

MOHAMED BARAKAT
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 (<https://mohamed-barakat.github.io>)

Personal:

Birthday: 21 December 1973
 Place of birth: Cairo, Egypt
 Nationality: German (since February 2013)
 Marital status: married, two sons and one daughter

School education:

1979 – 1983 Orouba language School in Cairo
 1983 – 1992 Deutsche Evangelische Oberschule in Cairo
 May 1992 German Abitur

Higher education:

1992 – 1997 Study of mathematics with minor physics
 at the RWTH Aachen University
 1995 Vordiplom in mathematics
 with the total degree “*very good*”
 October 1997 Diploma in mathematics at the RWTH Aachen University
 with the total degree “*excellent*”
 January 2002 Ph.D. in mathematics at the RWTH Aachen University
 “*summa cum laude*”
 March 2010 Habilitation in mathematics at the RWTH Aachen University

Academia:

1993 – 1994 Teaching assistant at the
 Institut für Statistik und Wirtschaftsmathematik
 2000 – 2002 Research assistant at the
 Lehrstuhl B für Mathematik, RWTH Aachen University
 2002 – 2008 Scientific assistant at the
 Lehrstuhl B für Mathematik, RWTH Aachen University
 2008 – 2009 Research assistant at the
 Saarland University
 since October 2009 Lecturer at the
 University of Kaiserslautern
 summer semester 2014 Deputy professor of Algebra at the
 Catholic University Eichstätt-Ingolstadt
 summer & winter semester 2015 Deputy professor of Algebra at the
 RWTH Aachen University
 since February 2016 Full professor of pure mathematics at the
 University of Siegen

Grants & prizes:

- Nov. 1997 – Nov. 2000 Ph.D. grant from the graduate school
“Analyse und Konstruktion in der Mathematik”
- October 2002 Borchers-Medal of the RWTH Aachen University
- October 2002 Friedrich-Wilhelm Prize of the RWTH Aachen University

Research visits:

- Winter 2002/03 Guest of the mathematical institute
(4 month) of the Utrecht University
- November 2007 Guest at INRIA – Sophia Antipolis, Nice
(1 week) as member of the Procope program
Computational Methods in Mathematical Systems Theory
- May 2008 Guest at the Departamento de Álgebra
(1 week) of the Universidad de Sevilla
- March 2012 Guest at the Departamento de Álgebra
(2 weeks) of the Universidad de Sevilla
- June 2012 Guest at INRIA – Saclay, Paris
(1 week) as member of the Procope program
Constructive Algebra for Systems Theory
- December 2012 Guest at INRIA – Saclay, Paris
(1 week) as member of the Procope program
Constructive Algebra for Systems Theory
- February 2015 Guest at the Departamento de Álgebra
(1 week) of the Universidad de Sevilla

Further research activities:

- Since December 2013 Foreign member of the
2 years Proyecto de Investigación de excelencia,
Junta de Andalucía – Singularidades,
geometría algebraica aritmética
y teoría de representaciones:
estructuras y métodos diferenciales, cohomológicos,
combinatorios y computacionales.

**Acquired research
funding:**

- July 2013
3 years
PhD position (126225 €) + 9000 € travel fund
for a winning proposal in the DFG priority program
“Algorithmic and Experimental Methods
in Algebra, Geometry, and Number Theory”,
Project: *Constructive derived equivalences
and equivariant vector bundles*
- January 2017
4 years
Postdoc position (266400 €) + 4000 € travel fund
for a winning proposal in the DFG
Collaborative Research Centre TRR 195
“Symbolic Tools in Mathematics and their Application”,
Project: *Central software project:
Interaction, high-performance and support*
- January 2017
4 years
Postdoc position (266400 €) + 16000 € travel fund
+ 31816 € Research assistant
for a winning proposal in the DFG
Collaborative Research Centre TRR 195
“Symbolic Tools in Mathematics and their Application”,
Project: *Derived categories of equivariant coherent sheaves*

Refereed publications (inverse chronological)

- [1] Mohamed Barakat and Markus Lange-Hegermann, *A constructive approach to the module of twisted global sections on relative projective spaces*, To appear in *Algorithmic and Experimental Methods in Algebra, Geometry, and Number Theory*, (Springer), (arXiv:1409.6100).
- [2] Takuro Abe, Mohamed Barakat, Michael Cuntz, Torsten Hoge, and Hiroaki Terao, *The freeness of ideal subarrangements of Weyl arrangements*, *J. Eur. Math. Soc.* **18** (2016), no. 6, 1339–1348, (arXiv:1304.8033).
- [3] Mohamed Barakat, *On subdirect factors of a projective module and applications to system theory*, *Multidim. Syst. Sign. Process.* **26** (2015), 339–348, (arXiv:1305.0058).
- [4] Mohamed Barakat and Markus Lange-Hegermann, *On the Ext-computability of SERRE quotient categories*, *Journal of Algebra* **420** (2014), 333–349, (arXiv:1212.4068).
- [5] Mohamed Barakat and Markus Lange-Hegermann, *Characterizing Serre quotients with no section functor and applications to coherent sheaves*, *Appl. Categor. Struct.* **22** (2014), no. 3, 457–466, (arXiv:1210.1425).
- [6] Mohamed Barakat and Markus Lange-Hegermann, *On monads of exact reflective localizations of Abelian categories*, *Homology, Homotopy and Application* **15**, (2013), no. 2, 145–151, (arXiv:1202.3337).
- [7] Mohamed Barakat and Michael Cuntz, *Coxeter and crystallographic arrangements are inductively free*, *Advances in Mathematics* **229** (2012), no. 1, 691–709, (arXiv:1011.4228).
- [8] Mohamed Barakat and Markus Lange-Hegermann, *An axiomatic setup for algorithmic homological algebra and an alternative approach to localization*, *J. Algebra Appl.* **10** (2011), no. 2, 269–293, (arXiv:1003.1943).
- [9] Mohamed Barakat and Simon Görtzen, *Simplicial cohomology of smooth orbifolds in GAP*, *Proceedings of the third International Congress on Mathematical Software - ICMS 2010 (Kobe, Japan)* (K. Fukuda et al., ed.), *Lecture Notes in Computer Science*, vol. 6327, Springer, 13–17 September 2010, pp. 46–49, (<http://www.mathb.rwth-aachen.de/~barakat/ICMS10/SCO.pdf>).
- [10] Mohamed Barakat and Stanislaus Maier-Paape, *Conley index theory*, *Proceedings of the 19th International Symposium on Mathematical Theory of Networks and Systems - MTNS 2010 (Budapest, Hungary)* (András Edelmayer, ed.), 5–9 July 2010, pp. 1645–1651 (http://www.conferences.hu/mtns2010/proceedings/Papers/286_472.pdf).
- [11] Mohamed Barakat, *Purity filtration and the fine structure of autonomy*, *Proceedings of the 19th International Symposium on Mathematical Theory of Networks and Systems -*

- MTNS 2010 (Budapest, Hungary) (András Edelmayer, ed.), 5–9 July 2010, pp. 1657–1661 (http://www.conferences.hu/mtns2010/proceedings/Papers/288_451.pdf).
- [12] Mohamed Barakat and Stanislaus Maier-Paape, *Computation of connection matrices using the software package conley*, Internat. J. Bifur. Chaos Appl. Sci. Engrg. **19** (2009), no. 9, 3033–3056.
- [13] Mohamed Barakat and Daniel Robertz, *conley: Computing connection matrices in Maple*, J. Symbolic Comput. **44** (2009), no. 5, 540–557, ([arXiv:math.DS/0701173](http://arxiv.org/abs/math/0701173)).
- [14] Mohamed Barakat and Daniel Robertz, *homalg – A meta-package for homological algebra*, J. Algebra Appl. **7** (2008), no. 3, 299–317, ([arXiv:math.AC/0701146](http://arxiv.org/abs/math/0701146)).
- [15] Mohamed Barakat and Daniel Robertz, *Computing invariants of multidimensional linear systems on an abstract homological level*, Proceedings of the 17th International Symposium on Mathematical Theory of Networks and Systems - MTNS 2006 (Kyoto, Japan), 2006, pp. 542–559, (http://www.mathb.rwth-aachen.de/~barakat/mtns/homalg_mtns06.pdf).
- [16] Mohamed Barakat and Daniel Robertz, *homalg: First steps to an abstract package for homological algebra*, Proceedings of the X meeting on computational algebra and its applications - EACA 2006 (Sevilla, Spain), 2006, pp. 29–32, (http://www.mathb.rwth-aachen.de/~barakat/eaca/homalg_eaca06.pdf).
- [17] Mohamed Barakat, *The existence of Cartan connections and geometri- zable principal bundles*, Arch. Math. (Basel) **83** (2004), no. 2, 159–163, ([arXiv:math.DG/0206136](http://arxiv.org/abs/math/0206136)).
- [18] Mohamed Barakat, *jets. A MAPLE-package for formal differential geometry*, Computer algebra in scientific computing (Konstanz, 2001), Springer, Berlin, 2001, pp. 1–12, (<http://www.mathb.rwth-aachen.de/~barakat/casc/casc.pdf>).
- [19] Mohamed Barakat and Martin Oberlack, *Reduction and long time behaviour of homo- geneous turbulence under spatially constant mean-velocity gradient*, Advances in tur- bulence VIII: Proc. of the Eights European Turbulence Conference (Barcelona, Spain) (C. Dopazo, ed.), CIMNE, June 27-30 2000, pp. 865–868.

Preprints (inverse chronological)

- [20] Mohamed Barakat and Markus Lange-Hegermann and Sebastian Posur, *Elimination via saturation*, ([arXiv:1707.00925](http://arxiv.org/abs/1707.00925)).
- [21] Mohamed Barakat and Markus Lange-Hegermann, *Gabriel morphisms and the computability of Serre quotients with applications to coherent sheaves*, ([arXiv:1409.2028](http://arxiv.org/abs/1409.2028)).
- [22] Mohamed Barakat, *Spectral filtrations via generalized morphisms*, ([arXiv:0904.0240](http://arxiv.org/abs/0904.0240)).

- [23] Mohamed Barakat and Barbara Bremer, *Higher extension modules and the Yoneda product*, (arXiv:0802.3179).

Non-refereed publications (inverse chronological)

- [24] Mohamed Barakat, Max Horn, Frank Lübeck, Oleksandr Motsak, Max Neunhöffer, Hans Schönemann, *The GAP package SingularInterface*, *Computeralgebra-Rundbrief*, **55**, 29–33, October 2014, (<http://www.fachgruppe-computeralgebra.de/data/CA-Rundbrief/car55.pdf>).
- [25] Mohamed Barakat, *Computations of unitary groups in characteristic 2*, (for J.-P. Serre), 2013, (<http://www.mathematik.uni-kl.de/~barakat/forJPSerre/UnitaryGroup.pdf>).
- [26] Mohamed Barakat and Markus Lange-Hegermann, *Computing Ext in Serre quotient categories*, Mini-Workshop: Constructive Homological Algebra with Applications to Coherent Sheaves and Control Theory, no. 25, MFO, Oberwolfach, 2013, pp. 14–17.
- [27] Mohamed Barakat and Markus Lange-Hegermann, *The homalg project*, *Computeralgebra-Rundbrief*, **51**, 6–9, October 2012, (<http://www.fachgruppe-computeralgebra.de/data/CA-Rundbrief/car51.pdf>).
- [28] Mohamed Barakat, *Jet groupoids and the invariance of geometric structures*, Mini-Workshop: Algebraic and Analytic Techniques for Polynomial Vector Fields, no. 57, MFO, Oberwolfach, 2010, pp. 19–21.
- [29] Mohamed Barakat, *Spectral sequences and effective computations*, Mini-Workshop: Formal Methods in Commutative Algebra: A View Toward Constructive Homological Algebra, no. 50, MFO, Oberwolfach, 2009, pp. 7–12.

Theses

- [30] *Pro-Nilpotente Lie-Algebren*, Diploma thesis, Lehrstuhl B für Mathematik, RWTH Aachen University, October 1997.
- [31] *Functional spaces. A direct approach*, PhD thesis, RWTH Aachen University, January 2002.
- [32] *The homomorphism theorem and effective computations*, Habilitation thesis, RWTH Aachen University, April 2009.

Software projects

- [33] *The homalg project*. 2003–current. (<http://homalg-project.github.io>).
- [34] *conley package*. 2006–2008. (<http://www.mathb.rwth-aachen.de/conley/>).
- [35] *jets package*. 2000–2007. (<http://www.mathb.rwth-aachen.de/~barakat/jets/>).

Editorial activity

- [36] Associate Editor, *The Journal of Software for Algebra and Geometry*.

Organized (since 2010)

- [37] PLESKEN's 60th birthday colloquium. RWTH Aachen University, 7 May, 2010. (co-organizer)
- [38] *The second SINGULAR-GAP developers meeting*. University of Kaiserslautern, 14–18 November 2011. (organizer)
- [39] *The third SINGULAR-polymake-GAP developers meeting*. University of St Andrews, 27–31 August 2012. (organizer)
- [40] *The fourth SINGULAR-GAP developers meeting*. RWTH Aachen University, 7–11 January 2013. (organizer)
- [41] OBERWOLFACH MINI-WORKSHOP: *Constructive Homological Algebra with Applications to Coherent Sheaves and Control Theory*. Mathematisches Forschungsinstitut Oberwolfach, 12–18 May 2013. (co-organizer)
- [42] *The fifth SINGULAR-GAP developers meeting*. RWTH Aachen University, 6–10 January 2014. (co-organizer)
- [43] *First GAP Days*. RWTH Aachen University, 25–29 August 2014. (co-organizer)
- [44] *Seventh de Brún Workshop on Homological Perturbation Theory*. National University of Ireland, Galway, 1–5 December 2014. (co-organizer)
- [45] *Second GAP Days*. RWTH Aachen University, 16–20 March 2015. (co-organizer)
- [46] *Third GAP Days*. NTNU Trondheim, 14–23 September 2015. (co-organizer)
- [47] *Minisymposium der DMV Jahrestagung: Computer Algebra and Applications*. Hamburg, 21–25 September 2015. (co-organizer)
- [48] *Session on computational aspects of homological algebra, group, and representation theory at ICMS 2016*. ZIB Berlin, 11–14 July 2016. (co-organizer)
- [49] *GAP Days Fall 2017*. University of Siegen, Workshop: 30 August – 1 September, Code sprint: 4–8 September, 2017. (co-organizer)

Advised PhD theses

- [50] SEBASTIAN POSUR: *Constructive category theory and applications to equivariant sheaves*, PhD thesis, University of Siegen (**submitted February 2017**).
- [51] SEBASTIAN GUTSCHE: *Constructive category theory with applications to algebraic geometry*, PhD thesis, University of Siegen (**submitted April 2017**).

- [52] MARTIN BIES: *Cohomologies of coherent sheaves and massless spectra in F-theory*, PhD thesis, Institut für theoretische Physik, University of Heidelberg (coadvisor, **in preparation**).
- [53] KAMAL SALEH: *Constructive Quillen model structures*, PhD thesis, University of Siegen (**in preparation**).

Advised graduation theses

- [54] FLORIAN DIEBOLD: *Greatest common divisors using homological algebra*, Bachelor thesis, August 2011, University of Kaiserslautern.
- [55] HENNING KOPP: *Cube-attack-like cryptanalysis and higher order differential attacks*, Bachelor thesis, September 2011, University of Kaiserslautern.
- [56] NINA BINDEL: *Presentation of two fully homomorphic schemes by Gentry*, Bachelor thesis, October 2011, University of Kaiserslautern.
- [57] SEBASTIAN GUTSCHE: *An algorithmic framework for toric geometry*, Master thesis, March 2012, RWTH Aachen University.
- [58] SEBASTIAN POSUR: *G-equivariant coherent sheaf cohomology*, Master thesis, March 2013, RWTH Aachen University.
- [59] EVA MARIA HEMMERLING: *Efficient primary decomposition of zero dimensional ideals*, Bachelor thesis, March 2014, University of Kaiserslautern.
- [60] KAMAL SALEH: *Constructions in Boij-Söderberg theory*, Master thesis, March 2015, RWTH Aachen University.
- [61] MARCEL HARK: *Minimal free resolutions and the perturbation lemma*, Master thesis, September 2016, RWTH Aachen University.