

Patrick Orson - Curriculum Vitae

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RESEARCH INTERESTS Low-dimensional topology of manifolds, and knot theory. Applications of classical surgery theory and L -theory to knot concordance and topological 4-manifolds. Stable homotopy-type invariants refining knot homology theories.

EMPLOYMENT **Visiting Assistant Professor** *Boston College* Sep 2017 – present
Currently researching and teaching at Boston College.

Postdoctoral Research Associate *UQÀM* Jan 2017 – Aug 2017
Worked in CIRGET at the Université du Québec à Montréal, taught at McGill University.

Visitor *Hausdorff Institute for Mathematics, Bonn* Nov 2016 – Dec 2016
Participant in the Junior Trimester Program “Topology” as part of the 4-manifolds and Knot Concordance group.

Postdoctoral Research Associate *University of Durham* Jan 2015 – Oct 2016
Worked on the EPSRC research grant *New homotopy-type invariants of knots*. Developing new applications and directions for the Lipshitz–Sarkar stable homotopy type refinement of Khovanov homology.

EDUCATION **PhD** *University of Edinburgh* 2015

- **Thesis - Double L -theory**

A theory of chain-complex ‘double-cobordism’ with applications to spectral flow in the signature operator, high-dimensional knot theory, and the algebra of Seifert forms (supervised by Prof. Andrew Ranicki).

MA Mathematics (Cantab) *University of Cambridge* 2012

MMath (Part III), Merit *University of Cambridge* 2009
Specialising in geometry and topology. Particularly 4-manifold topology.

- **Part III Essay - Small 4-manifolds**

A review of advances in recent years on finding exotic smooth structures on $\mathbb{C}P^2 \# m\overline{\mathbb{C}P^2}$ (supervised by Prof. Ivan Smith).

BA Mathematics (Cantab), First Class *University of Cambridge* 2008

TEACHING **Course Instructor** *Boston College*
Course instructor for Introduction to Abstract Mathematics. Sep 2018 – Dec 2018
Course instructor for Calculus II. Jan 2018 – Apr 2018
Course instructor for Calculus I. Sep 2017 – Dec 2017

Course Instructor *McGill University* Jan 2017 – April 2017
Course instructor for Calculus I.

Teaching Assistant *University of Edinburgh*

Jan 2011 - Dec 2014

- *MSc/MMath Geometry and Topology*
- *Geometry, Linear Algebra, Fundamentals of Pure Mathematics, Proofs and Problem Solving, Foundations of Calculus, Several Variable Calculus, Geometry and Convergence, Group Theory.*

Twice nominated for an Edinburgh University Students' Union teaching award.

Course lecturer *Linyi Normal University, Shandong, China*

July 2009

Designed and taught a short course on *Riemann Surfaces* for a summer school.

PUBLICATIONS *Khovanov homotopy calculations using flow category calculus;*
with A. Lobb and D. Schütz.
Preprint: <http://arxiv.org/abs/1710.01857>.

A calculus for flow categories;
with A. Lobb and D. Schütz.
Preprint: <http://arxiv.org/abs/1710.01798>.

Triple linking numbers and surface systems;
with C. W. Davis, M. Nagel and M. Powell.
Preprint: <http://arxiv.org/abs/1709.08478>.

Satellites and concordance of knots in 3-manifolds;
with S. Friedl, M. Nagel and M. Powell.
To appear in *Trans. Amer. Math. Soc.*
<https://arxiv.org/abs/1611.09114>.

Smooth and topological almost concordance;
with M. Nagel, J. Park and M. Powell.
Int. Math. Res. Not. (2018), rnx338
<https://arxiv.org/abs/1707.01147>.

Framed cobordism and flow category moves;
with A. Lobb and D. Schütz.
To appear in *Algebr. Geom. Topol.*
<http://arxiv.org/abs/1605.02003>.

The Khovanov stable homotopy type of colored links;
with A. Lobb and D. Schütz.
Algebr. Geom. Topol. 17 (2017), no. 2 1261-1281.
<http://arxiv.org/abs/1602.01386>.

Double L-groups and doubly-slice knots;
Algebr. Geom. Topol. 17 (2017), no. 1, 273-329.
<http://arxiv.org/abs/1508.01048>.

Double Witt groups.
Preprint: <http://arxiv.org/abs/1508.00383>.

Twist spinning of knots and metabolizers of Blanchfield pairings;
with S. Friedl.
Annales de Toulouse, Volume 2, number 5 (2015).

<http://arxiv.org/abs/1312.1934>.

- MEETINGS & CONFERENCES**
- Wesleyan Topology Seminar** *Wesleyan University* Feb 2018
Gave a talk on smooth and topological almost concordance.
- Rice Topology Seminar** *Rice University* Mar 2017
Gave a talk on almost concordance of knots in the topological category.
- British Topology Meeting** *University of Glasgow* Aug 2016
Gave a talk on converting knot homology theories, such as colored Khovanov homology, to stable homotopy type invariants.
- Regensburg Topology Seminar** *Universität Regensburg* Nov 2015
Gave a talk on ideas for modifying the Lipshitz–Sarkar homotopy type for Khovanov homology to the setting of Lee homology.
- Durham Geometry Seminar** *University of Durham* Jan 2015
Gave a talk on high-dimensional knots and chain complex cobordism.
- Transpennine Topology Triangle** *University of Sheffield* Jul 2014
Presented the technical localisation sequence results of double L -theory from my thesis, with an application to doubly-slice knots.
- Manchester Topology Seminar** *University of Manchester* Nov 2013
Presented some aspects of the relation of my work on double L -theory to jumps in a 1-parameter family of Atiyah–Patodi–Singer η -invariants.
- Scottish Topology Seminar** *University of Glasgow* Sep 2013
Presented some aspects of my research on high-dimensional knots and L -theory.
- British Topology Meeting** *University of Aberdeen* Sep 2013
Gave a talk on doubly-slice knots and algebraic L -theory including a new, quicker proof that $K\# - K$ is doubly-slice.
- SEMINARS ORGANISED**
- Khovanov Homotopy Type** *Boston College* Jan 2018 – June 2018
Organised a seminar about the Lipshitz–Sarkar stable homotopy refinement of Khovanov homology. <https://www2.bc.edu/patrick-orson/khovanovhtpy>
- Surfaces in 4-manifolds** *Boston College* Aug 2017 – Dec 2017
Joint organising and running a Learning Seminar for staff and students centred around Gabai’s recent 4-Dimensional Lightbulb Theorem.
- Seiberg–Witten and stable homotopy** *UQAM* Jan 2017 – May 2017
Joint organised and ran a Learning Seminar for staff and students studying the Manolescu refinement of the Seiberg–Witten Floer homology using stable homotopy theory. <https://www2.bc.edu/patrick-orson/SWstable>
- Surgery Theory and Homology Surgery** *HIM* Nov 2016 – Dec 2016
Organised and ran a Learning Seminar as part of the Junior Trimester Program in Topology. Intended to give an overview of the Browder–Novikov–Sullivan–Wall surgery theory with particular emphasis on its relevance to low-dimensional topologists working on 4-manifolds and knot concordance.

Chern–Simons Theory Study Group *Durham University* 2015/16
Joint organised an interdisciplinary reading group for physicists and mathematicians interested in the interactions between Witten’s Chern–Simons results and knot theory.
<https://www2.bc.edu/patrick-orson/chernsimons>

Algebraic L–Theory Study Group *University of Edinburgh* 2013/14
Organised and ran a reading group for staff and students studying abstract chain-dualities on algebraic bordism categories and their interaction with sheaf theory.

Surgery Theory Study Group *University of Edinburgh* 2011/12
Organised and ran a working group for staff and students studying interesting aspects of algebraic and geometric surgery theory. <https://www2.bc.edu/patrick-orson/surgerygroup>

PG Geometry and Topology Seminar, *University of Edinburgh* 2011/12
Organised and ran the postgraduate geometry and topology seminar.

Index Theory Seminar Series *University of Edinburgh* Jan 2011 – May 2011
Organised and ran a seminar series for staff and students. <https://www2.bc.edu/patrick-orson/indextheory>

**ACADEMIC
REFERENCES**

Dr. Andrew Lobb
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DH1 3LE, UK
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Prof. Stefan Friedl
Universität Regensburg
93053 Regensburg, Germany
stefan.friedl@mathematik.uni-regensburg.de

Dr. Mark Powell
Durham University
DH1 3LE, UK
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**TEACHING
REFERENCE**

Prof. C. K. Cheung
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