Carl McTague

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first dot last name at bc dot edu

Academic Positions.

- Boston College, Computer Science (USA):
  - Assistant Professor of the Practice (2022–present).
  - Visiting Assistant Professor (2019–22).
- Visiting Assistant Professor of Mathematics at the University of Rochester (USA) (2015–9).
- Johns Hopkins University, Baltimore (USA):
  - JJ Sylvester Assistant Professor of Mathematics (2013–5).
  - Lecturer in Mathematics (2012–3).
- Research Fellow (funded by EPSRC) at the University of Southampton (UK) (2011–2).
- Postdoc at the Max Planck Institute for Mathematics, Bonn (Germany) (2010–1).

Education.

- Cambridge University (UK).
  - PhD in Pure Mathematics under the supervision of Burt Totaro (2006–10).
    Thesis: *Generalizations of Elliptic Genera*.
  - Part III of the Mathematical Tripos with Distinction (2004–5).
- University of Cincinnati (USA).
  - BA in Composition, College Conservatory of Music (CCM) (2000–4).
    Electroaccoustic focus under Mara Helmuth and Christopher Bailey.
  - BA in Mathematics, College of Arts and Sciences (1999–2004).
- Walnut Hills High School, Cincinnati (USA) (1993–9).

Publications.

- Differentials Propagating through a Hall of Mirrors: A New Algorithm for Computing the Algebraic EHP Sequence, in preparation.
- An Efficient Data Structure for the Steenrod Algebra and Related Algebras, in preparation.
- Formal Verification of a New Algorithm for Computing the Algebraic EHP Sequence, in preparation.
- String Cobordism at the Prime 3, with Vitaly Lorman and Doug Ravenel, in preparation.
- A New Approach to Euler Calculus for Continuous Integrands, arXiv:1511.00257.
- On the Greatest Common Divisor of Binomial Coefficients $\binom{n}{q}, \binom{n}{2q}, \binom{n}{3q}, \ldots$, arXiv:1510.06696, *Amer. Math. Monthly* 124-4 (2017) 353–356.
- Shrinking the Fibers of a Submersion Splits the Riemann Tensor, arXiv:1504.04298.
- tmf Is Not a Ring Spectrum Quotient of String Bordism, arXiv:1312.2440, *Contemp. Math.*, 707 (2018) 67–76.
- The Cayley Plane and String Bordism, arxiv:1111.4520, *Geometry & Topology* 18-4 (2014) 2045–2078.
- The Cayley Plane and the Witten Genus, arxiv:1006.0728.
- Stiefel-Whitney Numbers for Singular Varieties, arxiv:1004.4348, *Math. Proc. Camb. Phil. Soc.* 150 (2011) 273–289.
- Stratified Morse Theory, unpublished expository essay, available from website.
- with JP Crutchfield, Automated Pattern Detection—An Algorithm for Constructing Optimally Synchronizing Multi-Regular Language Filters, arxiv:cs/0410017, *Theoretical Computer Science* 359 (2006) 306–328.

- with DP Feldman and JP Crutchfield, The Organization of Intrinsic Computation: Complexity-Entropy Diagrams and the Diversity of Natural Information Processing, arxiv:0806.4789, *Chaos* 18(4), Dec 2008, 59–73.

Honors and Awards.

- Cambridge Philosophical Society Research Studentship (2009).
- Lundgren Research Award, Cambridge University (2009).
- Smith/Rayleigh-Knight essay prize, Cambridge University (2008).
- *NSF Graduate Research Fellowship* (2005–10).
- Bursary from the Cambridge Overseas Trusts (2004–5, 2006–9).
- *Fulbright Scholar* at Ruprecht-Karls-Universität Heidelberg, Germany (2005–6).
- Tutorial Prize from St Edmund's College, Cambridge (2005).
- McKibbin Medal for Manliness (essentially *co-valedictorian* of Uni Cincinnati College of Arts and Sciences) (2004).
- Phi Beta Kappa (2004).
- Alternate for *Marshall Scholarship* (2003).
- *Goldwater Scholar* (2002–4).
- Uni Cincinnati Math Department Awards: Gulden and Kieval Scholarships (2003, 2004); Hancock Scholarship (2002); and Kieval Scholarship (2001).
- Uni Cincinnati Greenholz Scholarship (2001), Medical/Engineering Dual Admissions Full Scholarship (1999–2002), Cincinnatus Scholarship (1999–2003).

Teaching Experience.

- Boston College
  - Logic & Computation, Randomness & Computation, Data Structures, Formal Methods, and Reinforcement Learning.
- University of Rochester
  - Calculus, Linear Algebra, Differential Equations, Complex Analysis, Transition to Higher Math, Topology, Mathematics of Politics.
- Johns Hopkins University
  - Linear Algebra, Differential Equations, Honors Multivariable Calculus, Honors Analysis, Knot Theory.
- Supervised calculus tutorials for a self-paced course for computer science undergraduates and a conventional lecture course for math undergraduates for the Uni. Southampton (2011–2).
- Supervised Part II Algebraic Topology (2006,7,8,10) and Representation Theory (2009) for Trinity, Trinity Hall and several other Cambridge colleges.

Research Experience prior to PhD.

- Studied intersection cohomology with Markus Banagl, Uni Heidelberg (2005–6).
- Studied spatially extended dynamical systems with Jim Crutchfield, Santa Fe Institute:
  - Graduate Fellow, Santa Fe Institute (Summer 2004).
  - Visiting Researcher, Santa Fe Institute (Summers 2002 and 2003).
  - NSF "REU" Undergraduate Intern, Santa Fe Institute (Summer 2001).
- Data Analysis for Gene Somoza, Medications Development Research Unit, Cincinnati, funded by the National Institute on Drug Abuse (Part-Time) (1997–9).

Activities.

- Reviewer for Oxford and Princeton University Presses.
- Co-organized Rochester Topology Seminar (2017–9).

- Computed the Hirzebruch L-polynomials L_n for $n = 6, \ldots, 14$ (expressing the signature of a $4n$-dimensional manifold in terms of its Pontrjagin numbers). L_{14} required two days to compute on the Uni Rochester supercomputer. Added these polynomials to Wikipedia and the Online Encyclopedia of Integer Sequences [OEIS:A237111], along with code to compute them (2014).
- Co-organized the Hopkins Topology Seminar (2014–5).
- Independent projects in computer music (1994–present).
- Independent projects in bookbinding including conception, creation & free online distribution of software to improve bookbinding practice (2010–present).
- Designed equations & commutative diagrams for Swiss luxury watchmaker Concord's world-wide advertising campaign. Work has appeared in ads worldwide including large color ads in the *Financial Times* & *The Economist* (2007–9).
- My photograph of Andreu Alfaro's sculpture *Lebenskraft* was displayed at the Museum of Mathematics in NYC and included on a DVD sold at the gift shop (2012).
- Co-organized the Cambridge Graduate Geometry Tea lecture series (2008–10).
- Trinity Hall Graduate Society Computing Officer (2006–8).
- Studied with West Clare fiddle master Kevin Crehan (2002–3).
- Taught Irish fiddle at the Riley School of Irish Music, Cincinnati (1998–2003).

Skills.

- Fluent in German (1988–present). Four years of Latin in Junior/High School (1993–6).
- Programming Languages: Axiom, C, C++, *Coq*, GAP, *Go*, *Haskell*, Java, *JavaScript*, *JAX*, LaTeX, Lean4, Macaulay 2, *Mathematica*, Maxima, *OCaml*, Perl, SQL, Postscript, Python, *Rust*, Scheme, *SuperCollider*.
- Online learning platforms enthusiastically used: Cocalc, Gradescope, and Webwork.
- Lecture video production software: DaVinci Resolve.

Research Talks.

- Mathematics Colloquium and Topology Seminar at Wayne State Uni (February 2018).
- Mathematics Colloquium at Reed College (September 2017).
- Invited talk at AMS Sectional Meeting, Buffalo (September 2017).
- Topology Seminar at Uni Rochester (September 2017).
- Contributed talk to *Homotopy Theory: Tools and Applications* at UIUC (July 2017).
- Topology Seminar at Johns Hopkins University (May 2017).
- Applied Topology Seminar at Brown University (April 2017).
- Topology Seminar at Uni Rochester (Sept 2015).
- Topology Seminars at Uni Regensburg and Wuppertal (July 2015).
- Three invited lectures at 'Flavors of Cohomology' workshop, Uni Pittsburgh (June 2015).
- Invited Speaker at IU/PU/IUPUI Joint Topology Seminar, Indianapolis (April 2015).
- Invited talk at 48th Spring Topology and Dynamics Conference, Uni Richmond (March 2014).
- Hopkins Undergraduate Math Club talk about my work on bookbinding (November 2013).
- Algebraic Topology Seminar, Princeton University (October 2013).
- Topology Seminar, Johns Hopkins University (September 2012).
- Contributed talk to ATMCS 5, Edinburgh, *A New Approach to Euler Calculus for Continuous Integrands* (July 2012).
- Mathematical Physics Seminar, ETH Zürich (October 2011).
- Differential Geometry Seminar at Uni Augsburg (November 2010).
- Differential Geometry Seminar at Uni Munich (November 2010).
- Topology Seminar at Max Planck Institute for Mathematics in Bonn (October 2010).
- Topology Seminar at Uni Manchester (March 2010).

- Topology Seminar at Uni Sheffield (October 2009).
- Topology Seminar at Uni Edinburgh (October 2009).
- Invited to present a concert of my computer music (including the premiere of *In Medias Res*) at the *Centro Nacional de las Artes* in Mexico City as part of *Encuentro Internacional de Ciencia y Arte* (October 2009).
- Cambridge-Oxford-Warwick Junior Algebraic Geometry (Calf) Seminar, Cambridge (May 2009).
- Graduate Homotopy Theory Conference, Cambridge (December 2007).
- Work in Progress Seminar, Cambridge (October 2006).
- Fulbright Seminar, Berlin (March 2006).
- Seminar Talk at Max Planck Institute for Mathematics in the Sciences, Leipzig (November 2005).
- Seminar Talk to Dynamics of Learning Research Group, Santa Fe Institute (August 2004).
- Invited Keynote Speech, *International Mathematica Symposium*, Imperial College London, *Music Through Computation* (July 2003).
  - Earlier versions of the talk were given both at the Complex Systems Summer School's special session on music and complexity at St. John's College, Santa Fe, and as a Uni Cincinnati Mathematics Colloquium (both June 2003).
- Mathematics Colloquium at Uni Cincinnati (October 2001).

Expository Talks.

- Talks in Equivariant Homotopy Theory Seminar, Uni Rochester (Spring 2016).
- Talk on Dürer's engraving *Melencolia I* (1514) in Rochelle Tobias's seminar in the German dept at Hopkins (May 2013).
- *The Cell Lemma*, Kervaire Invariant One Seminar, Uni Bonn (November 2010).
- *The Image of* $\mathrm{H}_*\mathrm{BU}\langle 6\rangle$ *in* $\mathrm{H}_*\mathrm{BU}$, Graduate Geometry Tea (July 2010).
- *The Adams Spectral Sequence*, Cambridge Graduate Geometry Tea (May 2010).
- *Plumbing: How to use* E_8 *to construct exotic spheres*, Grantchester Lectures on Punts, Exceptional Cambridge Graduate Geometry Tea on the river Cam (July 2009).
- *How to use basic representation theory of finite groups to construct maximal vector fields on spheres*, Cambridge Graduate Geometry Tea (March 2009).
- *Characteristics Classes of Homogeneous Spaces*, Cambridge Graduate Geometry Tea (November 2008).
- *Al-Khwārizmī, The Father of Algebra*, Millennium Mathematics Project (December 2007).
- *Thom's Construction of L-classes via Maps to Spheres and its Generalization to Singular Spaces*, Topology Seminar, Uni Heidelberg (June 2006).
- *The Piecewise Linear DeRham Theorem*, Topology Seminar, Uni Heidelberg (June 2006).
- *The Todd Genus and its Role in the Hirzebruch-Riemann-Roch Theorem*, Topology Seminar, Uni Heidelberg (November 2005).
- *Stratified Morse Theory*, Part III Seminar, Cambridge (March 2005).
- *An Introduction to Intersection Homology*, Part III Seminar, Cambridge (December 2004).
- *The Generalized Atiyah-Hirzebruch Spectral Sequence and the Uniqueness of Cohomology Theories Satisfying the Dimension Axiom*, Topology Seminar, Uni Cincinnati (May 2004).
- *Whitney Stratificiations*, Topology Seminar, Uni Cincinnati (February 2004).
- *Pontrijagin Classes and Numbers*, Topology Seminar, Uni Cincinnati (December 2003).

Articles about my Music.

- *Undergrad's Work Mixes Math and Music* by Professor Joanna Mitro, *The Right Angle* (UC Math Department's Newsletter) (2003).
- *Math-Music Whiz Invited to International Symposium* by Marianne Kunnen-Jones, UC Public Relations, www.uc.edu/news/NR.asp?id=622 (2003).

- *6 Integers: Making Music with Mathematica* by Maryka Baraka, Wolfram Research, www.wolfram.com/mathematica/customer-stories/6-integers-is-a-mathematica-generated-musical-composition.html (1999).