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Scott Morrison - Resume

Employment

Miller Fellowship, UC Berkeley.

July 2009-present. I am a Miller Fellow at UC Berkeley, in the mathematics department. Please see my research statement for a description of my current interests.

Post-doctoral research, Microsoft Station Q.

April 2007-June 2009. Station Q is a multidisciplinary research group, focusing on *topological quantum computing*. The research interests of the group cover *condensed matter physics*, especially topological phases and the fractional quantum hall effect, and *quantum topology*, a field of mathematics describing topological quantum field theories (TQFTs) and their applications. During my stay at Station Q, my research was primarily on *extensions of TQFT* which introduce ideas from homological algebra, and on *the classification of TQFTs* related to von Neumann algebras and quantum groups.

Education

University of California, Berkeley, Doctor of Philosophy (Mathematics).

2001-2007. Worked with Prof. Vaughan Jones. Received the 2007 Herbert Alexander Prize for Outstanding Dissertation in Pure Mathematics. Received the Outstanding Graduate Student Instructor Award, 2004.

University of New South Wales, Bachelor of Science (Hons.)

1998-2001, Sydney, Australia. First class honours in Mathematics, and the University Medal.

Publications

——2010——

The blob complex

Joint with Kevin Walker. Submitted to *Geometry & Topology*, available at arXiv:1009.5025.

Subfactors of index less than 5, part 2: quadratic tangles and triple points

Joint with David Penneys, Emily Peters and Noah Snyder. Available at arXiv:1007.2240.

Subfactors of index less than 5, part 1: the principal graph odometer

Joint with Noah Snyder. Available at arXiv:1007.1730.

Cyclotomic integers, fusion categories, and subfactors

Joint with Frank Calegari and Noah Snyder, with an appendix by Victor Ostrik. To appear *Communications in Mathematical Physics*, available at arXiv:1004.0665.

Knot polynomial identities and quantum group coincidences

Joint with Emily Peters and Noah Snyder. To appear *Quantum Topology*, available at arXiv:1003.0022.

Non-cyclotomic fusion categories

Joint with Noah Snyder. To appear *Transactions of the American Mathematical Society*, available at arXiv:1002.0168.

—–2009—–
Constructing the extended Haagerup planar algebra
Joint with Stephen Bigelow, Emily Peters and Noah Snyder. To appear *Acta Mathematica*, available at `arXiv:0909.4099`.

Man and machine thinking about the smooth 4-dimensional Poincaré conjecture
Joint with Michael Freedman, Robert Gompf and Kevin Walker, *Quantum Topology*, Volume 1, Issue 2 (2010), pp. 171208. Available at `arXiv:0906.5177`.

The braid group surjects onto G_2 tensor space
In press *Pacific Journal of Mathematics*, available at `arXiv:0907.0256`.

—–2008 and earlier—–
Skein theory for the D_{2n} planar algebras
Joint with Emily Peters and Noah Snyder, *Journal of Pure and Applied Algebra* Vol. 214, No. 2 (2010) pp. 117-139. Available at `DOI:10.1016/j.jpaa.2009.04.010` or `arXiv:0808.0764`.

A Diagrammatic Category for the Representation Theory of $U_q(\mathfrak{sl}_n)$
Ph.D. thesis, available at `arXiv:0704.1503`.

Fixing the functoriality of Khovanov homology
Joint with David Clark and Kevin Walker, *Geometry and Topology* 13 (2009) 1499-1582. Available at `DOI:10.2140/gt.2009.13.1499` or `arXiv:math.GT/0701339`.

On Khovanov's cobordism theory for $\mathfrak{su}_3$ knot homology
Joint with Ari Nieh, *Journal of Knot Theory and its Ramifications* Vol. 17, No. 9 (2008). Available at `DOI:10.1142/S0218216508006555` or `arXiv:math.GT/0612754`

The Karoubi Envelope and Lee's Degeneration of Khovanov Homology
Joint with Dror Bar-Natan, *Algebraic & Geometric Topology* 6 (2006) 1459–1469. Available at `DOI:10.2140/agt.2006.6.1459` or `arXiv:math.GT/0606542`.

Classifying Spinor Structures
BSc. honours thesis at UNSW. Available at `arXiv:math-ph/0106007`.

Outreach

I'm a co-founder and moderator of MathOverflow, a website for mathematicians to ask and answer research-level questions. MathOverflow is just over a year old, receives approximately 10000 visits each day, and the 9000 users ask or answer about 30 new questions each day. With Anton Geraschenko and Ravi Vakil, I wrote an opinion piece about MathOverflow for the June 2010 issue of the Notices of the AMS.

Software

FusionAtlas
A Mathematica package for analysing subfactors and fusion categories, with contributions by David Penneys, Emily Peters, Noah Snyder and James Tener. Available online.

Omath
A free implementation of the core Mathematica langauge, joint with Joseph Farjoun. Available from `http://omath.org`.

QuantumGroups
  A Mathematica package for the representation theory of quantum groups, including quantum knot invariants. Available online with a brief tutorial in `arXiv:1003.0022`.

KnotTheory and the Knot Atlas
  A Mathematica package for knot theory, co-maintained with Dror Bar-Natan, with contributions from many people. Available from the Knot Atlas.

Conferences

Quantum Topology in Wellington
  With David Gauld, I organised the Quantum Topology session of a joint NZMS/AMS meeting in Wellington, New Zealand, December 2007.

Subfactors in Maui
  I organised a conference on subfactors and topology in Maui, July 2007.

Teaching

University of California, Berkeley
  Outstanding Graduate Student Instructor Award, 2004. Teaching Assistant for 9 semesters, for MATH 1B (Introductory Calculus), 53 (Multivariable Calculus), 54 (Linear Algebra), 53H (Honors), 54H (Honors), 110 (Linear Algebra), and 121A (Mathematical Methods for the Physical Sciences).

University of New South Wales
  Tutor ("Teaching Assistant") for 2 semesters, introductory calculus.

  My current teaching statement is available online.

Selected talks

Classification of subfactors to index 5
  - *UCLA/DARPA subfactors meeting*, "Subfactors at index 5 and beyond", October 8 2010. (slides)
  - *Quantum groups, Clermont-Ferrand*, September 2 2010.
  - *Operator algebras satellite conference, Chennai*, August 11 2010.
  - *Non-commutative geometry and operator algebras, Vanderbilt*, May 11 2010. (slides)
  - *Fusion Categories at AMS Waco meeting*, "Fusion categories and small index subfactors", October 18 2009. (slides)
  - UC Berkeley Colloquium, "Fusion categories", September 3 2009. (blackboards)
  - UC Riverside Colloquium, "Classifying subfactor planar algebras", June 3 2009.

Blob Homology
  - *Low dimensional topology and categorification, Stony Brook*, June 23 2010. (slides)
  - *TQFT and link homology in Hahei*, January 18 2010.
  - *Homotopy Theory and Higher Algebraic Structures at AMS Riverside meeting*, November 8 2009. (slides and video)
  - Los Angeles Joint Topology Seminar, October 9 2009.
  - UC Riverside, June 3 2009.

- *AMS Annual meeting, Washington DC*, January 6 2009. (slides)
- *Georgia Topology Conference*, May 15 2008.

Extended Haagerup

- *Tensor Categories in Bloomington, Indiana*, "Extended Haagerup exists!", March 22 2009. (slides, video and blog post)

Coincidences of tensor categories

- *Quantum Invariants of 3-manifolds and Modular Categories at St Paul AMS meeting*, April 10 2010.
- *Algebraic Structures in Knot Theory at AMS Riverside meeting*, November 7 2009. (slides)

The Cappell-Shaneson spheres and the s-invariant

- *Knots in Washington* January 9 2009. (slides)
- UC San Diego, topology seminar, December 4 2008. (slides)

Skein theory for the D_{2n} subfactors

- University of Tokyo operator algebras seminar, October 16 2008.
- University of New South Wales, pure mathematics seminar, October 7 2008.
- Pennsylvannia State University, noncommutative geometry seminar, September 16 2008.
- *Planar Algebras and Subfactors* at Vanderbilt, April 18-20 2008.

Khovanov Homology

Introduction

- *MSRI introductory workshop for the link homology semester*, January 25-26 2010. "Khovanov homology II, functoriality, deformations and the s-invariant" (lecture notes, streaming video, video) and "Khovanov homology I" (lecture notes, streaming video, video)
- "Local Khovanov Homology", *Workshop on Geometric Methods in the Topology of 3-Dimensional Manifolds (NZ Mathematics Research Institute)*, Taipa, New Zealand, January 2006. (slides)

Functoriality

- "Functoriality and duality in Khovanov homology", Kyoto, May 23 2007. (notes)
- Columbia, gauge theory seminar, November 17 2006. (slides)
- Invited speaker at *Categorification in Algebra and Topology*, Uppsala, September 7-10, 2006. (slides)
- *Park City Mathematics Institute*, July 3 2006. (slides)
- *Knots in Washington*, May 6 2006. (slides)

4-manifold TQFT invariants

- *TQFT and link homology in Hahei*, January 17 2010
- *Quantum Topology Special Session of the joint NZMS/AMS Wellington meeting*, December 12-15 2007. (slides)
- *Quantum Topology in Hanoi*, Vietnam, August 6-10 2007. (slides)
- *Oporto conference on Link Homology*, Portugal, July 5-8 2007. (slides)

Rational tangles

- *AMS Annual meeting, Washington DC*, January 8 2009. (slides)

SU(3)

- "A topological categorification of $\mathfrak{su}_3$", University of Oregon colloquium, December 4 2006. (slides)
- "A cobordism theory for $\mathfrak{sl}_3$ knot homology", UCSB, topology seminar, April 11 2006. (slides)

Genus bounds

- "Genus bounds and spectral sequences made easy" Kyoto, May 15 2007. (slides)
- UC Davis Student Topology Seminar, February 22 2007.
- UC Berkeley Topology Seminar, February 21 2007.
- UT Austin *Winter School on Knot Theory and Representations*, January 11-14 2007.

Spiders for $U_q(\mathfrak{sl}_n)$

- Station Q Seminar, UC Santa Barbara, October 2 2007. (slides)
- University of Cologne, algebra seminar, November 2005.
- *Quantum Topology AMS Meeting*, Snowbird, Utah, June 2005. (slides)