# Curriculum Vitae


## Dr. Andreas Braun

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## Education and Professional Career

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|---|---|
| since 9/2019 | Assitant Professor at the Department of Mathematical Sciences, Durham University |
| 9/2017 -9/2019 and 8/2015 - 8/2016 | Postdoctoral Research Assistant at the Mathematical Institute, University of Oxford |
| 9/2016 - 8/2017 and 10/2014 - 7/2015 | Postdoctoral Research Assistant at the Rudolf Peierls Centre for Theoretical Physics, University of Oxford |
| 10/2012 - 9/2014 | Postdoctoral Research Assistant at the Institute of Mathematics, King's College London |
| 7/2012 - 9/2012 | Visitor at Kavli IPMU Tokyo |
| 04/2010 - 6/2012 | Postdoctoral Research Assistant at the Technical University of Vienna |
| 5/2/2010 | PhD in Physics at the University of Heidelberg<br>Title of thesis:<br>'*F-Theory and the Landscape of Intersecting D7-branes*' |
| 10/2006 - 2/2010 | Graduate studies at the University of Heidelberg<br>Supervisor: Arthur Hebecker |
| 12/06/2006 | Diploma in Physics at the University of Heidelberg<br>Title of thesis:<br>'*Moduli Stabilization in 6d Supergravity with Flux*'<br>Supervisor: Arthur Hebecker |
| 2000-2006 | Student of Physics and Mathematics at the Universities of Heidelberg and Helsinki |

## Grants and scholarships

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| 2020 | Seedcorn grant 'Compact Geometric engineering and quantum gravity' |
| 2015 | STSM grant within MPNS COST Action MP1210 to pursue work at ICTP Trieste |
| 2012 | JSPS postdoctoral fellowship under grant PE 12530<br>for an extended visit to IPMU Tokyo |
| 2006-2010 | PhD Scholarship from the Heidelberg Graduate School of<br>Fundamental Physics |
| 2009 | Grant from the Heidelberg Graduate School of Fundamental Physics<br>for conducting research at the Harvard High Energy Physics Theory Group |
| 2003 | Erasmus scholarship for studies at the University of Helsinki |

## Conference talks

2023

Physics and Special Holonomy, KITP Santa Barbara (plenary talk)
'*Geometrizing Domain Walls in 5D SCFTs'*

2021

NBMPS 63 Durham (plenary talk)
'*The fate of higher form symmetries in string compactification'*

2020

Special Holonomy and Branes, virtual meeting hosted by the
American Institute of Mathematics, San Jose, California (plenary talk)
'*Higgs Bundles & Exceptional Holonomy'*

2019

Desy Theory Workshop, 'Quantum field theory meets gravity'
'$G_2$ *manifolds and string dualities*'

Physics and Special Holonomy, KITP Santa Barbara (plenary talk)
'*Spin(7) Connected Sums and String Theory Dualities'*

Special Holonomy and Algebraic Geometry, Imperial College London (plenary talk)
'*Exceptional Holonomy, String Duality and Vector Bundles'*

2018

Bethe Forum, Bonn:
String Theory Challenges in Particle Physics and Cosmology (plenary talk)
'*Exceptional Magic'*

Physics and Geometry of F-Theory, Madrid (plenary talk)
'*From F-Theory to $G_2$ manifolds*'

European Conference on Strings, Geometry and Black Holes, London (plenary talk)
'*Exceptional Magic*'

2017

First annual meeting of the Simons Collaboration on Special Holonomy in Geometry, Analysis, and Physics, Simons Foundation, New York (plenary talk)
'*$G_2$ manifolds and string dualities*'

Constructions of compact exceptional holonomy spaces: past present and future, Imperial College London (plenary talk)
'*$G_2$ mirror symmetry*'

Physics and Geometry of F-theory, ICTP Trieste (plenary talk)
'*Tops and G2 mirror symmetry*'

2016

Workshop on Singular Spaces in String and M-theory,
Fields Institute, Toronto (plenary talk)
'*Heterotic-Type IIA Duality and Degenerations of K3 Surfaces*'

F-theory at 20, Caltech, Pasadena (plenary talk)
'*Tops as Building Blocks for G2 manifolds*'

2015

Workshop on String Theory, Particle Physics and Cosmology,
GGI Florence (plenary talk)
'*Constructing G2 manifolds*'

Physics and Geometry of F-Theory, MPI Munich (plenary talk)
'*Anatomy of Calabi-Yau Fourfolds*'

2014

Conference on String Phenomenology, ICTP Trieste
'*Ensembles of F-theory Flux Vacua and the Middle Cohomology of Calabi-Yau Fourfolds*

Geometry and Physics of F-theory, Heidelberg (plenary talk)
'*Classifying elliptic fibrations on attractive K3 surfaces*'

2013

String Math UK, Surrey (plenary talk)
'*On Singular Fibres in F-Theory*'

2011

4th Workshop on Geometric Methods in Theoretical Physics,

SISSA, Trieste (plenary talk)
'*Fluxes and algebraic cycles in IIB and F-Theory*'

2008

Mathematical Challenges in String Phenomenology, Vienna (plenary talk)
'*D7-brane moduli and their flux stabilization via F-theory*'

2007

39th School on High-energy Physics, Maria Laach
'*F-theory and the open string landscape*'

19th Bad Honnef meeting 'Physics beyond the standard model' (plenary talk)
'*Flux-induced D-terms in a KKLT-like model*'

## Invited Seminars and Lectures

2023

'Hodge classes on Calabi-Yau fourfolds'
University of Utrecht

2021

'The fate of higher form symmetries in string compactification'
ICTP Trieste

2020

'String Compactifications and Arithmetic'
Universität des Saarlandes

'String Compactifications and Arithmetic'
Instituto de Matemática Pura e Aplicada, Rio de Janeiro

2019

'What's new in $G_2$ ?!'
University of Rome, Tor Vergata

'What's new in $G_2$ ?!'
Durham University

'$G_2$ manifolds and duality between heterotic strings and M-Theory'
IPM Tehran

'$G_2$ Mirror Symmetry'
Yeditepe University, Istanbul

2018

'What's new in $G_2$ ?!'
Kavli IPMU, Tokyo

'What's new in $G_2$ ?!'
Yau Mathematical Sciences Center, Tsinghua University, Beijing

'The Strings that tie together Quantum Field Theory,
Geometry and Gravity' (colloquium)
Aspen Center for Physics

'$G_2$ manifolds and string dualities'
Uppsala University

'Exceptional Magic'
ULB Bruessels

'Exceptional Magic'
Technical University of Vienna

2017

'Compact G2 manifolds and Dualities between M-Theory,
Heterotic String Theory and F-Theory'
University of Southampton

'Compact G2 manifolds and the Duality between M-Theory and
Heterotic String Theory'
ICTP, Trieste

'Compact G2 manifolds and the Duality between M-Theory and
Heterotic String Theory'
Northeastern University, Boston

'Compact G2 manifolds and the Duality between M-Theory and
Heterotic String Theory'
Simons Center for Geometry and Physics, Stony Brook

'$G_2$ manifolds and string dualities'
Cornell University, Ithaca

'Polytopes and $G_2$ mirror symmetry'
CEA Saclay

'Polytopes and $G_2$ mirror symmetry'
CERN

2016

'Heterotic-IIA Duality and Degenerations of K3 surfaces'
ICTP Trieste

'Gauge Symmetry in F-Theory Flux Vacua'
Cornell University, Ithaca

2014

'Anatomy of the middle cohomology of Calabi-Yau 4folds'
Technical University of Vienna,

'Geometrically Massive U(1)s and F-Theory'
Institute of Mathematics, University of Liverpool

'Geometrically Massive U(1)s and F-Theory',
MPI für Physik, Munich

'From M-Theory to F-Theory: classifying elliptic fibrations'
Technical University of Vienna

2013

'On Singular Fibres in F-Theory', ICTP Trieste

2012

'On Singular Fibres in F-Theory', Kavli IPMU, Tokyo

Lecture Series on 'Singularity Theory', INFN Roma II, Tor Vergata

2011

'G-flux in F-Theory and algebraic cycles', IPhT Paris

'G-flux in F-Theory and algebraic cycles', Bonn University

'An explicit construction of G4 Fluxes in F-Theory', Heidelberg University

'An explicit construction of G4 Fluxes in F-Theory', LMU Munich

'Algebraic cycles and fluxes', DESY Hamburg

2009

'Elliptic K3s, $T^4/Z_2$ and Enriques involutions', Bonn University

## PhD students

2020- Hugo Fortin
2020- Richie Dadhley

## Master students

2023

Aidan McFadden, 'Applying Reinforcement Learning to $G_4$ Flux Stabilisation Conditions in F-Theory'
(Durham University)

Parna Shirani Bidabadi, 'Micro State Counting of Black Holes From String Theory'
(Durham University)

2021

Anton Burnet, 'An Introductory Overview of Gauge Enhancement in M-theory'
(Durham University)

2018

Suvajit Majumder, 'Discrete torsion on $G_2$ orbifolds'
(University of Oxford)

Alexander Otto , 'Discrete Torsion for Calabi-Yau and $G_2$ Orbifolds'
(University of Oxford)

2017

Dmitry Manning-Coe, 'Lattices: from roots to string compactifiocations'
(University of Oxford)

## Teaching experience

2022/2023

Lecture Series 'Geometry of Mathematical Physics', MATH3471, Durham University
Lecture Series 'Quantum Field Theory II', Durham University

2021/2022

Lecture Series 'Geometry of Mathematical Physics', MATH3471, Durham University
Lecture Series 'String Theory', Durham University

2020/2021

Lecture Series 'Dynamical Systems III', MATH3091, Durham University

2019/2020

Lecture Series 'Dynamical Systems III', MATH3091, Durham University

2017

Lecture series 'General Relativity I, C7.5'
at the Mathematical Institute, University of Oxford
(I was runner-up for the prize of 'Most Acclaimed Lecturer',
awarded by the Oxford Student Union for this lecture)

2016

Lecture series 'General Relativity I, C7.5', including tutorials
at the Mathematical Institute, University of Oxford

Lecture Series on 'Geometrical and Topological Methods in Physics',
Heidelberg Physics Graduate Days, Heidelberg

Supervision of a master dissertation by Dmitry Manning-Coe on
'Lattice Theory and String Compactifications', University of Oxford

2015

Lecture Series on 'Geometrical Methods for String Phenomenology' at the
'School on Methods for String Phenomenology', Galileo Galilei Institute, Florence

2014

Tutor for Balliol College, University of Oxford

2012

Lecture series, including tutorials, on 'String Theory' at TU Vienna

2011

Lecture series on 'Singularity Theory with Applications to String Theory', TU Vienna

2010

Lecture series, including tutorials,
on 'Supersymmetry and Supergravity' at TU Vienna

2008

Organization of a student seminar (physics and mathematics) on
'Index theorems and Anomalies in QFT' at the University of Heidelberg .

2009
-2004 Tutor for various lectures in theoretical physics, including classical mechanics, quantum mechanics and general relativity.

## Outreach

2019 Jeremiah Horrocks Autumn Lecture
'*String Theory and Mathematical Beauty in Theoretical Physics*'
University of Central Lancashire

2016 Contribution '*C is for Calabi-Yau manifolds*' to the
Oxford Mathematics Alphabet

2007 Public lecture: 'Stringtheorie - Physik oder Philosophie?',
Philosophisches Seminar, University of Heidelberg

## Preprints, see also my inspire profile

1. A. P. Braun, E. Sabag, M. Sacchi and S. Schafer-Nameki,
"$G_2$-Manifolds from 4d $N$=1 Theories, Part I: Domain Walls,"
arXiv:2304.01193 [hep-th]

## Publications in Peer-Reviewed Journals

1. A. P. Braun, B. Fraiman, M. Graña, S. Lüst and H. Parra de Freitas,
"Tadpoles and gauge symmetries,"
JHEP **08** (2023), 134
arXiv:2304.06751 [hep-th]

2. A. P. Braun, M. Larfors and P. K. Oehlmann,
"Gauged 2-form symmetries in 6D SCFTs coupled to gravity,"

JHEP **12** (2021), 132
arXiv:2106.13198 [hep-th]

3. A. P. Braun, J. Chen, B. Haghighat, M. Sperling and S. Yang,
"Fibre-base duality of 5d KK theories,"
JHEP **05** (2021), 200
arXiv:2103.06066 [hep-th]

4. A. P. Braun and R. Valandro,
"$G_4$ flux, algebraic cycles and complex structure moduli stabilization,"
JHEP **01** (2021), 207
arXiv:2009.11873 [hep-th]

5. A. P. Braun,
"M-Theory and Orientifolds,"
JHEP **09** (2020), 065
arXiv:1912.06072 [hep-th]

6. A. P. Braun, S. Majumder and A. Otto,
"On Mirror Maps for Manifolds of Exceptional Holonomy,"
JHEP **1910** (2019) 204
arXiv:1905.01474 [hep-th]

7. A. P. Braun, S. Cizel, M. Hubner and S. Schafer-Nameki,
"Higgs Bundles for M-theory on $G_2$-Manifolds,"
JHEP **1903** (2018) 199
arXiv:1812.06072 [hep-th]

8. B. S. Acharya, A. P. Braun, E. E. Svanes and R. Valandro,
"Counting Associatives in Compact $G_2$ Orbifolds,"
JHEP **1903** (2018) 138
arXiv:1812.04008 [hep-th]

9. A. P. Braun, C. R. Brodie, A. Lukas and F. Ruehle,
"NS5-Branes and Line Bundles in Heterotic/F-Theory Duality,"
Phys. Rev. D **98** (2018) no.12, 126004
arXiv:1803.06190 [hep-th]

10. A. P. Braun and S. Schäfer-Nameki, "Spin(7)-Manifolds as Generalized Connected Sums and 3d N=1 Theories,"
JHEP **1806** (2018) 103
arXiv:1803.10755 [hep-th]

11. A. P. Braun, M. Del Zotto, J. Halverson, M. Larfors, D. R. Morrison and S. Schäfer-Nameki, "Infinitely Many M2-instanton Corrections to M-theory on $G_2$-manifolds,"

JHEP **1809** (2018) 077
arXiv:1803.02343 [hep-th]

12. A. P. Braun, C. R. Brodie and A. Lukas,
"Heterotic Line Bundle Models on Elliptically Fibered Calabi-Yau Three-folds,"
JHEP **1804** (2018) 087
arXiv:1706.07688 [hep-th]

13. A. P. Braun and M. Del Zotto,
"Towards Generalized Mirror Symmetry for Twisted Connected Sum $G_2$ Manifolds,"
JHEP **1803** (2018) 082
arXiv:1712.06571 [hep-th]

14. A. P. Braun and S. Schäfer-Nameki,
"Compact, Singular G2-Holonomy Manifolds and M/Heterotic/F-Theory Duality,"
JHEP **1804** (2018) 126
arXiv:1708.07215 [hep-th]

15. A. P. Braun, A. Lukas and C. Sun,
"Discrete Symmetries of Calabi-Yau Hypersurfaces in Toric Four-Folds,"
Commun. Math. Phys. (2017)
arXiv:1704.07812 [hep-th]

16. A. P. Braun and M. Del Zotto,
"Mirror Symmetry for $G_2$-Manifolds: Twisted Connected Sums and Dual Tops,"
JHEP **1705** (2017) 080
arXiv:1701.05202 [hep-th]

17. A. P. Braun and T. Watari,
"Heterotic-Type IIA Duality and Degenerations of K3 Surfaces,"
JHEP **1608** (2016) 034
arXiv:1604.06437 [hep-th]

18. A. P. Braun,
"Tops as Building Blocks for G2 Manifolds,"
JHEP **1710** (2017) 083
arXiv:1602.03521 [hep-th]

19. A. P. Braun and S. Schäfer-Nameki,
"Box Graphs and Resolutions II: From Coulomb Phases to Fiber Faces,"
Nucl. Phys. B **905** (2016) 480
arXiv:1511.01801 [hep-th]

20. A. P. Braun, M. Rummel, Y. Sumitomo and R. Valandro,
"De Sitter vacua from a D-term generated racetrack potential in hypersurface Calabi-Yau compactifications,"

JHEP **1512** (2015) 033
arXiv:1509.06918 [hep-th]

21. A. P. Braun and T. Watari,
"The Vertical, the Horizontal and the Rest: anatomy of the middle cohomology of Calabi-Yau fourfolds and F-theory applications,"
JHEP **1501** (2015) 047
arXiv:1408.6167[hep-th]

22. A. P. Braun and T. Watari,
"Distribution of the Number of Generations in Flux Compactifications,"
Phys. Rev. D **90** (2014) no.12
arXiv:1408.6156[hep-ph]

23. A. P. Braun and S. Schäfer-Nameki,
"Box Graphs and Resolutions I,"
Nucl. Phys. B **905** (2016) 447
arXiv:1407.3520 [hep-th]

24. A. P. Braun, A. Collinucci and R. Valandro,
"Hypercharge flux in F-theory and the stable Sen limit,"
JHEP **1407** (2014) 121
arXiv:1402.4096[hep-th]

25. A. P. Braun, A. Collinucci and R. Valandro,
"The fate of U(1)'s at strong coupling in F-theory,"
JHEP **1407** (2014) 028
arXiv:1402.4054[hep-th]

26. A. P. Braun, Y. Kimura and T. Watari,
"The Noether-Lefschetz problem and gauge-group-resolved landscapes: F-theory on K3 $\times$ K3 as a test case,"
JHEP **1404** (2014) 050
arXiv:1401.5908[hep-th]

27. A. P. Braun, F. Fucito and J. F. Morales,
"U-folds as K3 fibrations,"
JHEP **1310** (2013) 154
arXiv:1308.0553[hep-th]

28. A. P. Braun and T. Watari,
"On Singular Fibres in F-Theory,"
JHEP **1307** (2013) 031
arXiv:1301.5814[hep-th]

29. A. P. Braun, N. Johansson, M. Larfors and N. O. Walliser,
"Restrictions on infinite sequences of type IIB vacua,"
JHEP **1110** (2011) 091
arXiv:1108.1394[hep-th]

30. A. P. Braun, A. Collinucci and R. Valandro,
"G-flux in F-theory and algebraic cycles,"
Nucl. Phys. B **856** (2012) 129
arXiv:1107.5337[hep-th]

31. A. P. Braun, S. Gerigk, A. Hebecker and H. Triendl,
"D7-Brane Moduli vs. F-Theory Cycles in Elliptically Fibred Threefolds,"
Nucl. Phys. B **836** (2010) 1
arXiv:0912.1596[hep-th]

32. A. P. Braun, R. Ebert, A. Hebecker and R. Valandro,
"Weierstrass meets Enriques,"
JHEP **1002** (2010) 077
arXiv:0907.2691[hep-th]

33. A. P. Braun, A. Hebecker, C. Ludeling and R. Valandro,
"Fixing D7 Brane Positions by F-Theory Fluxes,"
Nucl. Phys. B **815** (2009) 256
arXiv:0811.2416[hep-th]

34. A. P. Braun, A. Hebecker and H. Triendl,
"D7-Brane Motion from M-Theory Cycles and Obstructions in the Weak Coupling Limit,"
Nucl. Phys. B **800** (2008) 298
arXiv:0801.2163[hep-th]

35. A. P. Braun, A. Hebecker and M. Trapletti, "Flux Stabilization in 6 Dimensions: D-terms and Loop Corrections,"
JHEP **0702** (2007) 015
hep-th/0611102

## Contributions to symposia and compiled volumes

1. A. P. Braun, J. Knapp, E. Scheidegger, H. Skarke and N. -O. Walliser,
"PALP - a User Manual," published in "Strings, Gauge Fields, and the Geometry Behind, The Legacy of Maximilian Kreuzer", World Scientific (2012)

arXiv:1205.4147 [math.AG]

2. A. P. Braun, A. Collinucci and R. Valandro,
"Algebraic description of G-flux in F-theory: new techniques for F-theory phenomenology,"
Fortsch. Phys. **60** (2012) 934
[arXiv:1202.5029 [hep-th]]

## References

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