Dr. rer. nat. Martin Bies

Curriculum Vitae

RPTU Kaiserslautern-Landau
Department of Mathematics
Gottlieb-Daimler-Straße 48
Office 48-407
67663 Kaiserslautern
Germany
December 15, 1987
German
+49 (0)631 205 2252
bies@mathematik.uni-kl.de
https://martinbies.github.io/
https://orcid.org/0000-0002-9609-1693
https://github.com/HereAround
https://www.linkedin.com/in/martin-bies-000a1156/

SUMMARY

I hold a **PhD in Physics** (*Heidelberg Univ., 2018*), specializing in **string theory** and **mathematics**. My research is inspired by **computational analysis** of **massless spectra in string vacua**, resulting in publications on **toric geometry**, **Freyd categories**, **Brill-Noether theory**, and **root bundles**. Proficient in *julia*, *C++*, and *python*, I excel in **open-source software development** (*git*) to advance **computational research**. My diverse expertise emphasizes my interdisciplinary commitment. With a history of **international collaborations**, full **English proficiency**, and extensive **teaching experience**, I showcase a versatile skill set.

RESEARCH EXPERIENCE

CURRENT, FROM 10/2022 (FT)
Mathematics Dept., RPTU Kaiserslautern-Landau, Germany
Postdoctoral Researcher

I work on the OSCAR computer algebra system (https://www.oscar-system.org/). My work enhances toric geometry capabilities and develops tools for string theory geometries using advanced algebraic geometry techniques. I have added 78,000+ lines and modified 59,000+ lines.

09/2021 – 08/2022 (FT)
Dept. of Phys. & Astron., University of Pennsylvania, USA
Simons Postdoctoral Fellow

Studied with M. Cvetič & R. Donagi *F-theory QSMs* via root bundles.

09/2020 – 08/2021 (FT)
Dept. of Mathematics, University of Pennsylvania, USA
Simons Postdoctoral Fellow

Work with M. Cvetič and R. Donagi on root bundles in string theory.

10/2019 – 09/2020 (FT)
Mathematical Institute, University of Oxford, UK
Long Term Visitor

Follow-up of *Wiener-Anspach* project (initiated at PTM, Brussels).

10/2018 – 09/2019 (FT)
PTM, Université Libre de Bruxelles, Belgium
Postdoctoral Researcher

M/F-Theory: SCFT Design (funded by *Foundation Wiener-Anspach*).

RESEARCH EXPERIENCE CONT.

02/2018 – 09/2018 (FT)
ITP, Heidelberg University, Germany
Postdoctoral Researcher

Cluster of Excellence EXC 2181 STRUCTURES.

TEACHING EXPERIENCE

2021, 2022	**Instructor for *Comp. Linear Algebra*** *University of Pennsylvania, USA*
2016, 2018	**Senior Tutor** *Heidelberg University, Germany*
2012 – 2018	**Tutor in 8 courses** *Heidelberg University, Germany*

EDUCATION

03/2014 – 02/2018	**PhD in Physics (Grade: MCL)** ADVISOR: T. WEIGAND & M. BARAKAT *Heidelberg University, Germany*
09/2012 – 02/2014	**Master of Physics (Grade: 1.0)** ADVISOR: T. WEIGAND *Heidelberg University, Germany*
10/2008 – 08/2012	**Bachelor of Physics (Grade: 1.1)** ADVISOR: T. WEIGAND *Heidelberg University, Germany*

SCHOLARSHIPS

09/2020 – 08/2022	**Simons Postdoctoral Fellow**
10/2018 – 09/2020	**Foundation Wiener-Anspach**
01/2010 – 02/2018	**Studienstiftung des dt. Volkes**
10/2010 – 06/2011	**ERASMUS exchange student** *Imperial College, London, UK*

LANGUAGES

German	**Native**	●●●●●
English	**Full Proficiency**	●●●●●
French	**Intermediate** (*CEFR Level B1*)	●●●○○

PUBLICATIONS

M. Bies, M. Cvetič, R. Donagi, M. Ong, *Improved Statistics for F-theory Standard Models*, Preprint, https://arxiv.org/abs/2307.02535.

M. Bies, *Root bundles: Applications to F-theory Standard Models*, Preprint, https://arxiv.org/abs/2303.08144.

M. Bies, L. Kastner, *Toric Geometry in* `OSCAR`, Computeralgebra Rundbrief, https://arxiv.org/abs/2303.08110.

M. Bies, M. Cvetič, R. Donagi, M. Ong, *Brill-Noether-general Limit Root Bundles: Absence of vector-like Exotics in F-theory Standard Models*, Journal of High Energy Physics, DOI: 10.1007/JHEP11(2022)004.

M. Bies, M. Cvetič, M. Liu, *Statistics of Root Bundles Relevant for Exact Matter Spectra of F-theory MSSMs*, Physical Review D, DOI: 10.1103/PhysRevD.104.L061903.

M. Bies, M. Cvetič, R. Donagi, M. Liu, M. Ong, *Root Bundles and Towards Exact Matter Spectra of F-theory MSSMs*, Journal of High Energy Physics, DOI: 10.1007/JHEP09(2021)076.

M. Bies, S. Posur, *Tensor Products of Finitely Presented Functors*, Journal of Algebra and Its Applications, DOI: 10.1142/s0219498822501869.

M. Bies, M. Cvetič, R. Donagi, L. Ling, M. Liu, F. Ruehle, *Machine Learning and Algebraic Approaches towards Complete Matter Spectra in 4d F-theory*, Journal of High Energy Physics, DOI: 10.1007/JHEP01(2021)196.

M. Bies, *Cohomologies of Coherent Sheaves and Massless Spectra in F-theory*, Heidelberg University Library, DOI: 10.11588/HEIDOK.00024045.

M. Bies, C. Mayrhofer, T. Weigand, *Algebraic Cycles and Local Anomalies in F-theory*, Journal of High Energy Physics, DOI: 10.1007/jhep11(2017)100.

M. Bies, C. Mayrhofer, T. Weigand, *Gauge Backgrounds and Zero-Mode Counting in F-theory*, Journal of High Energy Physics, DOI: 10.1007/jhep11(2017)081.

M. Bies, C. Mayrhofer, C. Pehle, T. Weigand, *Chow Groups, Deligne Cohomology and Massless Matter in F-theory*, Preprint, https://arxiv.org/abs/1402.5144.

RECORD OF TEACHING EXPERIENCE

01/2022 – 05/2022	Instructor for *Computational Linear Algebra* (University Of Pennsylvania, USA)
01/2021 – 05/2021	Instructor for *Computational Linear Algebra* (University Of Pennsylvania, USA)
04/2018 – 10/2018	Senior tutor for *Methods of Mathematical Physics 1* (Heidelberg University, Germany)
10/2016 – 03/2017	Tutor for *Theoretical Physics I* (Heidelberg University, Germany)
04/2016 – 09/2017	Senior tutor for *General Relativity* (Heidelberg University, Germany)
04/2015 – 09/2015	Tutor for *Theoretical Physics IV* (Heidelberg University, Germany)
10/2014 – 03/2015	Tutor for *Quantum Field Theory* (Heidelberg University, Germany)
10/2013 – 03/2014	Tutor for *Theoretical Physics III* (Heidelberg University, Germany)
04/2013 – 09/2013	Tutor for *Theoretical Physics II* (Heidelberg University, Germany)
10/2012 – 03/2013	Tutor for *Theoretical Physics I* (Heidelberg University, Germany)

CONFERENCES, TALKS AND POSTERS

07/2023 **Talk** at *Third Annual Meeting 2023 of SFB-TRR 195* (Saarbruecken, Germany)
Talk title: *F-Theory: Exemplifying OSCAR's Pursuit for Multidisciplinary Excellence*

07/2023 **Talk and Poster** at *StringMath 2023* (Melbourne, Australia)
Talk title: *Root bundles: Applications to F-theory Standard Models*
Poster title: `FTheoryTools` – *A Computer Tool for Singular Elliptic Fibrations*

07/2023 **Talk** at *StringPheno 2023* (Daejeon, South Korea)
Talk title: *Root bundles: Applications to F-theory Standard Models*

05/2023 **Talk** at *Computeralgebra Tagung 2023* (Hannover, Germany)
Talk title: *F-Theory Tools: String theory Applications of* `OCSAR`

05/2023 **Talk** at *Oberseminar algebraische Geometrie* (Saarbruecken, Germany)

Talk title: *F-Theory and Singular Elliptic Fibrations*

07/2022 *Strings 2022* (Vienna, Austria)

07/2022 **Talk** at *String Math 2022* (Warsaw, Poland)
Talk title: *Towards F-theory MSSMs*

07/2022 **Talk** at *String Pheno 2022* (Liverpool, England)
Talk title: *Towards F-theory MSSMs*

06/2022 Simons Collaboration on Homological Mirror Symmetry
Geometry, Topology and Singular Special Holonomy Spaces (Freiburg, Germany)

11/2021 Simons Collaboration on Homological Mirror Symmetry
Annual Meeting (New York, United States)

09/2021 **Talk** at *Summer series on string phenomenology*
Talk title: *Root Bundles and Towards Exact Matter Spectra of F-theory MSSMs*

09/2021 Simons Collaboration on Special Holonomy in Geometry, Analysis, and Physics
Progress and Open Problems (Stony Brook, United States)

09/2021 Simons Collaboration on Special Holonomy in Geometry, Analysis and Physics
Annual Meeting (New York, United States)

07/2021 *String Pheno 2021* (virtual conference)

06/2021 *Strings 2021* (virtual conference)

06/2021 *String Math 2021* (virtual conference)

12/2020 **Talk** at *String Data 2020* (virtual conference)
Talk title: *Vector-like spectra in F-theory* (joined with M. Liu)

10/2020 **Talk** (Philadelphia, United States)
Talk title: *Machine Learning and Algebraic Approaches towards Complete Matter Spectra in 4d F-theory*

06/2020 **Talk** at *Summer series on string phenomenology*
Talk title: *On Stratification Diagrams, Algorithmic Spectrum Estimates and Vector-Like Pairs in F-theory*

06/2020 *String Pheno 2020* (virtual conference)

12/2019 **Talk** (Philadelphia, United States)
Talk title: *From F-theory Standard Models to Freyd Categories and back*

09/2019 **Poster** at *Strings and Geometry* (Oxford, United Kingdom)
Poster title: *Tensor Products of Finitely Presented Functors*

08/2019 **Talk** at *gap singular meeting and school* (Lambrecht, Germany)
Talk title: *Monoidal Structures in Freyd Categories*

07/2019 *Strings 2019* (Brussels, Belgium)
10/2018 **Talk** (Brussels, Belgium)
Talk title: *Counting Massless Matter in F-theory with* `CAP`

08/2018 **Talk** at *`CAP_days 2018`* (Siegen, Germany)
Talk title: `CAP`*, Machine Learning and String Theory*

05/2018 **Talk** in seminar on *Holography and Large-N duality* (Heidelberg, Germany)
Talk title: *Conformal Invariants; Fefferman–Graham Expansion; Graham–Lee Theorem* (with Menelaos Zikidis)

03/2018 String Data 2018 (Munich, Germany)

07/2017 **Talk** at *String Pheno 2017* (Virginia, USA)
Talk title: *Zero Mode Counting in F-Theory via* `CAP`

12/2015 *String Math 2015* (Sanya, China)

09/2015 Third GAP Days (Trondheim, Norway)

03/2015 *Second `GAP` Days* (Aachen, Germany)

02/2015 *Physics and Geometry of F-Theory* (Munich, Germany)

12/2014 *Homological Perturbation Theory* (Galway, Ireland)

08/2014 **Talk** at *`GAP` Days* (Aachen, Germany)

Talk title: *String Theory, Sheaf Cohomology and the* `homalg` *Package*

07/2014 **Talk** (Aachen, Germany)
Talk title: *The Standard Model from String Theory*

05/2014 **Talk** at seminar series *What is?* (Heidelberg, Germany)
Talk title: *What is a Fermion/Boson (in Quantum Mechanics)?*

02/2014 *Geometry and Physics of String Compactifications* (Heidelberg, Germany)

02/2014 **Talk** (Heidelberg, Germany)
Talk title: *Cohomology of Holomorphic Pullback Line Bundles on Smooth and Compact Normal Toric Varieties*

05/2012 **Talk** (Heidelberg, Germany)
Talk title: *Intersecting D6-Brane Models*

ENGAGEMENT AT STUDIENSTIFTUNG DES DEUTSCHEN VOLKES

06/2018 Member of the admission board *Heidelberg*

12/2017 Member of the admission board *Ellwangen III*

05/2017 Training for admission board members – successfully completed

11/2016 Member of the admission board *Heidelberg*

REFERENCES

Dr. Mirjam Cvetič

POSITION Fay R. and Eugene L. Langberg Professor
EMPLOYER Department of Physics and Astronomy
University of Pennsylvania, USA
EMAIL cvetic@physics.upenn.edu
PHONE +1 (215) 898 8153

Dr. Ron Donagi

POSITION Thomas A. Scott Professor of Mathematics
EMPLOYER Department of Mathematics
University of Pennsylvania, USA
EMAIL donagi@math.upenn.edu
PHONE +1 (215) 898 8465

Dr. Max Horn

POSITION Professor
EMPLOYER Department of Mathematics
RPTU Kaiserslautern-Landau, Germany
EMAIL horn@mathematik.uni-kl.de
PHONE +49 631 205 2730