

CURRICULUM VITAE  
MARC LACKENBY  
SEPTEMBER 2015

lackenby@maths.ox.ac.uk

<http://maths.ox.ac.uk/~lackenby>

Mathematical Institute, University of Oxford

Radcliffe Observatory Quarter, Woodstock Road, Oxford OX2 6GG

Tel: 01865 273561 Fax: 01865 273583

AGE: 43

PRINCIPAL RESEARCH INTERESTS

Topology, geometry & group theory, particularly in dimension three.

MAJOR AWARDS

- London Mathematical Society Whitehead Prize (2003)
- EPSRC Advanced Fellowship (2004 - 09)
- Philip Leverhulme Prize (2006)
- Invited Speaker, ICM 2010 (topology section)
- Invited Speaker, Clay Research Conference (2012)

PROFESSIONAL EXPERIENCE

- 2006 - present, Professor, Oxford University and Tutorial Fellow, St. Catherine's College, Oxford
- 1999 - 2006, University Lecturer, Oxford University and Tutorial Fellow, St. Catherine's College, Oxford
- 1996 - 99, Research Fellow, Trinity College, Cambridge (on leave 1997 - 98)
- 1997 - 98, Miller Research Fellow, UC Berkeley

EDUCATION

- 1994 - 97, PhD, Cambridge (supervisor W.B.R. Lickorish)
- 1990 - 94, Cambridge Mathematics Tripos, Parts I, II and III

SERVICES TO THE MATHEMATICAL COMMUNITY

- I have been an Editor of three major journals:
  - *The Journal of Topology* (2007 - present),
  - *The Journal of the London Mathematical Society* (2008-2013),
  - *Groups, Geometry and Dynamics* (2007 - present).
- I was a member of the Royal Society's Research Appointment Panel from 2009-12.

- I sat on the selection panel for EPSRC Advanced Research Fellows in 2004.
- I was a member of the Research Policy Committee of the London Mathematical Society from 2009-12.
- I ran the graduate Taught Course Centre, based at Oxford, Warwick, Imperial, Bath and Bristol, in the set-up phase from March 2006 to March 2007.
- I organised a workshop in Oxford on the Geometry & Topology of 3-Manifolds in 2004, attended by over 70 participants from 15 different countries.
- I jointly organised a workshop on 3-dimensional Geometry and Topology in Warwick in July 2007.
- I jointly organised a Durham Symposium on the Geometry and Arithmetic of Lattices in July 2011.
- I was an organiser of a conference on the Topology of 3-Manifolds in Montreal in May 2013.

#### PUBLICATIONS

1. The Whitney trick, **Topol. Appl.** 71 (1996) 115-118
2. Fox's congruence classes and the quantum-SU(2) invariants of links in 3-manifolds, **Comment. Math. Helv.** 71 (1996) 664-677
3. Surfaces, surgery and unknotting operations, **Math. Ann.** 308 (1997) 615-632
4. Dehn surgery on knots in 3-manifolds, **J. Amer. Math. Soc.** 10 (1997) 835-864
5. Upper bounds in the theory of unknotting operations, **Topology** 37 (1998) 63-73
6. (Joint with Daryl Cooper) Dehn surgery and negatively curved 3-manifolds, **J. Differential Geom.** 50 (1998) 591-624
7. Word hyperbolic Dehn surgery, **Invent. Math.** 140 (2000) 243-282
8. Taut ideal triangulations of 3-manifolds, **Geom. Top.** 4 (2000) 369-395
9. Attaching handlebodies to 3-manifolds, **Geom. Top.** 6 (2002) 889-904
10. Exceptional surgery curves in triangulated 3-manifolds, **Pacific J. Math.** 210 (2003) 101-163
11. The canonical decomposition of once-punctured torus bundles, **Comment. Math. Helv.** 78 (2003) 363-384
12. The volume of hyperbolic alternating link complements. **Proc. London Math. Soc.** 88 (2004) 204-224
13. The asymptotic behaviour of Heegaard genus, **Math. Res. Lett.** 11 (2004) 139-149
14. The Heegaard genus of amalgamated 3-manifolds, **Geom. Dedicata** 109 (2004) 139-145
15. A characterisation of large finitely presented groups, **J. Algebra** 287 (2005) 458-473
16. Expanders, rank and graphs of groups, **Israel J. Math.** 146 (2005) 357-370
17. Classification of alternating knots with tunnel number one, **Comm. Anal. Geom.** 13 (2005) 151-186
18. Heegaard splittings, the virtually Haken conjecture and Property  $(\tau)$ , **Invent. Math.** 164 (2006) 317-359

19. Covering spaces of 3-orbifolds, **Duke Math J.** 136 (2007) 181-203
20. Some 3-manifolds and 3-orbifolds with large fundamental group, **Proc. Amer. Math. Soc.** 135 (2007) 3393-3402
21. Adding high powered relations to large groups, **Math. Res. Lett.** 14 (2007) 983-993
22. (Joint with Darren Long and Alan Reid) Covering spaces of arithmetic 3-orbifolds, **Int. Math. Res. Not.** (2008)
23. An algorithm to determine the Heegaard genus of simple 3-manifolds with non-empty boundary, **Alg. Geom. Top.** 8 (2008) 911-934
24. (Joint with Darren Long and Alan Reid) LERF and the Lubotzky-Sarnak conjecture, **Geom. Topol.** 12 (2008) 2047-2056
25. New lower bounds on subgroup growth and homology growth, **Proc. London Math. Soc.** 98 (2009) 271-297.
26. Large groups, Property  $(\tau)$  and the homology growth of subgroups, **Math. Proc. Camb. Phil. Soc.** 146 (2009) 625-648
27. Surface subgroups of Kleinian groups with torsion, **Invent. Math.** 179 (2010) 175-190
28. The crossing number of composite knots, **J. Topology** 2 (2009) 747-768
29. (Joint with Daryl Cooper and Jessica Purcell) The length of unknotting tunnels, **Alg. Geom. Top.** 10 (2010) 637-661
30. Spectral geometry, link complements and surgery diagrams, **Geom. Dedicata** 147 (2010) 191-206
31. Detecting large groups, **J. Algebra** 324 (2010) 2636-2657
32. (Joint with Alexander Coward) Unknotting genus one knots, **Comment. Math. Helv.** 86 (2011) 383-399
33. Finite covering spaces of 3-manifolds, **Proc. International Congress Math.** Volume II, 1042-1070, Hindustan Book Agency, New Delhi, 2010
34. (Joint with Rob Meyerhoff) The maximal number of exceptional Dehn surgeries, **Invent. Math** 191 (2013) 341-382
35. (Joint with Alexander Coward) An upper bound on Reidemeister moves, **Amer. J. Math** 136 (2014) 1023–1066.
36. Finding disjoint surfaces in 3-manifolds, **Geom. Dedicata** 170 (2014) 385–401.
37. Core curves of triangulated solid tori, **Trans. Amer. Math. Soc** 366 (2014) 6027–6050.
38. The crossing number of satellite knots, **Alg. Geom. Top** 14 (2014) 499–529.
39. (Joint with Jessica Purcell) Geodesics and compression bodies, **Exp. Math.** 23 (2014) 218–240.
40. Elementary knot theory, **Clay Mathematics Institute** (accepted)
41. A polynomial upper bound on Reidemeister moves, **Annals Math.** 182 (2015) 491–564.

## PREPRINTS

42. (Joint with Jessica Purcell) Cusp volumes of alternating knots
43. (Joint with Jessica Purcell) Essential twisted surfaces in alternating link complements

## OTHER

- A short article on my work appeared in the magazine **Science** in 2007.

## DOCTORAL STUDENTS (TOGETHER WITH THE PAPERS ARISING FROM THEIR THESIS)

1. Stelios Koundouros (PhD 2003)  
*Universal surgery bounds on hyperbolic 3-manifolds*, *Topology* 43 (2004) 497–512.
2. Alex Mijatovic (PhD 2003)  
*Simplifying triangulations of  $S^3$* . *Pacific J. Math.* 208 (2003) 291–324.  
*Triangulations of Seifert fibred manifolds*, *Math. Ann.* 330 (2004) 235–273.  
*Triangulations of fibre-free Haken 3-manifolds*, *Pacific J. Math.* 219 (2005) 139–186.  
*Simplicial structures of knot complements*, *Math. Res. Lett.* 12 (2005) 843–856.
3. Vivien Easson (PhD 2005)  
*Surface subgroups and handlebody attachment*, *Geom. Topol.* 10 (2006) 557–591
4. Alexander Coward (PhD 2008)  
*Ordering the Reidemeister moves of a classical knot*, *Algebr. Geom. Topol.* 6 (2006) 659–671.  
*Algorithmically detecting the bridge number of hyperbolic knots*, Preprint.
5. Liam Wall (PhD 2010)  
*Homology in finite index subgroups*, Thesis
6. Karin Alcaraz (PhD 2012)  
*The Alexander polynomial of closed 3-manifolds*, Thesis
7. Jessica Banks (PhD 2012)  
*On links with locally infinite Kakimizu complexes*, *Alg. Geom. Top.* 11 (2011) 1445–1454.  
*Homogeneous links, Seifert surfaces, digraphs and the reduced Alexander polynomial*, *Geom. Ded.* 166 (2013) 67–98.  
*Minimal Genus Seifert Surfaces for Alternating Links*, Preprint  
*The Kakimizu complex of a connected sum of links*, *Trans. A.M.S* 365 (2013) 6017–6036.
8. Hemanth Saratchandaran (started 2010)  
*Four dimensional hyperbolic link complements via the Kirby calculus*, Thesis
9. Henry Bradford (started 2011)  
*New Uniform Diameter Bounds in Pro- $p$  Groups*, Preprint.  
*Expansion, Random Walks and Sieving in  $SL_2(\mathbb{F}_p[t])$* , Preprint.
10. Antonio De Capua (started 2012)
11. Gareth Wilkes (started 2014)

INVITED LECTURES (\* denotes plenary talk)

- \* 1. MSRI, Berkeley, Low-dimensional topology workshop (August 1996)
- \* 2. Newton Institute, Cambridge, 4-d geometry and quantum field theory (December 1996)
- \* 3. UC Santa Barbara, Southern California Topology Conference (February 1997)
- \* 4. Athens Georgia, Georgia Topology Conference (August 1997)
- \* 5. Tokyo Institute of Technology, Workshop on orbifolds (July 1998)
- \* 6. Oberwolfach, Topology meeting (September 1999)
- \* 7. Warwick, Low-dimensional topology meeting (January 2000)
- \* 8. Sheffield, British Topology meeting (April 2000)
- \* 9. Montreal, 3-manifolds meeting (June 2001)
- 10. Lyon, French-American Congress of Mathematics (July 2001)
- \* 11. Lyon, Conference on Property ( $\tau$ ) (May 2002)
- \* 12. Xi'an, Satellite conference of the ICM (August 2002)
- \* 13. Oberwolfach, Topology meeting (September 2002)
- \* 14. Oberwolfach, meeting on hyperbolic 3-manifolds (May 2003)
- \* 15. Oberwolfach, meeting on discrete groups and profinite groups (May 2003)
- \* 16. Newton Institute, Cambridge, conference on Kleinian groups (August 2003)
- \* 17. Banff International Research Station, 3-manifolds meeting (September 2003)
- \* 18. CIRGET, Montreal, conference on 3-manifold theory (May 2004)
- 19. Toulouse, Canada-France Congress of Mathematics (July 2004)
- \* 20. Oxford, Workshop on 3-dimensional geometry and topology (August 2004)
- 21. Liverpool, British Mathematics Colloquium, 'morning speaker' (April 2005)
- \* 22. Austin, Texas, meeting on 3-manifolds (May 2005)
- \* 23. ICTP, Trieste, conference on 3-manifold theory (June 2005)
- \* 24. Institute of Advanced Study, Princeton, workshop on Lie groups, representations and discrete mathematics (3 talks in November 2005, 1 talk in February 2006)
- \* 25. ICMS, Edinburgh, 3-manifolds conference (3 talks, March 2006)
- \* 26. Oberwolfach, Topology meeting (September 2006)
- \* 27. Oxford, launch meeting for the Journal of Topology (March 2007)
- \* 28. Princeton, Thurston's 60th birthday conference (July 2007)
- \* 29. Bristol, Heilbronn Annual Conference (September 2007)
- \* 30. Trinity College, Dublin, meeting on pro- $p$  groups and low-dim'l topology (September 2007)
- \* 31. IPAM, UCLA, meeting on Expanders in Pure and Applied Mathematics (February 2008)
- \* 32. Göttingen, Autumn School on Geometric Invariants of Groups (4 talks, November 2008)
- \* 33. Oxford, 60th birthday conference for Fritz Grunewald (April 2009)
- \* 34. Warwick, conference on Dehn filling (May 2009)
- \* 35. Athens Georgia, Georgia Topology Conference (May 2009)

- \* 36. Imperial College, London, conference on rank gradient (June 2009)
- \* 37. UC Davis, Geometric topology in 3 and 4 dimensions (June 2009)
- 38. Cambridge, Young Researchers in Mathematics (March 2010)
- \* 39. St Andrew's, Edinburgh Mathematical Society meeting (May 2010)
- 40. Hyderabad, International Congress of Mathematics (August 2010)
- \* 41. Oxford, conference on the Geometry and Analysis of Groups (November 2010)
- \* 42. Pisa, conference on the Geometric Topology of Knots (May 2011)
- \* 43. London, centenary conference in honour of Poincaré (May 2012)
- \* 44. Oxford, Clay Research Conference (June 2012)
- \* 45. Schrödinger Institute, Vienna, workshop on rank gradient (3 talks, August 2012)
- \* 46. Cambridge, British Topology Meeting (September 2012)
- \* 47. Grenoble, Tripode seminaire (October 2012)
- \* 48. Scottish topology meeting (March 2013)
- \* 49. McGill, Montreal, XVI Colloque Panquécois des Étudiants de l'ISM (May 2013)
- \* 50. Cortona, Conference on 3-manifolds in honour of Ricardo Benedetti (June 2013)
- \* 51. Columbia, Geometry and Topology in New York (August 2013)
- \* 52. York, North British Geometric Group Theory (June 2014)
- \* 53. IMPA, Rio, conference on Hyperbolic Geometry and Minimal Surfaces (January 2015)
- \* 54. Banff, conference on Computability, Analysis and Geometry (March 2015)
- \* 55. Berkeley, conference on Groups, Geometry and 3-Manifolds (May 2015)

SEMINARS AND COLLOQUIA (SINCE 2007)

1. Colloquium, Edinburgh (January 2007)
2. Topology seminar, Edinburgh (January 2007)
3. Topology seminar, Oxford (January 2007, 3 talks)
4. Colloquium, Durham (March 2007)
5. Colloquium, Aberdeen (October 2007)
6. Topology seminar, Oxford (May 2008, 2 talks)
7. Public lecture on the Poincaré conjecture, Oxford (July 2008)
8. Pure maths seminar, Queen Mary's College, London (September 2008)
9. Lecture, the Chancellor's Court of Benefactors, Oxford (October 2008)
10. Topology seminar, Cambridge (October 2008)
11. Geometry, topology & dynamics seminar, Orsay (February 2009)
12. Topology seminar, Oxford (March 2009)
13. Operator algebras seminar, Paris VII (June 2009)
14. Analysis and geometry seminar, Paris VII (October 2009)
15. Analysis and geometry seminar, Paris VII (November 2009)

16. Pure maths seminar, Royal Holloway, London (May 2011)
17. Topology seminar, Cambridge (May 2012)
18. Geometry and topology seminar, Imperial College, London (May 2012)
19. Topology seminar, Oxford (June 2012)
20. Fellows' seminar, St Catherine's College, Oxford (October 2012)
21. Topology seminar, Oxford (November 2012)
22. Colloquium, Warwick (March 2013)
23. Topology seminar, Oxford (January 2014)
24. Colloquium, Durham (October 2014)
25. Topology seminar, Oxford (January 2015)

Before 2007, I gave seminars at the following universities:

Oxford, Cambridge, Warwick, Imperial College (London), Queen Mary's College (London), King's College (London), University College (London), Edinburgh, Aberdeen, Leicester, Liverpool, Southampton, Newcastle, Sheffield, UC Berkeley, UC Davis, UC Santa Barbara, UC Irvine, Stanford, U Texas at Austin, U Georgia at Athens, U Illinois at Chicago, Princeton, Cornell, Columbia, U Montreal.

#### TEACHING

I am strongly committed to teaching, both at undergraduate and graduate levels. For graduate students, post-docs and fellow faculty members, I organise regular advanced classes on a variety of topics. I have also designed a new lecture course Topology & Groups.

In 2006, I was awarded an *Excellence in Teaching Award*, and in 2013, I was given a *Mathematical Institute Teaching Award*.

#### UNDERGRADUATE COURSES

<i>Term</i>	<i>Title</i>
MT 2000	Differential equations and discrete mathematics
HT 2001, 2002, 2003	Algebraic topology
MT 2001	Differential and difference equations
MT 2004, 2006, 2008	Topology & Groups
HT 2011	Algebraic topology
HT 2011, 2012, 2013, 2014	Topology

#### GRADUATE COURSES

1998 & 1999	Hyperbolic manifolds
2000	Three-dimensional manifolds
2015	Mapping class groups of surfaces

#### ADVANCED CLASSES

2000	Teichmüller spaces	2001	$\mathbb{R}$ -trees
2002	The Seifert fibre space theorems	2003	Isomorphism problem for hyperbolic groups
2006	Property ( $\tau$ )	2007	Hyperbolicity of the curve complex
2008	Virtual fibering of 3-manifolds	2009	Cube complexes
2010	The Dehn function of $SL(n, \mathbb{Z})$	2011	Quantum invariants and Property T
2012	Cube complexes	2013	Unknot recognition
2014	4-manifolds		

#### ADMINISTRATION

##### EXAMINING

Prelims	2000-03
Mods	2012
Prelims	2013-14

##### DEPARTMENTAL COMMITTEES

2000-02	Teaching committee
2001-02	Course structure committee
2011-12	Syllabus review working party
2012-present	Departmental committee

##### COLLEGE COMMITTEES

2001-04	Domestic committee
2002	Mastership committee
2002-04	Nominating committee
2002-08	Finance committee
2009-12	Academic policy committee
2012-13	Investment subcommittee
2013-present	Finance committee
2014-present	Computing committee