

APPENDIX: CURRICULUM VITAE

RAFAËL BOCKLANDT

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PERSONAL DETAILS

First Names: Rafaël Robert Julia
Surname: Bocklandt
Gender: Male
Date of birth: 6th of October, 1977
Place of birth: Hamme, Belgium
Citizenship: Belgian

EDUCATION

- 10/1995–07/1999 Licentiaat Zuivere Wiskunde (\cong Master in Pure Mathematics) at Ghent University
Thesis: *Knot invariants and the Jones Polynomial*; Supervisor: Prof. Dr. W. Mielants
Degree: Greatest Distinction
- 10/1996–07/2000 Licentiaat Theoretische Natuurkunde (\cong Master in Theoretical Physics) at Ghent University
Thesis: *Noncommutative geometry and the Standard Model of Physics*; Supervisor: Prof. Dr. H. Verschelde
Degree: Great Distinction
- 10/2000–07/2001 Aggregaat Natuurkunde (\cong Master in Teaching Physics) at Ghent University
Degree: Distinction
- 10/2001–07/2002 Advanced Master in Linguistics at Ghent University
Thesis: *Dialect Loss of the Youth in Hamme*; Supervisor: Prof. Dr. J. Taeldeman
Degree: Distinction

10/1999–04/2002 Phd in Mathematics at the University of Antwerp
Thesis: *The Geometry of Quotient Varieties of Quivers*; Supervisor: Prof. Dr. L. Le Bruyn.
on-line: <http://www.algebra.ua.ac.be/research/thesis.pdf>

WORKING EXPERIENCE

10/1999–08/2002 Full time teaching assistant algebra and geometry at the University of Antwerp

09/2002–09/2003 Part time teaching assistant algebra and geometry at the University of Antwerp

09/2002–10/2002 Post-doctoral research fellow for the TMR at the University of Bielefeld

11/2002–07/2003 Post-doctoral research fellow at the University La Sapienza in Rome

10/2003–12/2008 Post-doctoral research fellow for the Flemish Science Fund (FWO) at the University of Antwerp

1/2009–12/2012 Lecturer in mathematics at the University of Newcastle.

1/2009–6/2009 Part-time teacher at Atheneum Berchem

1/2013–Now Lecturer in mathematics at the University of Amsterdam.

COURSES TAUGHT

At the University of Antwerp:

10/1999–09/2006 Exercises Algebra for 3rd year mathematics students

10/1999–09/2003 Exercises Commutative Algebra for 3rd year mathematics students

10/1999–09/2002 Exercises Differential Geometry for 3rd year mathematics students

10/1999–09/2002 Exercises Lie Theory for 4th year mathematics students

10/2003–2006 Full Course on Representation Theory for 3rd year mathematics students

10/2003–Now Full Course on Coding Theory and Cryptography for 4th year mathematics and computer science students

10/2006–2007 Full Course on Differential Geometry II for 4th year mathematics students

04/2005–2007	Advanced Master Course on a special topic in algebra and geometry: 2005: Geometric Invariant theory 2006: Kleinian Singularities 2007: Knot theory and SL_2 -representations.
10/2007–2008	Full Course on Riemann Surfaces for 2nd year mathematics students
10/2008–2009	Full Course on differential Geometry for 2nd year mathematics students
10/2008–2009	Full Course on Number Theory for 3rd year mathematics students
10/2008–2009	Full Course on Knot theory for 5th year mathematics students
At the University of Newcastle:	
10/2009–2012	Full Course on Linear Algebra for 2nd year mathematics students
10/2009–2012	Full Course on Coding Theory for 3rd year mathematics students
At the University of Newcastle:	
10/2013–Now	Full Course on Chaos theory to 2nd year Beta-Gamma students

GRANTS AND ORGANIZING

10/2005–12/2007	Together with Geert Van de Weyer I obtained a research grant of 7000 euro from the Flemish Science Fund for the research project <i>Slice machinery, quiver moduli and quivers with relations</i> . We used this to organize <ul style="list-style-type: none"> • a mini workshop on noncommutative Geometry in Antwerp [18–20/01/2006], • a weekly seminar that explored connections between non-commutative algebra, theoretical physics and string theory [11/2007–12/2007].
10/2011–Now	Together with Peter Jorgensen and Stefan Kolb we organized 2 ARTIN-meeting at Newcastle University at held on 24-25/10/2011 and on 12-13/04/2012.
10/2011–2012	Together with Alastair Craw and Ivan Cheltsov we obtained funding from the LMS and GMS to organize a quarterly seminar day between the Universities Glasgow, Edinburgh, Aberdeen and Newcastle for Algebraic geometry and Noncommutative geometry. (EGAN-seminar)
10/2012–Now	Together with Michael Wemyss, Ivan Cheltsov, Gwyn Bellamy and Vladimir Guletskii we obtained funding from the LMS to organize a quarterly seminar day between the Universities Glasgow, Edinburgh, Liverpool and Newcastle for Algebraic geometry and Noncommutative geometry. (GLEN-seminar)

2012-2013 Together with Peter Jorgensen and Stefan Kolb we obtained funding from the LMS (7500£) and EPSRC (7500£) to organize a conference in Newcastle in the spring of 2013 about triangulations in Algebra, Geometry and Quantization.

RESEARCH VISITS - FOREIGN EXPERIENCE

09/2002–10/2002 Post-doctoral research fellow for the TMR at the University of Bielefeld with Prof. Dr. Claus Ringel.

11/2002–07/2003 Post-doctoral research fellow at the University La Sapienza in Rome with Prof. Dr. Claudio Procesi and Prof. Dr. Corrada de Concini.

01–15/09/2006 Research visit at the University of Washington in Seattle to work with Prof. Dr. Paul Smith.

11–22/12/2006 Research visit at the Newton Institute at the University of Cambridge to participate in the Noncommutative Geometry Program.

14–18/04/2008 Research visit at the University of Bath to work with Prof. Dr. Alastair King.

15–25/05/2008 Research visit at the University of Chicago to work with Dr. Travis Schedler.

OTHER RELEVANT EXPERIENCE

10/2005-7/2006 Supervisor of the undergraduate thesis of Damiaan Lemmens entitled *Hopf Algebras and Renormalization*.

10/2006-7/2007 Supervisor of the undergraduate thesis of Raf Robberechts entitled *Vassiliev Invariants*.

9/2010-Now Cosupervisor of the graduate thesis of Nick Loughlin.

08/2007–09/2007 Lecturer for *GAMAP 2007, Socrates Intensive Program on Geometric and Algebraic Methods with Applications in Physics* in Antwerpen.

10/2005–12/2008 Science popularization: I gave lectures about connections between geometry, algebra and its applications to cryptography and GPS-systems.

10/2004–12/2008 Member of the educational commission for the department of Mathematics at the University of Antwerp.

1/2009–Now Member of the Staff-Student Committee for the school of Mathematics at the University of Newcastle.

LANGUAGE KNOWLEDGE

Dutch	native
English	good
French	good
Italian	fair
Portuguese	basic

RESEARCH RECORD

RESEARCH INTERESTS

- Resolutions of singularities:
noncommutative crepant resolutions, mutations, tilting bundles on Fano varieties, Calabi Yau varieties and algebras, dimer models
 - Noncommutative geometry:
smooth orders, noncommutative symplectic geometry, formally smooth algebras, derived equivalences between noncommutative algebras and algebraic varieties.
 - Geometric invariant theory:
quotient singularities, moduli spaces of representations, slice theorems.
 - Homological mirror symmetry:
Matrix factorizations for dimer models, Fukaya categories of (punctured) surfaces, dimer models and their relation to mirror symmetry for 2-dimensional Fano varieties and 3-dimensional Calabi-Yau varieties, Applications of quivers in theoretical physics and topology.
 - Representation theory of quivers:
Local quivers, quivers with potentials, preprojective algebras, McKay correspondence.
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OVERVIEW OF MY RESEARCH

Geometric invariant theory and quivers

In my PhD Thesis *The Geometry of Quotient Varieties of Quivers* I classified all quivers Q and dimension vectors α such that the quotient space classifying all semi-simple α -dimensional representations of Q , $\text{rep}_\alpha Q // \text{GL}_\alpha$, is a smooth variety [1,6]. Together with colleagues from Antwerp we extended these methods to investigate singularities that can occur in these varieties [4,5,7], the properties of the fibers of the quotient map [12] and other geometric objects associated to noncommutative algebras like character varieties, moduli spaces, graded representation spaces and Brauer-Severi varieties [2,8,9,10].

Noncommutative symplectic geometry

Together with my supervisor Lieven Le Bruyn I also studied the connection between noncommutative symplectic geometry, preprojective algebras and a type of infinite dimensional Lie algebras called Necklace Lie Algebras [2].

Resolutions of singularities and Calabi Yau Algebras

The notion of a noncommutative crepant resolution (NCCR) was introduced by Van den Bergh to act as a substitute for a commutative crepant resolution. I have shown in [10] that in the graded case for 3-dimensional Gorenstein singularities these NCCRs must come from a superpotential because they satisfy the Calabi Yau property. Together with Michael Wemyss and Travis Schedler we extended the superpotential method to arbitrary dimensions in the case that the algebra is Koszul [14]. In the case that the 3-dimensional Gorenstein singularity is toric I was able to show that the algebra comes from a combinatorial structure called a Dimer model [17] and I investigated the combinatorial conditions on dimer models that are needed to give rise to an NCCR in [16].

Homological mirror symmetry

Recently I have been investigating the connection between dimer models and homological mirror symmetry. I associated to each dimer model two categories: a category of matrix factorizations and a Wrapped Fukaya category. I was able to show that one can construct a duality on dimer models that interchanges these 2 categories. This fact could then be used to recover the commutative mirror symmetry for punctured surfaces [20]. I also used this result to interpret toric systems associated to strongly exceptional sequences of line bundles on Fano surfaces as an instance of mirror symmetry [21].

PUBLICATIONS

Publications in refereed journals

1. Bocklandt, Raf; Smooth quiver representation spaces. *J. Algebra* 253 (2002), no. 2, 296–313.
2. Adriaenssens, Jan; Bocklandt, Raf; Van de Weyer, Geert; Smooth character varieties for torus knot groups. *Comm. Algebra* 30 (2002), no. 6, 3045–3061.
3. Bocklandt, Raf; Le Bruyn, Lieven; Necklace Lie algebras and noncommutative symplectic geometry. *Math. Z.* 240 (2002), no. 1, 141–167.
4. Bocklandt, Raf; Le Bruyn, Lieven; Van de Weyer, Geert; Smooth order singularities. *J. Algebra Appl.* 2 (2003), no. 4, 365–395.
5. Bocklandt, Raf; Le Bruyn, Lieven; Symens, Stijn; Isolated singularities, smooth orders, and Auslander regularity. *Comm. Algebra* 31 (2003), no. 12, 6019–6036.

6. Bocklandt, Raf; Symmetric quiver settings with a regular ring of invariants. Special issue on linear algebra methods in representation theory. *Linear Algebra and its Appl.* 365 (2003), 25–43.
7. Bocklandt, Raf; Quiver quotient varieties and complete intersections. *Algebras and Representation Theory*, 8 (2005), no. 1, 127 – 145.
8. Bocklandt, Raf; Van de Weyer, Geert; Symens, Stijn; The flat locus of Brauer Severi fibrations of smooth orders. *Journal of Algebra*, 297 (2006), no. 1, 101–124.
9. Bocklandt, Raf; Symens, Stijn; The local structure of graded representations. *Communications in algebra*, 34 (2006), no. 12, 4401–4426.
10. Bocklandt, Raf; Graded Calabi Yau algebras of dimension 3. *Journal of Pure and Applied Algebra* 212 (2008), no. 1, 14–32.
11. Bocklandt, Raf; Van de Weyer, Geert; Cofree quiver settings. *Journal of Algebra* 319 (2008), no. 5, 2082–2105.
12. Bocklandt, Raf; Van de Weyer, Geert; The power of slicing in non-commutative geometry. *Bulletin of the Belgian Math. Soc.*, vol. 15 (2008), no. 2, 303–310
13. Peeters, Gino; Bocklandt, Raf; Van Houdt, Benny; Multiple Access Algorithms without Feedback using Combinatorial Designs. *IEEE Transactions on Communications* 57 (2009), no. 9, 2724–2733.
14. Bocklandt, Raf; Schedler, Travis; Wemyss Michael; Superpotentials and Higher Order Derivations. *Journal of Pure and Applied Algebra* 214 (2010), no. 9, 1502–1522.
15. Bocklandt, Raf; A Slice Theorem for Quivers with an Involution. *Journal of Algebra and its Applications* 9 2010, no. 3, 339–363.
16. Bocklandt, Raf; Consistency Conditions for dimer models
Glasgow Mathematical Journal / Volume 54 / Issue 02 / April 2012, pp 429 - 447
17. Bocklandt, Raf; Calabi Yau algebras and Quiver Polyhedra
Math. Zeitschrift online first. 2012, DOI: 10.1007/s00209-012-1006-z
18. Bocklandt, Raf; Generating Toric noncommutative crepant resolutions
Journal of Algebra. <http://dx.doi.org/10.1016/j.jalgebra.2012.03.040>
19. Bocklandt, Raf; Toric systems and mirror symmetry
preprint: arXiv:1201.4855
Accepted for *Compositio Mathematica*

Preprints

20. Bocklandt, Raf; The Local structure of Calabi Yau Algebras.
preprint: arXiv:0711.0179
21. Bocklandt, Raf; Noncommutative Mirror Symmetry and Punctured Surfaces
preprint: arXiv:1111.3392
Submitted to transactions of the AMS

Other publications

1. Bocklandt, Raf; Graded 3-dimensional Calabi Yau algebras. Extended Abstract for the workshop on Interactions between Algebraic Geometry and Noncommutative Algebra. Oberwolfach Report Volume 3, Issue 2, 2006.

Course Notes

1. Differential Geometry II
on-line: <http://www.algebra.ua.ac.be/notes/diff2.pdf>
2. Advanced Master Course on Kleinian Singularities
on-line: <http://www.algebra.ua.ac.be/notes/kleinian.pdf>
3. Representation theory
on-line: <http://www.algebra.ua.ac.be/notes/representation.pdf>
4. Coding theory and Cryptography
on-line: <http://www.algebra.ua.ac.be/notes/codes.pdf>
5. Linear Algebra
on-line: <http://www.algebra.ua.ac.be/notes/LA.pdf>
6. Coding Theory
on-line: <http://www.algebra.ua.ac.be/notes/CT.pdf>

Mathematical Reviews for the AMS

1. Review of: Su, Xiuping; Tame roots of wild quivers. *J. Algebra* 280 (2004), no. 2, 590–609.
2. Review of: Crawley-Boevey, William; Van den Bergh, Michel; Absolutely indecomposable representations and Kac-Moody Lie algebras. With an appendix by Hiraku Nakajima. *Invent. Math.* 155 (2004), no. 3, 537–559.
3. Review of: Enochs, E.; Estrada, S.; Garcia Rozas, J. R.; Oyonarte, L.; Flat covers of representations of the quiver A_∞ . *Int. J. Math. Math. Sci.* (2003), no. 70, 4409–4419.
4. Review of: Li, Longcai; Zhang, Yingbo; Representation theory of the system quiver. *Sci. China Ser. A* 46 (2003), no. 6, 789–803.
5. Review of: Buchweitz, Ragnar-Olaf; Liu, Shiping; Dimension of the mesh algebra of a finite Auslander-Reiten quiver. *Comm. Algebra* 31 (2003), no. 5, 2207–2217.
6. Review of: Adriaenssens, Jan; Le Bruyn, Lieven; Local quivers and stable representations. *Comm. Algebra* 31 (2003), no. 4, 1777–1797.
7. Review of: Crawley-Boevey, William; Normality of Marsden-Weinstein reductions for representations of quivers. *Math. Ann.* 325 (2003), no. 1, 55–79.
8. Review of: Simson, Daniel; Chain categories of modules and subprojective representations of posets over uniserial algebras. *Proceedings of the Second Honolulu Conference on Abelian Groups and Modules (Honolulu, HI, 2001)*. *Rocky Mountain J. Math.* 32 (2002), no. 4, 1627–1650.

9. Review of: Derksen, Harm; Weyman, Jerzy; On the canonical decomposition of quiver representations. *Compositio Math.* 133 (2002), no. 3, 245–265.

TALKS

- 09/03/2001 A smooth introduction to quiver representations
FRIS-Seminar University of Antwerp
- 26/03/2001 Coregular quiver representations
Séminaire d'Algèbre
Université Pierre et Marie Curie
Paris
- 09/06/2001 Coregular quiver representations
BMS/DMV Joint Meeting
University of Liège
- 22/02/2002 Quivers with a regular ring of invariants,
Workshop on Algebraic Lie Representations
University of Bielefeld
- 02/09/2002 Smooth order singularities
Conference on Noncommutative algebra and geometry
Almeria
- 10/10/2002 The geometry of quiver quotient varieties
Representation Theory Seminar
University of Bielefeld
- 05/02/2003 The geometry of quiver quotient varieties
Seminario di Algebra
University La Sapienza
Rome
- 05/05/2003 The geometry of quiver quotient varieties
Seminario di Algebra
University of Padova
- 26/01/2004 Reduction moves for quiver settings
Algebra Seminar
University of Wuppertal
- 21/05/2005 The power of slicing in noncommutative geometry
JOINT BeNeLuxFra CONFERENCE in MATHEMATICS
University of Ghent
- 21/03/2006 Graded Calabi Yau algebras of dimension 3
Séminaire d'Algèbre
Université Pierre et Marie Curie
Paris
- 12/05/2006 Graded Calabi Yau algebras of dimension 3
Interactions between Algebraic Geometry and Noncommutative
Geometry
Oberwolfach

- 05/09/2006 Graded Calabi Yau algebras of dimension 3
Algebra Seminar
University of Washington
Seattle
- 21/12/2006 Graded 3-dimensional Calabi Yau algebras
Workshop: NCGw03 - Trends in Noncommutative Geometry
Newton Institute
Cambridge
- 22/10/2007 The local structure of Calabi Yau algebras
Algèbres de Calabi-Yau et Algèbres N-Koszul
CIRM
Luminy
- 05/01/2008 Superpotentials, higher order derivatives and Calabi Yau algebras
Liegrits Workshop
Oxford
- 15/04/2008 Toric CY3 algebras and tilings
Algebra Seminar
University of Bath
- 20/05/2008 All toric CY3 algebras come from dimer models
Algebra Seminar
University of Chicago
- 28/01/2009 Toric CY-3 algebras and quiver polyhedra
University of Glasgow
- 14/04/2009 Noncommutative resolutions of singularities
Algebra Seminar
University of Chicago
- 06/10/2009 Calabi Yau algebras and quiver polyhedra
Algebra Seminar
University of Sheffield
- 05/11/2009 Calabi Yau algebras and quiver polyhedra
Algebra Seminar
University of Cardiff
- 08/12/2009 Calabi Yau algebras and quiver polyhedra
Algebra Seminar
University of Manchester
- 8/02/2010 Calabi Yau algebras and quiver polyhedra
Algebra Seminar
University of Leeds
- 17/02/2010 Calabi Yau algebras and quiver polyhedra
Algebra Seminar
University of Bielefeld
- 28-30/03/2010 Nietcommutatieve resoluties van singulariteiten
Lezingenreeks voor het mastervak Capita Selecta
Universiteit Gent

- 14/08/2010 Toric noncommutative crepant resolutions
Workshop on McKay correspondence
University of Warwick
- 10/09/2010 Toric noncommutative crepant resolutions
50th BLOC meeting
University of Leicester
- 28/10/2010 Toric noncommutative crepant resolutions
Algebra Seminar
University of Aberdeen
- 11/11/2010 Toric noncommutative crepant resolutions
Algebra Seminar
University of Oxford
- 23/02/2011 Generating toric noncommutative crepant resolutions.
Algebra Seminar
University of Glasgow
- 28/03/2011 2 Expert talks on dimer models
Workshop on dimer models and algebraic surfaces
Wuppertal
- 05/05/2011 Generating toric noncommutative crepant resolutions.
Séminar d'algèbre
Paris
- 02-09-2011 Dimer Duality and Mirror Symmetry
Kent Algebra Days 2011
Canterbury
- 15-11-2011 Noncommutative mirror symmetry for punctured surfaces
Geometry Seminar in Oxford
- 23-11-2011 Noncommutative mirror symmetry for punctured surfaces
Number Theory and Representation Theory (LMS Inaugural
Meeting),
UEA London
- 14-12-2011 Noncommutative mirror symmetry for punctured surfaces
Noncommutative Algebraic Geometry and D-branes
Simons Center, Stony Brook
- 31-02-2012 Noncommutative mirror symmetry for punctured surfaces
MAGIC seminar, Imperial College London
- 29-02-2012 An introduction to mirror symmetry from a noncommutative
point of view
Algebra Seminar, Ghent University.
- 18-04-2012 Noncommutative mirror symmetry for punctured surfaces
INI-WIMCS meeting on noncommutative geometry in Cardiff
- 06-08-2012 Noncommutative projective geometry through the looking glass
Workshop on noncommutative algebraic geometry in Manches-
ter
- 30-10-2012 Noncommutative projective geometry through the looking glass
Workshop on New trends noncommutative algebraic geometry
at the BIRS in Banff (Canada)

POPULAR SCIENCE LECTURES

- | | |
|------------|---|
| 18/04/2007 | Priemgetallen, Kloklezen en geheime codes
Openlesdag UA
Universiteit Antwerpen |
| 15/05/2007 | Regelmatige veelvlakken en de gulden snede
Universiteit Antwerpen |
| 25/01/2008 | Priemgetallen en Cryptografische codes met publieke sleutels
Studiecentrum voor Kernenergie
Mol |
| 20/03/2008 | De wiskunde achter het GPS-systeem
Scheppers-Instituut
Mechelen |