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AREAS OF ACADEMIC SPECIALIZATION

History and Philosophy of Physics, Philosophy of Science.

AREAS OF ACADEMIC COMPETENCE

Metaphysics, Logic, Epistemology, Philosophy of Mathematics, Early Modern Philosophy.

ACADEMIC APPOINTMENTS

- 2018- Lichtenberg Professor for History and Philosophy of Physics, University of Bonn, Germany.
- 2015-18 Research Assistant Professor in History and Philosophy of Science, *Division of Humanities and Social Sciences, California Institute of Technology*; Scientific Editor, *Einstein Papers Project, California Institute of Technology*.
- 2013-14 Departmental Lecturer in Philosophy of Science, Department of Philosophy, University of Oxford, UK.
- 2012-15 Juniorprofessor (= Assistant Professor) for Philosophy at the Institute of Philosophy and at the Interdisciplinary Centre for Science and Technology Studies, Wuppertal University, Germany.
- 2010-15 Contributing Editor at the Einstein Papers Project, California Institute of Technology.
- 2009-12 Postdoctoral Fellow at the Institute of Philosophy and at the IZWT, Wuppertal University, Germany.

EDUCATION

- 2005-10 DPhil in Philosophy, Oxford University (Oriel College). Viva 11/2009; awarded 07/2010. Supervisors: Dr O. Pooley, Prof H. Brown and Dr J.N. Butterfield
- 2004-06 MA in Philosophy (with Distinction), Hamburg University.
- 2003-04 MSc in Theoretical Physics (with Distinction grade for the thesis), Imperial College London.
- 2000-03 BSc in Physics, Hamburg University.
- 2000-03 BA in Philosophy (with Distinction), Hamburg University.

VISITING FELLOWSHIPS

- 2012-2013: Visiting Fellow at the Center for Philosophy of Science, University of Pittsburgh.
- Fall 2008: Visiting Scholar at the Einstein Papers Project, California Institute of Technology.
- Spring 2008: Visiting Scholar at the Perimeter Institute for Theoretical Physics, Waterloo (Canada).
- 2004-05: Visiting Student in History and Philosophy of Science at the London School of Economics.

PUBLICATIONS

Monograph

- 'Einstein's Principles. On the Interpretation of Gravity'. Under Contract with *Oxford University Press*.

Edited books and special issues

- 'The Collected Papers of Albert Einstein, Volume 16. The Berlin Years: June 1927 - May 1929' with Diana Kormos Buchwald, Ze'ev Rosenkranz, Daniel J. Kennefick, József Illy, A. J. Kox,

Tilman Sauer, Jennifer Nollar James (eds.); Emily de Araujo, Joshua Eisenthal, Jennifer Rodgers, David Rowe (assoc. eds.). Princeton University Press, 2021.

- 'The Collected Papers of Albert Einstein, Volume 15. The Berlin Years: June 1925 - April 1927' with Diana Kormos Buchwald, Ze'ev Rosenkranz, József Illy, Anne Kox (eds.); Daniel J. Kennefick, A.J. Kox, Michel Janssen, Tony Duncan (assoc. eds.). Princeton University Press, 2018. Introduction available online at <https://arxiv.org/abs/1803.10662>
- 'Towards a Theory of Spacetime Theories' (with Gregor Schiemann and Erhard Scholz). *Einstein Studies*, Volume 13, Birkäuser/Springer, 2017.
- Special Issue on 'Particle Physics after the Higgs Discovery' (with Simon Friederich), in: *Studies in the History and Philosophy of Physics*, Volume 51, August 2015.
- 'The Collected Papers of Albert Einstein, Volume 14. The Berlin Years: April 1923 - June 1925' with Diana Kormos Buchwald, Ze'ev Rosenkranz, Tilman Sauer, József Illy, (eds.); Daniel J. Kennefick, A.J. Kox and Osik Moses (assoc. eds.). Princeton University Press, 2015.
- 'The Collected Papers of Albert Einstein, Volume 13. The Berlin Years: January 1922 – March 1923' with Diana Kormos Buchwald, Ze'ev Rosenkranz, Tilman Sauer, József Illy, (eds.); Daniel J. Kennefick, A.J. Kox and Osik Moses (assoc. eds.). Princeton University Press, 2012.
- 'Hermann Minkowski's "Space and Time"' (Translation). In: Vesselin Petkov (editor): 'Minkowski Spacetime: A Hundred Years later'. Springer, 2010.

Peer-Reviewed Articles

- 'Integrating Dark Matter, Modified Gravity, and the Humanities'. With Niels Martens, Miguel Angel Carretero Sahuquillo, Erhard Scholz and Michael Krämer. Forthcoming in *Studies in History and Philosophy of Modern Physics*, 2022.
- 'Cartography of the space of theories: an interpretational chart for fields that are both (dark) matter and spacetime'. With Niels Martens. *Studies in History and Philosophy of Modern Physics*, 72: 217-236, 2020. Open Access at <https://doi.org/10.1016/j.shpsb.2020.08.004>
- 'Dark Matter = Modified Gravity? Scrutinising the spacetime-matter distinction through the modified gravity / dark matter lens'. With Niels Martens. *Studies in History and Philosophy of Modern Physics*, 72: 237-250, 2020. Open Access at <https://doi.org/10.1016/j.shpsb.2020.08.003>
- 'The Equivalence Principle(s)'. *The Routledge Companion to Philosophy of Physics*, 2021, edited by E. Knox and A. Wilson, Routledge. Preprint at <http://philsci-archive.pitt.edu/17709/>
- 'General Relativity as a Hybrid theory: The Genesis of Einstein's work on the Problem of Motion'. *Studies in History and Philosophy of Modern Physics*. Vol. 67, August 2019, pages 167-190. Preprint at <https://arxiv.org/abs/1803.09872>
- 'Two Miracles of General Relativity'. With James Read and Harvey Brown. *Studies in History and Philosophy of Modern Physics*, Volume 64, November 2018, pp. 14-25. Preprint at <http://philsci-archive.pitt.edu/14589/>
- 'The Metaphysics of Super-Substantivalism'. *Nous*, Volume 52, Issue 1, 2018, pp. 24-46. Available online at <http://onlinelibrary.wiley.com/doi/10.1111/nous.12163/abstract>
- 'Literal vs Careful Interpretations of Scientific Theories: the Vacuum Approach to the Problem of Motion in General Relativity'. *Philosophy of Science*, Volume 84, Issue 5, December 2017. Extended preprint at <http://philsci-archive.pitt.edu/12461/>
- 'Introduction Towards a Theory of Spacetime Theories'. In: Lehmkuhl, Scholz, Schiemann (eds.). *Einstein Studies*, Volume 13, Birkäuser/Springer 2017.
- 'Einstein, the Reality of Space, and the Action-Reaction Principle' (with Harvey Brown), in *The Nature of Reality*, ed. Partha Ghose, Routledge, 2017. Preprint: <http://philsci-archive.pitt.edu/id/eprint/9792>.
- 'Particle Physics and the Higgs discovery: Philosophical Perspectives' (with Simon Friederich). *Studies in History and Philosophy of Physics*, Volume 51, August 2015, pp. 69-70.
- 'Why Einstein did not believe that General Relativity geometrizes gravity.' *Studies in History and Philosophy of Modern Physics*, Volume 46, May 2014, pp. 316-326.

- 'Time in Spacetimes.' *Philosophia Naturalis*, Volume 49, No. 2, December 2012.
- 'Mass-Energy-Momentum. Only there because of Spacetime?' *The British Journal for the Philosophy of Science*, Volume 62, No. 3, 2011, pp. 454-488.
- '*Super-Substantialismus in der Philosophie der Raumzeit*' In: Michael Esfeld (ed.): *Philosophie der Physik*. Suhrkamp 2011.
- 'Matter(s) in Relativity Theory'. In: Dorato, M., Rédei, M. and Suárez, M. (eds): *Philosophical Issues in the Sciences: Launch of the European Philosophy of Science Association*. Springer, 2010.
- 'Is spacetime a gravitational field?' In: Dennis Dieks, 'The Ontology of Spacetime II.' Series: *Philosophy and Foundations of Physics*, Elsevier Science, 2008.

REFEREE FOR

Nature Astronomy, The British Journal for the Philosophy of Science, Philosophy of Science, Studies in the History and Philosophy of Modern Physics, Studies in the History and Philosophy of Science, Synthese, General Relativity and Gravitation, Foundations of Science, Erkenntnis, International Journal for the Philosophy of Science, Foundations of Physics, the European Journal for Philosophy of Science, European Journal for History of Science Journal of the American Philosophical Association, Elsevier, NTM. Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin, Physics Today, Routledge, Princeton university Press, the Humboldt Foundation, Austrian Science Fund, the Foundation for Polish Science, the German Research Foundation, The Dutch Research Council, The Royal Society.

RESEARCH PRESENTATIONS (Selection)

Invited and Keynote Talks

'Einstein's Forgotten Interpretation: On the unification of gravity and inertia'

- 2021: Department of Physics, University of Houston at Texas, USA.
- 2021: Conference "Philosopher's and Einstein's Relativity", University of Napoli, Italy

'From Schwarzschild's Singularity and Hadamard's Catastrophe to Penrose's trapped surfaces'

- 2021: Oxford Mathematics Public Lecture, with Sir Roger Penrose and Melwyn Bragg. Mathematical Institute, University of Oxford.

'Interpreting Spacetime Singularities'

- 2021: Faculty Colloquium of the Black Hole Initiative, Harvard University

'The History and Interpretation of Penrose's Singularity Theorem'

- 2021: Faculty Colloquium, Department of Physics, University of Bremen, Germany

'The History and Interpretation of Event Horizons'

- 2019: 9th Annual Conference of the Black Hole Initiative, Harvard University

'The History and Interpretation of Black Hole Solutions'

- 2018: Cambridge Seminar for Philosophy of Science, University of Cambridge, UK
- 2018: Philosophy of Physics Research Seminar, University of Oxford, UK

'Could it be that spacetime is neither fundamental nor emergent?'

- 2017: Workshop 'Spacetime: fundamental or emergent?' at the University of Bonn, Germany

'The genesis and interpretation of the problem of motion in General Relativity'

- 2017: 6th HPS Tuebingen Summer School

'The interpretation of vacuum solutions to Einstein's field equations'

- 2017: Workshop on 'Do Black Holes exist? The Physics and Philosophy of Black Holes'. 641th WE-Heraeus-Seminar of the German Physical Society (DPG).

'The discovery of gravitational waves: narrative and facts'

- 2017: Workshop on Political Epistemology at the Max Planck Institute for History of Science

'What Einstein really thought about General Relativity.'

- 2015: CIERA Interdisciplinary Colloquium, Northwestern University.

'The problem of motion in General Relativity'

- 2016: 'Annual Conference of the British Society for the Philosophy of Science', Cardiff (UK)

- 2016: '8th Quadrennial Fellows Conference of the Center for Philosophy of Science', Lund, Sweden
 - 2015: 'A Century of General Relativity. The 'Renaissance' of General Relativity in History: Assessing Einstein's Legacy in Post-World War II Physics.' The Max Planck Institutes of Gravitational Physics and of History of Science, Berlin.
 - 2015: History and Philosophy of Science Seminar, HSS Division, California Institute of Technology.
 - 2015: Conference on 'Particles, Fields and Relativity. Conference in Honour of Harvey Brown at 65'.
- 'Einstein, Cartan, Weyl: The neighborhood of General Relativity in the Space of Spacetime Theories'
- 2015: Space-Time Theories: Historical and Philosophical Contexts. Hebrew University of Jerusalem.
 - 2014: Philosophy of Physics Research Seminar, University of Oxford.
- 'Why Einstein never really cared about geometrization'
- 2012: Department of Philosophy, University of Maryland
- 'The Difference between Matter and Spacetime'
- 2011: The Sigma Club, London School of Economics (UK)
 - 2011: Institute for History and Foundations of Science, Utrecht University (Netherlands)
 - 2011: Institute of Philosophy, University of Bochum (Germany)
 - 2011: Institute of Philosophy, University of Dortmund (Germany)

Further Talks (Selection)

- 'Einstein's Black Hole'
- 2021: Triannual Meeting of the European Philosophy of Science Association, Trieste, Italy (with Jeroen van Dongen)
- 'The Einstein-Weyl correspondence and a geodesic theorem for a new type of spacetime'
- 2019: First Oxford-Notre Dame-Bonn Workshop in the Foundations of Spacetime Theories
 - 2019: Departmental Colloquium, Ludwig Maximilian University, Munich
- 'Literal vs scientific interpretations of scientific theories: the problem of motion in General Relativity'
- 2017: Annual Meeting of the German Physical Society
 - 2016: Biennial Meeting of the Philosophy of Science Association, Atlanta, Georgia.
 - 2016: 32nd Annual Boulder Conference on History and Philosophy of Science, "Gravity: Its History and Philosophy", University of Colorado at Boulder
- 'The connection between the Relativity Principle and Mach's Principle in Einstein's Work'
- 2016: 'Ernst Mach Centenary Conference 2016', Vienna (Austria)
- 'Against the Gravity/Inertia Split?' (with Oliver Pooley, Oxford)
- 2013: '17th UK and European Foundations of Physics Conference', LMU Munich.
- 'Why Einstein never really cared about geometrization'
- 2012: '23rd Biennial Meeting of the Philosophy of Science Association', San Diego (USA)
 - 2012: Center for Philosophy of Science, University of Pittsburgh
- 'The Difference between Matter and Spacetime'
- 2011: The Sigma Club, London School of Economics (UK)
 - 2011: Institute for History and Foundations of Science, Utrecht University (Netherlands)
 - 2011: Institute of Philosophy, University of Bochum (Germany)
 - 2011: Institute of Philosophy, University of Dortmund (Germany)
- 'Unification in Field Theories'
- 2010: '22nd Biennial Meeting of the Philosophy of Science Association' Montreal, Quebec (Canada).
 - 2010: Southern California Philosophy of Physics Reading Group (Irvine, USA).
 - 2010: 'Heuristics in Physics', Bad Honeff (Germany).
- 'Some Kinds of Spacetime Theories'
- 2010: 'Towards a Theory of Spacetime Theories.' Interdisciplinary Center for Science and

- Technology Studies, University of Wuppertal (Germany).
- 2010: Southern California Philosophy of Physics Reading Group.
- `Spacetime Matters: On Unifying and Geometrised Field Theories`
 - 2009: `Annual conference for philosophy of science.` Inter-University Centre (IUC), Dubrovnik (Croatia) .
 - 2010: `International Workshop on Poincaré, Hilbert and the Foundations of Physics` .
University of Mainz (Germany)
- `The Metaphysics of Super-Substantivalism`
 - 2008: The Ockham Society, Oxford University.
- `Mass-Energy-Momentum in General Relativity. Only there because of Spacetime?`
 - 2008: Southern California Philosophy of Physics Reading Group, Irvine (USA).
- `Geometrisation of Matter in Modern Physics`
 - 2008: `Third International Conference on the Ontology of Spacetime.`
Concordia University, Montreal (Canada).
 - 2008: `Annual Conference of the British Society for the Philosophy of Science`.
St Andrews University (Scotland).
- `Matter(s) in General Relativity`
 - 2007: 1st conference of the European Philosophy of Science Association (EPSA), Madrid (Spain).
 - 2007: Philosophy of Physics Discussion Group, Oxford University.
- `What is a Gravitational Field?`
 - 2007: 15th UK and European Foundations of Physics meeting, Leeds (UK).
 - 2007: Annual Meeting of the Philosophy of Physics Group of the German Physical Society,
Heidelberg (Germany).
 - 2007: Philosophy of Physics Seminar at the Department of Philosophy,
University of Bristol (UK).
- `Is Spacetime a Field?`
 - 2006: `Second International Conference on the Ontology of Spacetime.`
Concordia University, Montreal (Canada).

TEACHING EXPERIENCE

University of Bonn:

2020/2021: Introduction to Philosophy of Science; Research Seminar in History and Philosophy of Physics; Imre Lakatos: Proof and Refutations, Philosophy of Physics II: Special and General Relativity, The structure of thought experiments

2019/2020: Introduction to Logic and Philosophy of Science; Research Seminar in History and Philosophy of Physics; Introduction to Philosophy of Physics I: Classical Mechanics and Electrodynamics

2018/19: Introduction to Philosophy of Science; Core Readings in Philosophy of Science, Research Seminar in History and Philosophy of Physics; Concepts of Science; Einstein as a philosopher of science

University of Oxford:

2018: Visting lecturer at the University of Oxford. Graduate Supervision in Philosophy of Physics.

Caltech:

2015-2017: Guest lectures in Chris Hitchcock's "Philosophy of Space and Time", Frederick Eberhardt's "Introduction to Philosophy of Science" and Diana Buchwald's "Einstein" course.

University of Oxford:

2014:

- Tutorials in Philosophy of Science, The Leibniz-Clarke Correspondence, Intermediate Philosophy

of Physics (Quantum Mechanics). Intermediate Philosophy of Physics (Special Relativity),
Advanced Philosophy of Physics

- Lecture: Advanced Philosophy of Physics (with Oliver Pooley and Simon Saunders)
- Lecture: Philosophy of Science
- Lecture: The Leibniz-Clarke Correspondence (with Gonzalo Rordriguez-Pereyra).
- Lecture: 'Intermediate Philosophy of Physics: Special Relativity' (with Oliver Pooley).
- Graduate Class in Philosophy of Science (with Chris Timpson)
- Supervision of MSt students in Philosophy of Science.

2013:

- Lecture: 'Introduction to the Philosophy of Science'.
- Tutorials in Philosophy of Science
- Supervision of an MSt student in Philosophy of Physics.

University of Wuppertal:

2014/15: Lecture Course 'Introduction to Philosophy of Science' and 'The Leibniz-Clarke Correspondence'

2013: Seminars 'Cotemporary Philosophy of Science' and 'Introduction to Modal Logic'.

2012: Lecture Courses 'Introduction to Logic' and 'Space, Time, Big Bangs and Black Holes for Pedestrians'.

2011: Lecture Course 'Introduction to Logic', Graduate Seminar 'Philosophy of Mathematics and the Natural Sciences', Lecture Courses 'Introduction to Analytic Metaphysics' and 'The Leibniz-Clarke Correspondence'.

2010: Lecture Course 'Introduction to Logic', Undergraduate Seminar 'For and Against Method: Imre Lakatos vs. Paul Feyerabend' and Graduate Seminar 'Albert Einstein as a Philosopher'.

2009: Lecture course 'The Philosophical Foundations of Theories of Space and Time' and Undergraduate Seminar on 'The Structure of Scientific Thought Experiments'.

University of Oxford:

2007-08: College Lecturer for Logic (introductory and intermediate), St. Peter's College.

2008: Tutor for Knowledge and Reality, History from Descartes to Kant, Philosophy of Science and the Social Sciences, and General Philosophy, Wadham College.
Tutor for Philosophy of Science, Oriel College.

2008: Tutor for Philosophy of Science, Magdalen College.

2008: Tutor for Logic, Corpus Christi College.

2007: Tutor for Philosophy of Science, St. Annes College.

2006-07: Teaching Assistant for Logic, Magdalen College.

2006: Teaching Assistant for Logic, St. Annes College.

2006: Tutor for Philosophy of Physics for the Oxford Programme for Undergraduate Studies and for Philosophy of Science for the Oxford Overseas Study Course.

University of Hamburg:

2005: Assistant Teacher at the DESY-program "Understanding Physics" for 4th to 13th grade pupils.
DESY is the biggest research centre for physics in Germany.

2001-03: Teaching Assistant for Philosophy of Science, Hamburg University.

GRANTS, AWARDS AND SCHOLARSHIPS

2020-2023: Principal Investigator in the Research Group "Inductive Metaphysics". Funded by the German Science Foundation (DFG) for an initial 3 years with 2,7 Million Euros;

2018-2023: Principal Investigator of a Lichtenberg Grant by the Volkswagen Foundation, 2,9 Million Euros.

2017-2023: Principal Investigator in the Research Group "The Epistemology of the Large Hadron

Collider". Funded by the German Science Foundation (DFG) for an initial 3 years with 2,5 Million Euros; renewed in 2019 with funding for another 3 years with another 2,5 Million Euros of funding.

2010-11: Maurice. A. Biot Award of the California Institute of Technology.

2006-08: Doctoral Scholarship, British Society for the Philosophy of Science.

2006-08: Graduate Scholarship, Oriel College, Oxford University.

2005-08: Scholarship (tuition fees), Arts and Humanities Research Council, UK.

2005-06: Research Scholarship, Hamburg Foundation for Support of Science and Culture.

2005-07: Travel Grants from Oriel College, the European Science Foundation, the U.S. National Science Foundation, the Einstein Papers Project at Caltech, the Max-Planck-Institute for Gravitational Physics, the Max-Planck-Institute for Mathematics in the Sciences and the Newton Institute of Cambridge University.

2003-04: Erasmus Scholarship for a stay at Imperial College London.

ADMINISTRATIVE EXPERIENCE, PROFESSIONAL ACTIVITIES AND PROJECT GRANTS

2021- : Member of the Scientific Council of the Max Planck Institute for History of Science

2021- : Member of the Jury of the Copernicus Award, awarded by DFG and FNP jointly

2021- : Member of the Editorial Board of the journal "Philosophy of Physics".

2020- : Trustee of the Archive Trust for Research in Mathematical Science and Philosophy (Charity Registration Number 1141862)

2018: External Assessor to the BPhil in Philosophy and the MSt in Philosophy of Physics, University of Oxford.

2017- : Member of the Editorial Advisory Board of *Einstein Studies*.

2015-16: Several Outreach Activities for Caltech and the Einstein Papers Project: Giving presentations for major Caltech donors and members of the general public at the Einstein Papers Project; multiple talks at the Pasadena bookstore "Century Books".

2016: Reviewer for an NSF Grant Proposal.

2015: Lead organiser of "100 years General Relativity: On the foundations of spacetime theories" at the Annual meeting of the German Physical Society in Berlin.

2014: Co-Organiser of the '2nd International Spring School on Particle Physics and Philosophy'. Funded by the Volkswagen Foundation with 36.000 Euros.

2013: Convenor of the Philosophy of Physics Research Seminar of the Faculty of Philosophy, Oxford University.

2012: Elected Vice Speaker of the Philosophy of Physics Work Group of the German Physical Society (DPG). In this function, co-organiser of a workshop on 'Causality and Physics' in 2012 and of the annual conferences of the DPG since 2013.

2011: Co-Organiser of the '1st International Spring School on Particle Physics and Philosophy'. Funded by the Volkswagen Foundation with 30.000 Euros.

2011: Member of the Search Committee for the position of the Chair in History of Science at the University of Wuppertal.

2010: Organiser of an International Conference on the topic 'Towards a Theory of Spacetime Theories' at Wuppertal University. Funded by the Thyssen Foundation with 5.000 Euros.

2008-09: Junior Dean of St.Peter's College, Oxford University.

2008: Exam Setting and Marking, Logic and Philosophy of Science, Magdalen College and Corpus Christi College, Oxford University.

2007: Exam Setting and Marking, Logic and Philosophy of Science, St Anne's College, Oxford University.

2007: Invigilating for Oriel College, Oxford University.

2007-: Chair of the Graduate Joint Consultative Committee (GJCC) of the Faculty of Philosophy, Oxford University. (Representative of the Graduate Student Body of the Faculty.)

2006-: Chair and Organiser of the Philosophy of Physics Discussion Group of the Faculty of Philosophy, Oxford University.

2006: Member of the Organising Committee for the “10th Oxford Philosophy Graduate Conference”.

2006-: Overseas Representative of the Oriel College Middle Common Room.

2006-: Junior Member of the Isaac Newton Institute, University of Cambridge.

2005: Research Grant from the University of Neubrandenburg, taking part in the project “The observer in physics and systems theory.”

2001-03: Student representative in the Council of the Department of Philosophy, Hamburg University.

PROFESSIONAL AFFILIATIONS

British Society for the Philosophy of Science, European Philosophy of Science Association, American Physical Society, Philosophy of Science Association, German Physical Society.

LANGUAGES

English, German (fluent), French and Spanish (basic).