

David J. E. Marsh

Ernest Rutherford Fellow

I am a theoretical physicist working primarily on axion dark matter, with broad extended interests ranging from particle physics to galaxy formation. I am an expert in axion physics, recognised worldwide. I work on searches for axions ranging from cosmological surveys to terrestrial experiments, and study their implications for particle physics and string theory.

INSPIRE, Google Scholar

PERSONAL DETAILS

Birth 19th April, 1987
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WORK AND EDUCATION

Proleptic Lecturer <i>King's College London</i>	2022 - present
Ernest Rutherford Fellow <i>King's College London</i> Advanced fellowship.	2021 - present
University Professor <i>University of Göttingen</i> Tenure track position involving termly lecturing and student supervision.	2018 - 2021
Sofja Kovalevskaja Fellow <i>University of Göttingen</i> “Axion cosmology: the lightest possible dark matter candidate and string theory”. Fellowship awarded by the Alexander von Humboldt Foundation.	2017 - 2021
Royal Astronomical Society (RAS) Postdoctoral Fellow <i>King's College London (KCL)</i> “Precision Cosmology of Axions and Moduli”.	2015 - 17
Postdoctoral Reseracher <i>Perimeter Institute for Theoretical Physics (PI)</i>	2012-15
DPhil Theoretical Physics <i>Oxford University</i> Thesis: The String Axiverse and Cosmology. Supervisors: Pedro G. Ferreira and John March-Russell.	2009-12
MPhys, Mathematical Physics, First Class <i>University of Edinburgh</i> Thesis: Unitarity Bounds on Form Factors in Kaon Decays. Supervisor: Luigi Del Debbio. Graduated top of class.	2005-09

STUDENTS

Angelo Maggi, Liina Jukko *King's College London*
PhD candidates, (2021 - present)
David Ellis *University of Göttingen*
PhD Thesis “Astrophysics of Axion Miniclusters” (2018 - 2021). Now industry.

Juerk Bauer, Jondalar Kuss, Hendrik Müller (PhD Bonn), Jana Riess, Sophie Vogt (PhD Munich) *University of Göttingen*

Masters Theses (2019-2021)

Naomi Nimubona, Jana Riess, Alex Savenkov, Laurin Söding *University of Göttingen*

Bachelor Theses (2019-2020)

Waheed Ahmad, Maksym Brilenkov (PhD Oslo), Tamari Meshvelliiani (PhD Reykjavik), Mohammad Talezadehlari *University of Göttingen*

Astro Mundus Masters Theses (2018-2019)

Matthew Stott *King's College London*

Supervision as part of PhD (informal). Published “The Spectrum of the Axion Dark Sector” (2017), and “Black Hole Superradiance Constraints on the Mass Spectrum and Number of Axion-like Particles” (2018). Now industry.

Thomas Helfer *King's College London, (postdoc Johns Hopkins)*

Supervision as part of PhD (informal). Published “Black Hole Formation from Axion Stars” (2017).

Simon Rozier *Ecole Polytechnique, Paris-Saclay, (PhD at Institut Astrophysic de Paris)*

Visiting Honours project, KCL. Published “Structure Formation and Microlensing with Axion Miniclusters” (2017).

Ana Pop *Princeton (PhD Harvard)*

PI Summer Program, published “Axion Dark Matter, Solitons and the Cusp-Core Problem” (2015).

Luca Iliesiu *Princeton (PhD Princeton)*

PI Summer Program, published “Constraining Supersymmetry with Heavy Scalars Using the Cosmic Microwave Background” (2014).

Jonathan Tot *University of Waterloo (PhD Dalhousie)*

PI Summer Program, “Approximate Analytic Methods for Cosmological Perturbative Systems” (2013).

AWARDS AND GRANTS

Munich Institute for Astro and Particle Physics Workshop Grant Co-Principal Investigator. Total value €78k (2019).

Sofja Kovaleskaja Fellowship Total value €1.6million (2017).

RAS Fellowship Total value £168,177 (2015).

STFC Studentship Three year stipendiary PhD funding at University of Oxford.

Tait Medal and Schlapp Prize Graduated top of MPhys class, £1000 (2009).

EPSRC summer Studentship “Anomalous top quark decays.” £3000 (2008).

Nichol Foundation Scholarship Highest senior honours marks £1000 (2008).

Brodie Memorial Prize Highest marks in class £1000 (2006).

Margaret Campbell Scott Scholarship Highest entrance grades, £1000 (2005).

PROFESSIONAL SKILLS AND SERVICE

Group Leader Research group at University of Göttingen. Full capacity including four postdocs, two PhD students, and up to six undergraduate members.

Leader TOORAD (axion detection) Interest Group (2018 - present)

Co-PI Munich Institute for Astro and Particle Physics Workshop on Axion Cosmology (February-March 2020).

Board Member Institute for Astrophysics, University of Göttingen (2019 - present)

Member HETDEX (intensity mapping) Scientific Advisory Committee (2019)

Member LITEBIRD (CMB polarisation) Germany Consortium Member (2019 - present)

Lead Organiser and Chair “Axion Experiments in Germany”, workshop (2019)

Member CMB Stage-IV Working Group (2016).

Associate Member The neutron electric dipole moment experiment, nEDM. Axion dark matter search group (2016).

PhD and Masters Examination Committees Xiaolong Du, Bodo Schwabe, Jan Veltmaat, Tobias Binder, Benedikt Eggemeier, Jiajun Chen, Salome Mtchedlidze, Ruslan Brilenkov (University of Göttingen).

Member Euclid Consortium Theory Working Group (2012).

Organising Committee London Cosmology Discussion Meeting (2015 -2017).

Chair Perimeter Institute Cosmology and Gravitation Seminar Series (2013-2014).

Member “Wellness Accelerators” (2012-2014). Committee to organise social and community events for PI employees.

Organiser Workshop on “The String Axiverse.” Beecroft Institute for Particle Astrophysics and Cosmology (University of Oxford, 2013).

TEACHING

Lecture Course “*Dark Matter*” (2022/23) & ongoing
King’s College London. Masters.

Lecture Course “*General Relativity*” (2021/22)
King’s College London. Bachelors.

Lecture Course “*General Relativity*” (2020/21)
University of Göttingen, Masters and Bachelors, 40 hours. Taught online during pandemic.

Lecture Course “*Dark Matter*” (2020)
University of Göttingen, Masters and Bachelors, 40 hours. Designed and taught. Online during pandemic.

Seminar Course “*Cosmic Pathways to Life*” (2019/20 & 2020/21)
University of Göttingen, Masters, 20 hours. Designed and taught with Ansgar Reiners.

Lecture Course “*Axions*” (2019)
University of Göttingen, graduate, 20 hours. Designed and taught.

Lecture Course “*Introduction to Cosmology*” (2018)
University of Göttingen, undergraduate, 22 hours. Taught using “flipped classroom”.

Lecture Course “*Axion Theory and Searches*” (2018)
Heidelberg University Graduate Days, 15 hours. Designed and taught .

Lecture Series “*Axion Cosmology*” (2015)
IPhT CEA/Saclay, four lectures. Designed and taught. Published in Phys. Rept.

Lecture Series “*Cosmological Parameters and the Microwave Background*” (2016)
KCL: informal graduate lectures. Designed and taught.

Lecture Course/Mentoring “*Dark Matter and Cosmology*” (2013)
PI International Summer School for Young Physicists. One week course for high school students. Designed and taught.

Tutor *Special Relativity & Cosmology* (2010 - 2012)
Oxford University.

Tutor “*General Physics*” (2011)
Oxford University.

SELECTED SEMINARS

Invited talk “Axion Cosmology”, International Centre for Theoretical Sciences Summer School, Bangalore, India (November 2020).

- Invited talk** “Open problems in axion cosmology” at “Axion Theory and Searches”, CERN (July 2019)
- Colloquium** University of Göttingen Physics Department (June 2019)
- Colloquium** University of Mainz Physics Department (Nov. 2018)
- Plenary review** “Astrophysical and Cosmological Constraints on Axions”, Cosmo18, Daejeon, Korea (August 2018).
- Plenary review** “Axions”, Patras workshop on axions, WIMPs and WISPs, Thessaloniki, Greece (May 2017).
- Plenary review** “Axion Cosmology”, Hidden Sector Physics and Cosmophysics, Kyoto (Dec. 2016).
- Plenary review** “Axion Cosmology”, Dutch cosmology meeting, Amsterdam (Dec. 2015).
- Presentation** PI summer school “QCSYS” (quantum computing). General interest presentation on string cosmology for high school students (2014 & 2015).
- Presentation** Lecture for final year undergraduates on “String Cosmology”, University of Waterloo (2013 - 2014).
- Seminar** “An Introduction to the Standard Model of Particle Physics for Astronomers,” graduate level, Oxford (Apr. 2011).

REFeree WORK

Physical Review Letters
 Nature, Nature Physics
 Monthly Notices of the Royal Astronomical Society
 Journal of Cosmology and Astroparticle Physics
 National Science Foundation (U.S.A.)
 Physical Review D
 Physics Letters B
 Physics of the Dark Universe
 The Astrophysical Journal
 The Open Journal of Astrophysics
 Research in Astronomy and Astrophysics

OUTREACH AND PRESS

- Dark Matter Day** Livestream series of talks. King’s College London (2020).
- Cosmology Live!** Organised a series of online lectures during the coronavirus pandemic (2020-2021).
- Tuning Interference: Dark Matter Radio** Music installation at Science Gallery London (2019). In collaboration with Malcolm Fairbairn, David Ronan, and Aura Satz. Featured in New Scientist, The Quietus, Forbes Magazine, Londonist Magazine.
- Cheltenham Science Festival** Presentation and Discussion “What is the dark matter?”, with Jim Al-Khalili, Jocelyn Monroe, and Andrew Pontzen (2018).
- Antiuniversity** Talk and discussion at “self-organised” open university. “Our place in the Universe: the story of modern cosmology”, London (2017).
- STEM Ambassador** Volunteer for the London area (2016-present). Presented in schools from primary to 6th form on topics of my own design. Tutored mathematics for GCSE.
- Guerilla Science** Integalactic travel bureau, New York City (2014).
- BrainSpace Magazine** Two articles for children’s science magazine ages 8 to 14 (2015-2016).

Nautilus Magazine Popular article on “Dark Matter May Show Quantum Effects on a Galactic Scale” (2017). <https://tinyurl.com/y81bd9nz>

Defining Gravity, Defying Gravity YouTube video profiling me as a physicist and skateboarder (Dec. 2014). More than 10000 views. <http://tinyurl.com/zmgvkj5>

Waterloo Chronicle “Physics, Zen and the Art of Skateboarding.” Front page of local newspaper (Mar. 2015). <http://tinyurl.com/ze7kucu>

Time Magazine “Ride the science train.” Profile of outreach project on New York subway (Oct. 2013). <http://tinyurl.com/ke1mvvp>

For more details of my outreach activities, see my website.

LANGUAGES

English Native speaker.

German European standard B1 certificated.

French United Kingdom GCSE, A★.

Software FORTRAN, PYTHON, MATHEMATICA, MATLAB, L^AT_EX.