

# Curriculum Vitae of Ben Wormleighton

as of September 2017

## 1 Education

### Pre-higher education :

*The Park Community School* (September 2004-June 2009)

- 9 GCSEs at A\*, 4 GCSEs at A

*Petroc* (September 2009-June 2011):

- A2: Mathematics (A\*), Further mathematics (A\*), Further mathematics (additional) (A\*), Classical civilisations (A)
- AS: Religious studies (A), Critical thinking (A).

### Higher Education :

*University of Warwick, MMath Master's in Mathematics* (September 2011-June 2015):

First (100.6% overall; top of year or *valedictorian* of a class of  $\approx 280$ ).

- First year: 97.02% (top of year)
- Second year<sup>1</sup>: 100.42% (top of year)
- Third year: 100.45% (top of year)
- Fourth year: 101.59% (top of year).

*University of California at Berkeley, PhD* (August 2015-to graduate May 2020  $\pm 3$ ):

- August 2015: Preliminary exam (pass).
- November 2016: Qualifying exam (pass).

### Other skills :

- Familiarity with the computer algebra systems SAGE, MAGMA, OCTAVE, MATLAB.
- Fluent in  $\text{\LaTeX}$ , including beamer and tikz.

## 2 Academic activity

**Research statement** My interests and research activity to date have largely been within algebraic geometry; most prominently in the McKay correspondence and in mirror symmetry for orbifolds. Alongside these I am keen to explore applications of representation theory and combinatorics to geometrical problems and contrariwise.

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<sup>1</sup>Warwick uses the *Seymour formula* to accredit modules taken above a standard workload, and hence make possible the apparently paradoxical marks in my later years and for my degree as a whole.

**Other areas in which I have experience include...** toric geometry, orbifolds, Fano varieties, crepant resolutions, moduli spaces,  $K$ -theory, representation theory of quivers, graded ring methods and Hilbert series, algebraic combinatorics, lattice combinatorics, convex geometry, Ehrhart theory, Hodge theory, monomial ideals, cluster algebras, intersection theory, symplectic geometry, noncommutative resolutions and associated geometry, categorical Lie algebra actions...

**Grants :**

- *Equivariant geometry and the McKay correspondence in low dimensions*, funded as an Undergraduate Research Scholarship Scheme by Warwick Mathematics Institute, and supervised by Professor Miles Reid at the University of Warwick (August-September 2013).
- *Hilbert functions of orbifold del Pezzo surfaces*, funded by a London Mathematical Society Undergraduate Research Bursary, and supervised by Professor Alessio Corti at Imperial College London (July-September 2014).
- *UC Berkeley Graduate division conference travel grant* for travel to the second meeting of the British Algebraic Geometry (BRAG) conference at the University of Edinburgh (Spring 2016).
- *Visiting scholar at Nagoya University* funded by a travel grant from the mathematics department at UC Berkeley, a JSPS grant via Prof. Yukari Ito and an NSF grant via Prof. David Nadler (June-August 2016).
- *Berkeley Connect fellowship* fully funding me for the 2016-17 academic year in return for mentoring a group of forty undergraduates interested in pursuing math as a major and beyond (Fall 2016-Spring 2017).
- *Shoshichi Kobayashi Memorial Fund* also supported me during the Spring semester of 2017.
- *Berkeley Connect fellowship* fully funding me for the 2017-18 academic year in return for mentoring a group of forty undergraduates interested in pursuing math as a major and beyond (Fall 2017-Spring 2018).

**Teaching :**

- *STEP tuition*: In each of the academic years 2012/13 and 2013/14 I was employed by Bluecoat Sixth Form in Coventry to tutor a single student for STEP II and III examinations required for admission to the Uni. of Cambridge. Both students scored highly and were successfully admitted.
- *Warwick Maths Society*:
  - $\text{\LaTeX}$  classes (Autumn 2014)
  - MA106 Linear Algebra review (Spring 2014)
- *Graduate Student Instructor at UC Berkeley* (Fall 2015-Fall 2017):
  - MATH 54 Linear algebra and differential equations (59 students, Fall 2015; course instructor: Prof. David Nadler)
  - MATH 54 Linear algebra and differential equations (56 students, Spring 2016; course instructor Prof. Vivek Shende)
  - MATH 1A Calculus I (20 students, Fall 2017; course instructor Prof. Pierre Simon)
- *Course Instructor at UC Berkeley* (Summer 2017)
  - MATH 54 Linear algebra and differential equations (40 students, Summer 2017)

- *Berkeley Connect mentor at UC Berkeley* (Fall 2016-Spring 2018): I mentor two groups of 20 undergraduates interested in pursuing math as a major and beyond through collective and one-on-one discussion of challenges and opportunities that they might encounter in the future, or are presently undergoing.
- *Directed Reading Programme mentor at UC Berkeley* (Fall 2015-Spring 2016): I mentored a single undergraduate each semester by guiding their reading of a topic through discussion and helping them prepare a presentation.
  - Dynkin diagrams, M. B. Cesar (Fall 2015)
  - Fano polygons and toric geometry, J. Soldevilla (Spring 2016).

**Preprints :**

- *Reconstruction of orbifold del Pezzo surfaces from Hilbert series*, sole author (November 2014)
- *A geometrical explanation of quasi-period collapse*, with Al Kasprzyk (November 2014)
- *Contributions from quotient singularities on del Pezzo surfaces*, sole author (January 2015)
- *Relative realisations of cluster algebras*, sole author (November 2015)
- *Pythagorean triples and cluster algebras*, sole author (January 2016)
- *Reconciling mutations*, sole author (January; March 2016)
- *Mutations between crepant resolutions are informed by Reid's recipe*, with Yukari Ito (August 2017)

**Academic talks :**

- *G-Hilb for trihedral groups*, COW introductory school for algebraic geometry (Uni. of Warwick, September 2013)
- *Category theory: basics*, WMS talk given with Alex Best (Uni. of Warwick, November 2013).
- *Moduli problems and toric geometry*, WMS talk (Uni. of Warwick, January 2014)
- *G-Hilb for trihedral groups (II)*, Nagoya-Warwick workshop on the geometry of orbifolds, McKay correspondence, and representation theory (Uni. of Warwick, February 2014)
- *Moduli problems*, Tomorrow's Mathematicians Today (Uni. of Surrey, February 2014)
- *Hyperbolic angel problem*, WMS discussion group jointly led with Alex Best (Uni. of Warwick, February 2014)
- *The ubiquity of Dynkin diagrams*, WMS talk, Sussex postgraduate conference, Imperial undergraduate colloquium (Uni. of Warwick, June 2014; Uni. of Sussex, July 2014; Imperial College London, October 2014)
- *Hilbert functions of orbifold del Pezzo surfaces*, Imperial algebraic geometry seminar (Imperial College London, July 2014)
- *Reconstruction of orbifold del Pezzo surfaces from Hilbert series*, Imperial algebraic geometry seminar (Imperial College London, August 2014)
- *Fables of residual singularities*, derived categories symposium seminar (Uni. of Warwick, October 2014)
- *Mirror symmetry through toric geometry*, WIMP autumn meeting 2014 (Uni. of Warwick, November 2014)

- *Clusters, boats, and parallelograms*, MA613 McKay correspondence guest lecture (Uni. of Warwick, January 2015)
- *Stacks via toric geometry*, WMS talk (Uni. of Warwick, January 2015)
- *The Serre-Swan theorem*, WMS talk (Uni. of Warwick, January 2015)
- *Toric varieties and stacks*, Tomorrow's Mathematicians Today (Uni. of York, February 2015)
- *An algebraic combinatorics primer*, Imperial undergraduate colloquium (Imperial College London, June 2015)
- *Monomial ideals*, Commutative algebra and algebraic geometry seminar (UC Berkeley, September 2015)
- *A hodgepodge of Hodge structures*, Shimura varieties seminar (UC Berkeley, September 2015)
- *The geometry of cluster algebras I*, Student algebraic geometry seminar (UC Berkeley, October 2015)
- *Some highlights of homology*, Math 215A guest lecture (UC Berkeley, October 2015)
- *The geometry of cluster algebras II*, Student algebraic geometry seminar (UC Berkeley, October 2015)
- *Hilbert series of orbifold del Pezzo surfaces*, Berkeley-Tokyo winter school on geometry, topology and representation theory (UC Berkeley, February 2016)
- *Incarnations of the MMP*, Student algebraic geometry seminar (UC Berkeley, February 2016)
- *Groups, actions, and Chow groups*, Intersection theory seminar (UC Berkeley, March 2016)
- *The toric ansatz*, Student algebraic geometry seminar (UC Berkeley, March 2016),
- *Some thoughts on nonabelian McKay*, Student algebraic geometry seminar (Nagoya Uni., June 2016)
- *Singularities from mirror symmetry*, Algebraic geometry seminar (Nagoya Uni., July 2016)
- *Studio G-Hilb*, Student algebraic geometry seminar (UC Berkeley, September 2016)
- *The geometry of continued fractions*, Women in Math and SAGS (UC Berkeley, November 2016 and January 2017)
- *Canonical curves*, Commutative algebra student seminar (UC Berkeley, November 2016)
- *Categorical Lie algebra actions*, Student algebraic geometry seminar (UC Berkeley, October 2017).

**Outreach talks :**

- *A mathematician is a storyteller* (American Indian Model School, February 2017)
- *Enlarging your universe*, Faith and Reasons decal (UC Berkeley, March 2017 and October 2017).

**Poster presentations :**

- *Equivariant geometry in low dimensions and the McKay correspondence*, URSS showcase (Uni. of Warwick, October 2013)
- *Hilbert series of orbifold del Pezzo surfaces*, BrAG (Uni. of Edinburgh, April 2016)
- *G-Hilb for trihedral groups*, Noncommutative crepant resolutions, Ulrich modules, and generalisations of the McKay correspondence (RIMS, June 2016).

**Events that I have organised :**

- Throughout my third year of study at Warwick I served as *talks coordinator* on the Warwick Maths Society (WMS) executive committee: organising staff and student speakers for weekly academic talks intended to connect the the research and undergraduate aspects of the department. We were generously funded by the Warwick Mathematics Institute to offer refreshments after each talk.
- I am the founder and ex-overseer of a series of roughly masters' level conferences held jointly between Warwick and Imperial College London - accordingly called WIMP - on a termly basis. The meetings I oversaw took place in November 2014 at Warwick and March 2015 at Imperial College.
- I organise the student algebraic geometry seminar at UC Berkeley from November 2016-present.

**You may recognise me from :**

- COW/CALF algebraic geometry seminars
- Warwick seminars and reading groups
- COW introductory school for algebraic geometry (Uni. of Warwick, September 2013)
- Nagoya-Warwick workshop on the geometry of orbifolds, McKay correspondence and representation theory (Uni. of Warwick, February 2014)
- Tomorrow's Mathematicians Today (Uni. of Surrey, February 2014)
- Warwick-Seoul national symplectic geometry workshop (Uni. of Warwick, February 2014)
- What does it take to prove Fermat's last theorem?: number theory and mathematical logic workshop (Uni. of Warwick, March 2014).
- Noncommutative geometry, number theory and dynamics seminar (Uni. of Warwick, April-May 2014)
- $SL(2, \mathbb{R})$  dynamics on moduli spaces workshop (Uni. of Warwick, June 2014)
- YRM 2014 (Uni. of Warwick, July 2014)
- Sussex postgraduate conference in pure mathematics (Uni. of Sussex, July 2014)
- Introductory school on derived categories (Uni. of Warwick, September 2014)
- Nagoya-Warwick workshop on the McKay correspondence, orbifolds, and quivers (Uni. of Warwick, September 2014)
- BrAG British Algebraic Geometry conference (Uni. of Warwick, September 2014)
- Complex and symplectic geometry day (Uni. of Warwick, October 2014)
- Various events as part of the 2014-15 Warwick derived categories symposium
- WIMP autumn meeting '14 (Uni. of Warwick, November 2014)
- Tomorrow's Mathematicians Today (Uni. of York, February 2015)
- WIMP spring meeting '15 (Imperial College London, March 2015)
- UC Berkeley seminars and reading groups
- Berkeley-Tokyo winter school on geometry, representation theory, and topology (UC Berkeley, February 2016)
- Mirror symmetry and wall crossing (UC Berkeley, March 2016)

- Noncommutative crepant resolutions, Ulrich modules, and generalisations of the McKay correspondence (RIMS, June 2016)
- 17th Takagi lectures: categorification of invariants in gauge theory and symplectic geometry (RIMS, June 2016).

**Referees :**

*Personal tutor:* Prof. Colin Sparrow (Warwick)

*Research project supervisors:* Prof. Miles Reid (Warwick), Prof. Alessio Corti (Imperial), Prof. Yukari Ito (Nagoya)

*PhD advisor:* Prof. David Nadler (UC Berkeley).

**Miscellany :**

- *Book-Cycle:* I organised a branch of the literary charity BOOK-CYCLE on Warwick campus, which involved coordinating bookstalls and setting up sapling bookshelves around campus for students to use by browsing, borrowing, or donating. The funds raised support educational initiatives and access to literature across West Africa and the UK. Prior to coming to Warwick I was a volunteer for the related charity BOOKRELIEF UK in Devon.
- *Motofest:* I was part of the stewarding team for the 2014 and 2015 MOTOFEEST festivals celebrating Coventry's motoring heritage.
- *Poetry:* I reasonably frequently write poetry and even more frequently discuss the work of poets and writers past and present.
- Head Boy of House (June 2008-May 2009)
- House softball captain (Spring 2009)
- Award for Further Mathematics (for final results at Petroc)
- Ron Lockhart Prize in Mathematics (for second year results at Warwick)
- Wordplus theology course modules 1-5 (one complete year).