the two-sided bar construction,
Algebraic topology seminar, **Universidad Nacional Autónoma de México**/online (May 2021)

Multiplicative collapse in the Eilenberg–Moore spectral sequence,
Algebraic topology seminar, **University of Michigan**/online (Apr. 2021)

The K-theory of an isotropy action and an unsolved problem in polynomial rings (in Portuguese),

Seminário Salomônico, **Universidade Federal Fluminense, Niterói, RJ, Brazil** (August 2019)

Equivariant formality, K-theory, and isotropy,
Topology seminar, **University of Rochester** (October 2018)

Cohomogeneity-one actions and a little-remarked structure on the Mayer–Vietoris sequence,
Symplectic seminar, **University of Toronto** (March 2017)

Equivariant formality in rational cohomology and K-theory,
Geometry and topology seminar, **Western University, London, ON, Canada** (December 2016)

Equivariant formality of isotropy actions in rationalized cohomology and K-theory,
Seminário de física matemática, **IMPA, Rio de Janeiro** (May 2016)

Some contributed talks in colorful locations	*Products on Tor*,

Products on Tor,
Algebraic Topology, in Memory of Hans-Joachim Baues,
Max Planck Institute for Mathematics, Bonn (Oct. 2022)

Products on Tor, homogeneous spaces, and Borel cohomology,
Algebraic structures in topology, **San Juan, Puerto Rico** (May–June 2022)

Realization of fixed-point data for locally standard torus actions,
Glances@Manifolds, **Jagiellonian University, Kraków** (July 2018)

Formality and equivariant formality for isotropy actions (in Portuguese),
XX Encontro Brasileiro de Topologia,
Universidade Tecnológica Federal do Paraná, Curitiba, PR, Brazil (July 2016)

Teaching

Course coordinator and lecturer,

- Commutative Algebra (Imperial College London),
- Vector Calculus (University of Toronto, four semesters, **supervising** an undergraduate TA),
- Mathematics of Social Choice (Tufts University)

Seminar coordinator and lecturer,

- Formality (Western University),
- Equivariant Cohomology (Universidade de São Paulo)

Lecturer,

- Calculus (University of Toronto & Tufts University, three semesters),
- Finite Mathematics (Tufts University)

Reading group facilitator,

- *Foundations of Algebraic Geometry* (Western University)
  (mentor, Directed Reading Program in Mathematics),
- Topologia Diferencial (Universidade de São Paulo)

Teaching assistant (all at Tufts University),

- Differential Forms in Algebraic Topology,
- Mathematical Neuroscience,
- History of Mathematics,
- Number Theory,
- Complex Analysis,
- Real Analysis I & II

Tutor for eight students, ranging from Year 1 to M.S. (Imperial College London, 2021–2022)

Fellow of the Graduate Institute for Teaching (Tufts University, Summer 2010)

Memberships	Association for Women in Mathematics (AWM)

Service   **Organizer**, Special Session on Equivariant Cohomology,
AMS Spring Eastern Virtual Sectional Meeting (2022, with Loring W. Tu)

"Equivariant geometry and topology" session,
CMS Winter Meeting, Niagara, Ontario (2016, with Elisheva Adina Gamse).

Referee, seven venues including *Trans. Amer. Math. Soc.*, *J. Differential Geom.*, and *J. Topol.*

My version of refereeing involves following through and verifying every detail of each argument, generates several pages of commentary, and requires at least a week for a first pass, with less time spent on each subsequent revision.

Quick opinions, *Trans. Amer. Math. Soc.* and *J. Reine Angew. Math.*

Reviewer, *Mathematical Reviews*.

Editorial board, Poincaré Institute for Mathematics Education, Summer 2013
The Poincaré Institute is an NSF-funded collaboration between Tufts University and the non-profit Technical Education Research Centers designed to improve middle school mathematics education through graduate-level online courses offered to in-service middle school mathematics teachers.

(Copy)edited books and articles

I often provided feedback on papers and particularly texts I read. My approach is rather thorough and sometimes leads to what I like to consider significant improvement. For example, Prof. Tu had this to say in the preface to the second edition of *An Introduction to Manifolds*:

> Every author needs an audience. In preparing the second edition, I was particularly fortunate to have a loyal and devoted audience of two, George F. Leger and Jeffrey D. Carlson, who accompanied me every step of the way. Section by section, they combed through the revision and gave me detailed comments, corrections, and suggestions. In fact, the two hundred pages of feedback that Jeff wrote was in itself a masterpiece of criticism. Whatever clarity this book finally achieves results in a large measure from their effort.

by Loring Tu (selected)

- *Introductory Lectures on Equivariant Cohomology*, Annals of Math. Studies 204, Princeton Univ. Press, Princeton, New Jersey, 2020.
- *Elements of Equivariant Cohomology*, with Raoul Bott, unpublished.
- *Differential Forms in Algebraic Topology*, 2nd edition, with Raoul Bott, edition in progress.
- *Differential Geometry: Connections, Curvature, and Characteristic Classes*, Grad. Texts in Math. 275, Springer, New York, 2017.
- *An Introduction to Manifolds*, [first and] second edition, Universitext, Springer, New York, 2011.
- Raoul Bott: *Collected Papers*, volume 5 [collection of permissions], Birkhäuser, Basel, 2017.
- From sheaf cohomology to the algebraic de Rham theorem (with Fouad El Zein), pp. 69–121 in *Hodge Theory*, eds. Eduardo Cattani, Fouad El Zein, Phillip A. Griffiths, and Lê Dũng Tráng, Princeton Univ. Press, Princeton, New Jersey, 2014.
- Computing characteristic numbers using fixed points, in *A Celebration of the Mathematical Legacy of Raoul Bott*, CRM Proceedings and Lecture Notes, vol. 50, American Mathematical Society, Providence, RI, 2010, pp. 185–206.

by others

- *Mathematical Logic and Computation*, Jeremy Avigad, Cambridge University Press, 2022.
- *An Introduction to Modeling Neuronal Dynamics*, Christoph Börgers, Texts in Applied Mathematics vol. 66, Springer, New York, 2017.
- *A Primer on Mapping Class Groups*, Benson Farb and Dan Margalit, Princeton Mathematical Series vol. 49, Princeton University Press, Princeton, NJ, 2011.
- *Category Theory*, Steven Awodey, Oxford Logic Guides vol. 52, Oxford Univ. Press, New York, 2006.
- *Computability and Learnability*, Kevin Kelly, unpublished.
- An introductory text on the calculus of variations, William Hrusa, unpublished.

Languages	English: native (polished if ornate, a byproduct of formal overeducation)
	Portuguese: fluent at the level of the news, but not of poetry
	Mandarin: basic conversation (but worsening accent), menu comprehension

References (research)

Loring W. Tu, Professor
Department of Mathematics
Tufts University
177 College Avenue
Medford MA 02155
USA
loring.tu@tufts.edu

James Stasheff, Professor Emeritus
University of North Carolina at Chapel Hill
University of Pennsylvania
Department of Mathematics
209 South 33rd Street
Philadelphia, PA 19104-6395
USA
jds@math.upenn.edu

Yael Karshon, Professor
Department of Mathematics
University of Toronto
40 St. George Street
Toronto ON M5S 2E4
Canada
karshon@math.toronto.edu

Michael A. Hill, Professor
Department of Mathematics
University of California Los Angeles
Box 951555
Los Angeles, CA 90095-1555
USA
mikehill@math.ucla.edu

Ján Mináč, Professor
Department of Mathematics
Western University
Middlesex College
London ON N6A 5B7
Canada
minac@uwo.ca

Oliver Goertsches, Professor
Fachbereich Mathematik und Informatik
Philipps-Universität Marburg
Hans-Meerwein-Straße 6
35032 Marburg
Deutschland
goertsch@mathematik.uni-marburg.de

Matthias Franz, Professor
Department of Mathematics
Western University
Middlesex College
London ON N6A 5B7
Canada
mfranz@uwo.ca

References (teaching)

Kim Ruane, Professor and Chair
Department of Mathematics
Tufts University
177 College Avenue
Medford MA 02155
USA
kim.ruane@tufts.edu

Ilia Binder, Professor
Department of Mathematics
University of Toronto
40 St. George Street
Toronto ON M5S 2E4
Canada
ilia@math.toronto.edu

Books		
	1.	*The Rational Cohomology of Homogeneous Spaces* `jdkcarlson.github.io/homog_book.pdf` (**under revision for Springer's *Developments in Mathematics* series**, 155pp., 2018).
	2.	Solutions to *Introduction to Commutative Algebra* by Atiyah–MacDonald (2011, revised 2021, 134pp.) `jdkcarlson.github.io/intro_comm_alg(2021).pdf`

Preprints		
	1.	Products on Tor `arxiv.org/abs/2311.16007` (submitted, 2022, 23pp.)
	2.	A ring structure on Tor `arxiv.org/abs/2306.04860` (**under revision for *Forum Math. Sigma***, 2022, 44pp.)
	3.	The topology of Gelfand–Zetilin fibers `arxiv.org/abs/2107.02721` (submitted, 2021, 39pp., with Jeremy Lane)
	4.	Fixed points and semifree bordism `arxiv.org/abs/1908.06906` (submitted, 2019, 13pp.)
	5.	The K-theory of cohomogeneity-one actions `arxiv.org/abs/1805.00502` (**under revision for *Adv. Math.***, 2018, 40pp.)
	6.	Realization of abstract GKM isotropy data `jdkcarlson.github.io/realization.pdf` (2016–, with Elisheva Adina Gamse and Yael Karshon)
	7.	Commensurability of two-multitwist pseudo-Anosovs `arxiv.org/abs/1011.0247` (2010, 33pp.)

Publications		
	1.	The cohomology of homogeneous spaces in historical context `jdkcarlson.github.io/conf.pdf` (**to be published in *Contemp. Math.*** volume *Group Actions and Equivariant Cohomology*, 2023, 33pp.)
	2.	Equivariant formality of corank-one isotropy actions `arxiv.org/abs/2204.00135` and products of rational spheres (**to be published in *Math. Z.***, 2022, 45pp., with Chen He)
	3.	The cohomology of biquotients `arxiv.org/abs/2106.02986` via a product on the two-sided bar construction (**to be published in *Algebr. Geom. Topol.***, 2020, 48pp., appendix joint with Matthias Franz)
	4.	K-theory and formality `arxiv.org/abs/1810.09685` (***Int. Math. Res. Not.***, 2022, 46pp.)
	5.	Grassmannians and the equivariant cohomology of isotropy actions `arxiv.org/abs/1611.01175` (***Proc. Amer. Math. Soc.***, 2021, 15pp.)
	6.	The K-theory of the conjugation action `arxiv.org/abs/2312.00049` (***C. R. Math. Acad. Sci., Paris***, 2021, 2pp.)
	7.	The equivariant cohomology ring of a cohomogeneity-one action `arxiv.org/abs/1802.02304` (***Geom. Dedicata***, 2019, 18pp., with Chen He, Oliver Goertsches, and Liviu Mare)
	8.	Equivariant formality of homogeneous spaces `arxiv.org/abs/1511.06228` (***J. London Math. Soc.***, 2018, 23pp., with Chi-Kwong Fok)
	9.	Equivariant formality of isotropic torus actions `arxiv.org/abs/1410.5740` (***J. Homotopy and Relat. Struct.***, 2018, 34pp.)
	10.	Conceptions of topological transitivity `arxiv.org/abs/1108.4710` (***Topology Appl.***, 2012, 15pp., with Ethan Akin)