Curriculum Vitae

Andreas Holmstrom

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Contact:

- andreas.holmstrom@gmail.com
- +33 6 66 60 80 05
- www.andreasholmstrom.org

RESEARCH INTERESTS

- Interactions between homotopy theory and arithmetic geometry.
- L-functions and zeta functions, in particular conjectures on special values.
- Cohomology theories in algebraic and arithmetic geometry.
- Motivic stable homotopy theory, in particular over arithmetic base schemes.
- Arakelov geometry.

PUBLICATIONS

See the last page of this CV for the list as of Nov 2011, and see my webpage for an updated list.

MATHEMATICAL EDUCATION

- PhD program, University of Cambridge, United Kingdom.
  Thesis: Arakelov motivic cohomology.
  Advisor: Prof. Tony Scholl.
  January 2007 – October 2010.
- Certificate of Advanced Study in Mathematics ("Part III"), University of Cambridge.
  Graduated with Distinction.
  October 2005 – June 2006.
- MSc in Engineering Physics, Royal Institute of Technology (KTH), Stockholm, Sweden.
  August 2001 – September 2005.
- ERASMUS exchange student at École Polytechnique Fédérale de Lausanne, Switzerland.
  September 2004 – July 2005.

WORK EXPERIENCE

- Postdoc at IHES (Hodge Fellowship).
  September 2011 – August 2012
- Visiting researcher at California Institute of Technology.
  3 - 31 January 2011.
- Postdoc at University of Bordeaux.
  Funded by a grant on Motives and algebraic curves, working with Prof. Qing Liu.
  November 2010 – August 2011.
- Small-group tutoring for undergraduates in Cambridge in the following courses: Riemann surfaces; Groups, rings and modules; Number theory; Algebraic geometry.
  2007 – 2010.

- Marie Curie Early Stage Researcher (as part of the PhD program)
  EU Arithmetic Algebraic Geometry network / University of Cambridge.
  January 2007 – January 2008.
- Temporary lecturer, University of Nairobi.
  Taught Linear algebra and Introduction to abstract algebra.
  October 2006 – December 2006.
- Numerous other part-time and summer jobs during my studies.

ORGANISATIONAL RESPONSIBILITIES

- Initiated and co-organised a graduate student conference on homotopy theory in Cambridge in December 2007, with 30 participants from more than ten different countries.
- Initiated and organised a study group on motivic stable homotopy theory in Cambridge in early 2010.

LANGUAGES

- Fluent in English, Swedish and Norwegian.
- Good knowledge of French.

TALKS GIVEN

Invited seminar talks

- Arakelov motivic cohomology.
  IHES, November 2011.
- Arakelov motivic cohomology.
  Université Paul Sabatier, Toulouse, May 2011.
- Homotopy theory and values of zeta functions.
  University of Bordeaux, April 2011.
- Arakelov motivic cohomology.
  Caltech number theory seminar, January 2011.
- Arakelov motivic cohomology and special values of zeta functions.
  Sheffield Topology Seminar, April 2010.
- Higher arithmetic Chow groups and zeta functions.
  Nottingham Number Theory Seminar, March 2010.
- L-functions in number theory.
  University of Nairobi Colloquium talk, November 2006.

Conference talks

- An introduction to motives and stable homotopy theory.
  At the Birch-Swinnerton-Dyer summer school, Sardinia, June 2011.
- Arakelov motivic cohomology and zeta values.
  At Motives and homotopy theory of schemes, Oberwolfach, May 2010.
- Simplicial sheaves and cohomology theories.
  At the Algebra and Geometry graduate student conference, KTH, Stockholm, May 2009.
- What is a geometric category?
  At the Young Researchers in Mathematics conference, Cambridge, April 2009.
- Brown representability and arithmetic geometry.
  At the Graduate Homotopy theory conference, Cambridge, December 2007.

Talks at graduate student seminars in Cambridge

- Motivic homotopy theory over general base schemes. February 2010.
- Homotopy theory over Spec Z. November 2009.
- L-functions in arithmetic geometry. October 2009.
- What are simplicial sheaves? February 2009.
- Global Langlands functoriality. March 2008.
- Galois representations from torsion points on elliptic curves. November 2007.
- Cohomology theories in algebraic geometry. June 2007.
- Complex multiplication and modular curves. February 2007.
- Iwasawa theory. Spring 2006.
- What is etale cohomology? March 2006.

Other talks

- The Beilinson conjectures I and II.
  Two talks at the London Number Theory Study Group, January 2010.
- Elliptic curves over **C**.
  Graduate seminar, École Polytechnique Fédérale de Lausanne, February 2005.
- L-functions and Tate's thesis.
  Presentation of MSc thesis, KTH, Stockholm, September 2005.

CONFERENCE PARTICIPATION

- Géométrie arithmétique et motivique. Luminy, September 2011.
- Summer school on the Birch and Swinnerton-Dyer conjecture. Sardinia, June 2011.
- Regulators III. Barcelona, July 2010.
- Motives and homotopy theory of schemes. Oberwolfach, May 2010.
- Cohomology of algebraic varieties, Hodge theory, Algebraic cycles, Motives. Paris, April 2010.
- Focused workshop on $\mathbf{F}_1$-geometry. Granada, November 2009.
- Advanced School on Homotopy theory and Algebraic geometry. Seville, September 2009.
- Motivic homotopy theory. Münster, July 2009.
- Algebraic K-theory and Motivic Cohomology. Oberwolfach, June 2009.
- British-Nordic Congress of Mathematicians. Oslo, June 2009.
- Algebra and Geometry (Nordic graduate student conference). KTH, Stockholm, May 2009.
- Young Researchers in Mathematics. Cambridge, April 2009.
- The Grothendieck conference. IHES, January 2009.
- Diophantine approximation and Arakelov theory. Fields Institute, Toronto, October 2008.
- Homotopical group theory and topological algebraic geometry. Bonn, June 2008.
- Noncommutative constructions in arithmetic and geometry. London, June 2008.
- The Abel Symposium on Algebraic Topology. Oslo, August 2007.
- Motives and algebraic cycles. Fields Institute, Toronto, March 2007.
- Homotopy theory of schemes. Fields Institute, Toronto, March 2007.
- LMS/EPSRC short course: Topics in Arithmetic Geometry. London, August 2006.

COMPETITIONS

- Honourable mention at the IMO (International Mathematical Olympiad) 2000 in South Korea.
- Participated in IMO 1999 in Romania.
- Have ranked among the very best students in Sweden in numerous other competitions in programming, physics, and mathematics.

GRANTS AWARDED

For the PhD program (approximate figures)

- Royal Swedish Academy of Sciences (Magnusons): € 15 000.
- Sixten Gemzeus foundation: € 11 000.
- Cambridge European Trusts: € 17 000.
- Johan and Jakob Söderberg foundation: € 14 000.

For my undergradate studies

Smaller amounts (up to € 3000) from each of the following sources: Oscar Ekman Foundation for Sweden Abroad, KTH General Funds, Söderman's Extra, The C E Wikström Foundation, Ahlner's, Österby's, ERASMUS support, Sandviken foundation for excellence in studies at KTH, The Swedish Association for Graduate Engineers.

OTHER ACTIVITIES

- Am running the mathematical blog Motivic Stuff.
- Member of the Swedish Mathematical Society.
- Member of the London Mathematical Society.
- Member of the American Mathematical Society.
- Fellow of the Cambridge Philosophical Society.

LIST OF PUBLICATIONS

Thesis

- Title: *Arakelov motivic cohomology*.
  Submitted: 27 October 2010.
  Defense date: 3 December 2010.
  Available on www.andreasholmstrom.org/thesis.pdf

Published

- *Arakelov motivic cohomology and zeta values*. In *Motives and Homotopy Theory of Schemes. Abstracts from the workshop held 16-22 May, 2009*. Oberwolfach Reports 7, Issue 2 (2010).

Submitted

- *Arakelov motivic cohomology I* (joint with Jakob Scholbach)
  Available at http://arxiv.org/abs/1012.2523
  Abstract: This is the first in a series of papers developing a good theory of Arakelov motivic cohomology for arithmetic schemes. The motivation for this theory comes from the study of special values of L-functions and zeta functions, as well as the hope for so called higher arithmetic Riemann-Roch theory. Compared with previous approaches to higher arithmetic Chow groups by Feliu, Burgos and Goncharov, the main advantage in our approach is that we can work over an arithmetic base like Spec **Z** rather than just over a number field, which is crucial for any applications to special values. Another advantage is that we have good push-forward functoriality, which is necessary for any formulation of higher arithmetic Riemann-Roch theory. These improvements are due mainly to the fact that we use the work of Cisinski, Déglise,

Ayoub and Riou on motivic stable homotopy theory over very general base schemes. Using this theory, we can not only give a good definition of Arakelov motivic cohomology, but also give unconditional proofs of many of the structural properties one could hope that these new cohomology groups should satisfy. Two key ingredients in our definition is the construction of a motivic ring spectrum representing Deligne cohomology, together with a new definition of the Beilinson regulator. The main application in the paper is the formulation and proof of a higher arithmetic Riemann-Roch theorem for smooth morphisms.

Preprints in preparation (based on material in the thesis)

- *Products in Arakelov motivic cohomology* (joint with Peter Arndt).
  Abstract: Using recent results of Hornbostel on model structures on algebras over operads, we define a product structure on Arakelov motivic cohomology.
- *A1-representability of Bloch-Ogus theories.*
  Abstract: We discuss the general problem of constructing motivic ring spectra representing Bloch-Ogus cohomology theories.
- *Gluing of cohomology theories for arithmetic schemes.*
  Abstract: We show that objects in the motivic stable homotopy category over Spec **Z** satisfy a gluing formalism similar to the situation for etale sheaves or perverse sheaves. This gives a way of constructing cohomology theories for arithmetic schemes starting from the data of a cohomology theory over **Q** and a cohomology theory over each finite prime, together with certain "gluing maps".