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:

- Phenomenological aspects of standard models in **string theory**
- In particular **computation of massless spectra** of **string vacua**

Mathematics:

- Algorithms for cohomologies of **coherent sheaves**
- Constructive approaches to **Freyd categories**
- **Brill-Noether theory** and **root bundles**

Software development via **github**:

- **ToricVarieties_project** as part of the **homalg_project**
- **oscar-system**
- Experience in **gap**, **python**, **julia**, **C++**, **git**

Teaching experience
Instructor in 2021:
Computational Linear Algebra at 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 Sept. 2021	Simons Postdoctoral Fellow Department of Physics and Astronomy, University of Pennsylvania
Sept. 2020 - Aug. 2021	Simons Postdoctoral Fellow Department of Mathematics, University of Pennsylvania
Oct. 2019 – Sept. 2020	Long term visitor Mathematical institute, University of Oxford
Oct. 2018 – Sept. 2019	Postdoctoral Researcher Physique Théorique et Mathématique, Université Libre de Bruxelles
Feb. 2018 – Sept. 2018	Postdoctoral Researcher Institut für theoretische Physik, Ruprecht-Karls-Universität Heidelberg

Education

Mar. 2014 – Feb. 2018	PhD studies in physics (Heidelberg university) on the subject *Cohomologies of coherent sheaves and massless spectra in F-theory* 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 *Cohomologies of holomorphic line bundles in smooth and compact normal toric varieties* Supervisor: Prof. Dr. Timo Weigand Result: 1.0
Oct. 2008 – Aug. 2012	Bachelor studies in physics (Heidelberg university) on the subject *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* Supervisor: Prof. Dr. Timo Weigand Result: 1.1
Oct. 2010 – June 2011	Studies abroad at Imperial College (London, United Kingdom)

Software Development

I develop open-source software on **github**. My interest rests on tools which help to investigate geometries relevant to string theory. This includes *toric geometry*, for which I have written a collection of packages https://github.com/homalg-project/ToricVarieties_project. This includes the *gap-4* package *QSMExplorer*, which is currently under heavy development to reflect and extend recent insights into a class of string theory solutions known as the **Quadrillion Standard Models**.
I have also contributed to https://github.com/homalg-project/CAP_project and https://github.com/oscar-system/Oscar.jl. My programming experience includes the languages **gap**, **python**, **julia**, **C++**. For more details please visit my ***GitHub*-profile https://github.com/HereAround** or my ***website*** **https://martinbies.github.io/**.

Scientific Publications

- *Statistics of Root Bundles Relevant for Exact Matter Spectra of F-theory MSSMs* (arXiv-ID: 2104.08297)
  Collaborators: M. Cvetič, M. Liu
- *Root Bundles and Towards Exact Matter Spectra of F-theory MSSMs* (arXiv-ID: 2102.10115)
  Collaborators: M. Cvetič, R. Donagi, M. Liu, M. Ong
- *Machine Learning and Algebraic Approaches towards Complete Matter Spectra in 4d F-theory* (arXiv-ID: 2007.00009)
  Collaborators: M. Cvetič, R. Donagi, L. Ling, M. Liu, F. Ruehle
- *Tensor products of finitely presented functors* (arXiv-ID: 1909.00172)
  Collaborator: Sebastian Posur
- *Cohomologies of coherent sheaves and massless spectra in F-theory* (arXiv-ID: 1802.08860)
  PhD thesis
- *Algebraic Cycles and Local Anomalies in F-theory* (arXiv-ID: 1706.08528)
  Collaborators: Christoph Mayrhofer and Timo Weigand
- *Gauge Backgrounds and Zero-Mode Counting in F-theory* (arXiv-ID: 1706.04616)
  Collaborators: Christoph Mayrhofer and Timo Weigand
- *Chow groups, Deligne cohomology and massless matter in F-theory* (arXiv-ID: 1402.5144)
  Collaborators: Christoph Mayrhofer, Christian Pehle and Timo Weigand

Conferences

July 2021	String Pheno 2021 (virtual conference)
June 2021	Strings 2021 (virtual conference)
June 2021	String Math 2021 (virtual conference)
Dec. 2020	String data 2020 (virtual conference)
June 2020	String Pheno 2020 (virtual conference)
Sept. 2019	strings and geometry (Oxford, United Kingdom)
Aug. 2019	gap singular meeting and school (Lambrecht, Germany)
July 2019	Strings (Brussels, Belgium)
Aug. 2018	CAP_days 2018 (Siegen, Germany)
May 2018	Kontaktseminar – Schwerpunkt Banken und Beratung (Bonn, Germany)
May 2018	Physiker im Beruf (Bad Honnef, Germany)
Mar. 2018	string_data 2018 (Munich, Germany)
Jul. 2017	String Pheno 2017 (Virginia, USA)
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	GAP Days (Aachen, Germany)
Feb. 2014	Geometry and Physics of String Compactifications (Heidelberg, Germany)

Teaching Experience

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 *Heidelberg*
Dec. 2017	Member of the admission board *Ellwangen III*
May 2017	Training for admission board members – successfully completed
Nov. 2016	Member of the admission board *Heidelberg*