

CURRICULUM VITAE

DR. RER. NAT. MARTIN BIES

PERSONAL DETAILS

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Nationality: German
Date of birth: 15/12/1987



SUMMARY

Education	PhD in Physics (Heidelberg university – defended on 01/02/2018)
Past research	Physics: <ul style="list-style-type: none">• Phenomenological aspects of standard models in string theory.• In particular computation of massless spectra of string vacua. Mathematics: <ul style="list-style-type: none">• Algorithms for cohomologies of coherent sheaves.• Constructive approaches to Freyd categories.• Brill-Noether theory and root bundles. Software development via github since December 2015: <ul style="list-style-type: none">• Github-metric:<ul style="list-style-type: none">– More than 2500 contributions.– More than 500.000 lines of code added.– More than 480.000 lines of code modified/deleted.• Contributions to homalg_project, CAP_project, each consisting of more than 200.000 lines of code.• Other contributions include ToricVarieties_project, oscar-system.• Experience in gap, python, julia, C++, git.
Teaching experience	Instructor (2021, 2022): <i>Comp. Linear Algebra</i> (University of Pennsylvania) Senior Tutor in 2016 and 2018 (Heidelberg University) Tutor for 8 lecture courses (Oct. 2012 – Oct. 2018, Heidelberg University)
Language skills	German – mother tongue English – fluent (Imperial College International Diploma) French – (CEFR level B1)
Scholarships	Simons Postdoctoral Fellow (since Sept. 2020) FWA – Foundation Wiener-Anspach (Oct. 2018 – Sept. 2020) Studienstiftung des deutschen Volkes (Jan. 2010 – Feb. 2018)

PROFESSIONAL EXPERIENCE

Since Oct. 2022	Postdoctoral Researcher Department of Mathematics, TU Kaiserslautern Germany
Sept. 2021 - Aug. 2021	Simons Postdoctoral Fellow Department of Physics and Astronomy, University of Pennsylvania USA
Sept. 2020 - Aug. 2021	Simons Postdoctoral Fellow Department of Mathematics, University of Pennsylvania USA
Oct. 2019 – Sept. 2020	Long term visitor Mathematical institute, University of Oxford United Kingdom
Oct. 2018 – Sept. 2019	Postdoctoral Researcher Physique Théorique et Mathématique, Université Libre de Bruxelles Belgium
Feb. 2018 – Sept. 2018	Postdoctoral Researcher Institut für theoretische Physik, Ruprecht-Karls-Universität Heidelberg Germany

EDUCATION

Mar. 2014 – Feb. 2018	PhD studies in physics (Heidelberg university) on the subject <i>Cohomologies of coherent sheaves and massless spectra in F-theory</i> Supervisor physics: Prof. Dr. Timo Weigand (Uni. Heidelberg) Supervisor mathematics: Prof. Dr. Mohamed Barakat (Uni. Siegen) Result: Magna cum laude (very good)
Sept. 2012 – Feb. 2014	Master studies in physics (Heidelberg university) on the subject <i>Cohomologies of holomorphic line bundles in smooth and compact normal toric varieties</i> Supervisor: Prof. Dr. Timo Weigand Result: 1.0
Oct. 2008 – Aug. 2012	Bachelor studies in physics (Heidelberg university) on the subject <i>Intersecting D6-brane models on $T^2 \times T^2 \times T^2/(\sigma \times \Omega)$ and $T^2 \times T^2 \times T^2/(\mathbb{Z}_2 \times \mathbb{Z}_2 \times \sigma \times \Omega)$ orientifolds</i> Supervisor: Prof. Dr. Timo Weigand Result: 1.1
Oct. 2010 – June 2011	Studies abroad at Imperial College (London, United Kingdom)

SCIENTIFIC PUBLICATIONS

- *Root bundles: Applications to F-theory Standard Models*
Journal: Preprint
arXiv: <https://arxiv.org/abs/2303.08144>
- *Toric Geometry in OSCAR*
Journal: Computeralgebra Rundbrief
arXiv: <https://arxiv.org/abs/2303.08110>
Collaborators: L. Kastner
- *Brill-Noether-general Limit Root Bundles:
Absence of vector-like Exotics in F-theory Standard Models*
Journal: *Journal of High Energy Physics*
DOI: 10.1007/JHEP11(2022)004
Collaborators: Mirjam Cvetič, Ron Donagi, Marielle Ong
- *Statistics of Root Bundles Relevant for Exact Matter Spectra of F-theory MSSMs*
Journal: *Physical Review D*
DOI: 10.1103/PhysRevD.104.L061903
Collaborators: M. Cvetič, M. Liu
- *Root Bundles and Towards Exact Matter Spectra of F-theory MSSMs*
Journal: *Journal of High Energy Physics*
DOI: 10.1007/JHEP09(2021)076
Collaborators: M. Cvetič, R. Donagi, M. Liu, M. Ong
- *Tensor products of finitely presented functors*
Journal: *Journal of Algebra and Its Applications*
DOI: 10.1142/s0219498822501869
Collaborator: Sebastian Posur
- *Machine Learning and Algebraic Approaches towards Complete Matter Spectra in 4d F-theory*
Journal: *Journal of High Energy Physics*
DOI: 10.1007/JHEP01(2021)196
Collaborators: M. Cvetič, R. Donagi, L. Ling, M. Liu, F. Ruehle
- *Cohomologies of coherent sheaves and massless spectra in F-theory*
Journal: Heidelberg University Library
DOI: 10.11588/HEIDOK.00024045
- *Algebraic Cycles and Local Anomalies in F-theory*
Journal: *Journal of High Energy Physics*
DOI: 10.1007/jhep11(2017)100
Collaborators: Christoph Mayrhofer and Timo Weigand
- *Gauge Backgrounds and Zero-Mode Counting in F-theory*
Journal: *Journal of High Energy Physics*
DOI: 10.1007/jhep11(2017)081
Collaborators: Christoph Mayrhofer and Timo Weigand
- *Chow groups, Deligne cohomology and massless matter in F-theory*
Preprint: <https://arxiv.org/abs/1402.5144>
Collaborators: Christoph Mayrhofer, Christian Pehle and Timo Weigand

SOFTWARE DEVELOPMENT

I develop open-source software on **github**:

- Profile: <https://github.com/HereAround>.
- Coding skills: **gap**, **python**, **julia**, **C++** and more.
- Interests: Tools to investigate geometries relevant to string theory, in particular toric geometry.
- Current focus: <https://github.com/oscar-system/Oscar.jl>.
- Other contributions:
 - https://github.com/homalg-project/ToricVarieties_project,
 - https://github.com/homalg-project/CAP_project.

Additional information is available on my *website* <https://martinbies.github.io/>.

CONFERENCES AND TALKS

- May 2023 **Talk** at Computeralgebra Tagung 2023 (Hannover, Germany)
Title: F-Theory Tools: String theory applications of OCSAR
- May 2023 **Talk** at Oberseminar algebraische Geometrie (Saarbruecken, Germany)
Title: F-Theory and Singular Elliptic Fibrations
- July 2022 Strings 2022 (Vienna, Austria)
- July 2022 **Talk** at String Math 2022 (Warsaw, Poland)
Title: *Towards F-theory MSSMs*
- July 2022 **Talk** at String Pheno 2022 (Liverpool, England)
Title: *Towards F-theory MSSMs*
- June 2022 Simons Collaboration on Homological Mirror Symmetry
Geometry, Topology and Singular Special Holonomy Spaces (Freiburg, Germany)
- Nov. 2021 Simons Collaboration on Homological Mirror Symmetry
Annual Meeting (New York, United States)
- Sept 2021 **Talk** at Summer series on string phenomenology
Title: *Root Bundles and Towards Exact Matter Spectra of F-theory MSSMs*
- Sept 2021 Simons Collaboration on Special Holonomy in Geometry, Analysis, and Physics
Progress and Open Problems (Stony Brook, United States)
- Sept 2021 Simons Collaboration on Special Holonomy in Geometry, Analysis and Physics
Annual Meeting (New York, United States)
- July 2021 String Pheno 2021 (virtual conference)
- June 2021 Strings 2021 (virtual conference)
- June 2021 String Math 2021 (virtual conference)
- Dec. 2020 **Talk** at String Data 2020 (virtual conference)
Title: *Vector-like spectra in F-theory* (joined with M. Liu)
- Oct. 2020 **Talk** (Philadelphia, United States)
Title: *Machine Learning and Algebraic Approaches
towards Complete Matter Spectra in 4d F-theory*
- June 2020 **Talk** at Summer series on string phenomenology
Title: *On stratification diagrams, algorithmic spectrum estimates
and vector-like pairs in F-theory*
- June 2020 String Pheno 2020 (virtual conference)
- Dec. 2019 **Talk** (Philadelphia, United States)
Title: *From F-theory Standard Models to Freyd Categories and back*
- Sept. 2019 Poster at Strings and Geometry (Oxford, United Kingdom)
Title: *Tensor products of finitely presented functors*
- Aug. 2019 **Talk** at gap singular meeting and school (Lambrecht, Germany)
Title: *Monoidal structures in Freyd categories*
- July 2019 Strings (Brussels, Belgium)
- Oct. 2018 **Talk** (Brussels, Belgium)
Title: *Counting massless matter in F-theory with CAP*
- Aug. 2018 **Talk** at CAP_days 2018 (Siegen, Germany)
Title: *CAP, machine learning and string theory*
- May 2018 **Talk** in seminar on *Holography and Large-N duality* (Heidelberg, Germany)
Title: *Conformal invariants; Fefferman–Graham expansion; Graham–Lee theorem
(joined with Menelaos Zikidis)*
- Mar. 2018 String Data 2018 (Munich, Germany)
- Jul. 2017 **Talk** at String Pheno 2017 (Virginia, USA)
Title: *Zero Mode Counting in F-Theory via CAP*

CONFERENCES AND TALKS (CONTINUATION)

Dec. 2015	String Math (Sanya, China)
Sept. 2015	Third GAP Days (Trondheim, Norway)
Mar. 2015	Second GAP Days (Aachen, Germany)
Feb. 2015	Physics and Geometry of F-theory (Munich, Germany)
Dec. 2014	Homological Perturbation Theory (Galway, Ireland)
Aug. 2014	Talk at GAP Days (Aachen, Germany) Title: <i>String theory, sheaf cohomology and the homalg package</i>
July 2014	Talk (Aachen, Germany) Title: <i>The Standard Model From String Theory</i>
May 2014	Talk at seminar series <i>What is?</i> (Heidelberg, Germany) Title: <i>What is a fermion/boson (in quantum mechanics)?</i>
Feb. 2014	Geometry and Physics of String Compactifications (Heidelberg, Germany)
Feb. 2014	Talk (Heidelberg, Germany) Title: <i>Cohomology Of Holomorphic Pullback Line Bundles On Smooth And Compact Normal Toric Varieties</i>
May 2012	Talk (Heidelberg, Germany) Title: <i>Intersecting D6-Brane Models</i>

TEACHING EXPERIENCE

Jan. 2022 – May. 2022	Instructor	Computational linear algebra
Jan. 2021 – May. 2021	Instructor	Computational linear algebra
Apr. 2018 – Oct. 2018	Senior tutor	Methods of mathematical physics 1
Oct. 2016 – Mar. 2017	Tutor	Theoretical physics I
Apr. 2016 – Sept. 2016	Senior tutor	General relativity
Apr. 2015 – Sept. 2015	Tutor	Theoretical physics IV
Oct. 2014 – Mar. 2015	Tutor	Quantum field theory
Oct. 2013 – Mar. 2014	Tutor	Theoretical physics III
Apr. 2013 – Sept. 2013	Tutor	Theoretical physics II
Oct. 2012 – Mar. 2013	Tutor	Theoretical physics I

ENGAGEMENT AT *Studienstiftung des deutschen Volkes*

June 2018	Member of the admission board <i>Heidelberg</i>
Dec. 2017	Member of the admission board <i>Ellwangen III</i>
May 2017	Training for admission board members – successfully completed
Nov. 2016	Member of the admission board <i>Heidelberg</i>

OTHER SEMINARS/CONFERENCES

May 2018	Kontaktseminar – Schwerpunkt Banken und Beratung (Bonn, Germany)
May 2018	Physiker im Beruf (Bad Honnef, Germany)