

# CARL M<sup>c</sup>TAGUE

www.mctague.org/carl

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## Academic Positions.

- Research Fellow (funded by EPSRC) at the University of Southampton (UK) (2011–present).
- Postdoc at the Max Planck Institute for Mathematics, Bonn (Germany) (2010–2011).

## 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 Mathematics, College of Arts and Sciences (1999–2004).
  - BA in Composition, College Conservatory of Music (CCM) (2000–4).
- Walnut Hills High School, Cincinnati, Ohio (1993–9).

## Publications.

- *The Cayley Plane and String Bordism*, arxiv:1111.4520.
- *The Cayley Plane and the Witten Genus*, arxiv:1006.0728.
- *Stiefel-Whitney Numbers for Singular Varieties*, *Math. Proc. Camb. Phil. Soc.* 150 (2011), 273–289. arxiv:1004.4348, doi:10.1017/S0305004110000630.
- *Stratified Morse Theory*, unpublished expository essay, <http://www.mctague.org/carl/math/stratified-morse-theory/stratified-morse-theory.pdf>.
- *Automated Pattern Detection—An Algorithm for Constructing Optimally Synchronizing Multi-Regular Language Filters*, with JP Crutchfield, *Theoretical Computer Science* 359 (2006), 306–328. arxiv:cs/0410017, doi:10.1016/j.tcs.2006.05.002.
- *The Organization of Intrinsic Computation: Complexity-Entropy Diagrams and the Diversity of Natural Information Processing*, with DP Feldman and JP Crutchfield, *Chaos* 18(4), Dec 2008, 59–73. arxiv:0806.4789, doi:10.1063/1.2991106.

## 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 (essentially *co-valedictorian* of University of Cincinnati College of Arts and Sciences) (2004).
- Phi Beta Kappa (2004).
- Alternate for *Marshall Scholarship* (2003).
- *Goldwater Scholar* (2002–4).
- University of Cincinnati Mathematics Department Awards: Gulden and Kieval Scholarships (2003, 2004); Hancock Scholarship (2002); and Kieval Scholarship (2001).
- University of Cincinnati Greenholz Scholarship (2001), Medical / Engineering Dual Admissions Full Scholarship (1999–2002), Cincinnati Scholarship (1999–2003).

### Teaching Experience.

- 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, Universität 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.

- Co-organized the Cambridge Graduate Geometry Tea lecture series (2008–10).
- Designed equations and commutative diagrams for Swiss luxury watchmaker Concord’s worldwide advertising campaign (see [www.concord.ch](http://www.concord.ch)). Work has appeared in ads worldwide including large color ads in the Financial Times & The Economist (2007–9).
- 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).
- Independent projects in computational music (1994–present).

### Skills.

- Fluent in German (1988–present). Four years of Latin in Junior/High School (1993–6).
- Programming Languages: Axiom, C, C++, *Haskell*, Java, Javascript,  $\text{\LaTeX}$ , *Macaulay 2*, *Mathematica*, Maxima, *Perl*, SQL, Postscript, Scheme, SuperCollider.

### Research Talks.

- *The Cayley Plane and String Bordism*, Mathematical Physics Seminar, ETH Zürich, (October 2011).
- *The Cayley Plane and the Witten Genus*, Seminars at the Universities of Sheffield & Edinburgh (October 2009), the University of Manchester (March 2010), the Max Planck Institute for Mathematics in Bonn (October 2010), and the Universities of Munich & Augsburg (November 2010).
- Invited to present a concert of my computer music at the *Centro Nacional de las Artes* in Mexico City as part of *Encuentro Internacional de Ciencia y Arte* (October 2009).
- *The Cayley Plane Genus*, Cambridge-Oxford-Warwick Junior Algebraic Geometry (Calf) Seminar, Cambridge (May 2009).
- *Elliptic Cohomology Equals Bordism Modulo Flops*, Graduate Homotopy Theory Conference, Cambridge (December 2007).
- *When Does a Singular Space Have a Signature?* Work in Progress Seminar, Cambridge (October 2006).
- *Characteristic, Signature, and Singularity*, Fulbright Seminar, Berlin (March 2006).
- *Automated Pattern Analysis of Cellular Automata*, Max Planck Institute for Mathematics in the Sciences, Leipzig (November 2005).
- *The Multi-Regular Language Filtering Problem*, Dynamics of Learning Research Group, Santa Fe Institute (August 2004).

- *Music through Computation*, Invited Keynote Speech, *International Mathematica Symposium*, Imperial College London (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 UC Mathematics Department Colloquium Lecture (both June 2003).

- *Cellular Automata as Operators on Regular Language Space*, special lecture in the UC Mathematics Department Colloquium Series (October 2001).

### Seminar Talks.

- *The Cell Lemma*, Kervaire Invariant One Seminar, Universität Bonn (November 2010).
- *The Image of  $H_*BU(6)$  in  $H_*BU$* , Graduate Geometry Tea (July 2010).
- *The Adams Spectral Sequence*, Graduate Geometry Tea (May 2010).
- *Plumbing: How to use  $E_8$  to construct exotic spheres*, Grantchester Lectures on Punts, Exceptional 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*, Graduate Geometry Tea (March 2009).
- *Characteristics Classes of Homogeneous Spaces*, Graduate Geometry Tea (November 2008).
- *Al-Khwārizmī, The Father of Algebra*, Millenium Mathematics Project (December 2007).
- *Thom's Construction of L-classes via Maps to Spheres and its Generalization to Singular Spaces*, Topology Seminar, Mathematics Institute, Universität Heidelberg (June 2006).
- *The Piecewise Linear DeRham Theorem*, Oberseminar Topologie, Mathematics Institute, Universität Heidelberg (June 2006).
- *The Todd Genus and its Role in the Riemann-Roch-Hirzebruch Theorem*, Topology Seminar, Mathematics Institute, Universität Heidelberg (November 2005).
- *Stratified Morse Theory*, Part III Seminar, DPMMS, Cambridge University (March 2005).
- *An Introduction to Intersection Homology*, Part III Seminar, DPMMS, Cambridge University (December 2004).
- *The Generalized Atiyah-Hirzebruch Spectral Sequence and the Uniqueness of Cohomology Theories Satisfying the Dimension Axiom*, University of Cincinnati Topology Seminar (May 2004).
- *Whitney Stratifications*, University of Cincinnati Topology Seminar (February 2004).
- *Pontrijagin Classes and Numbers*, University of Cincinnati Topology Seminar (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, <http://www.uc.edu/news/NR.asp?id=622> (2003).
- *6 Integers: Making Music with Mathematica* by Maryka Baraka, Wolfram Research, <http://www.wolfram.com/news/mctague.html> (1999).