

# JOHANNES KLEINER

## PERSONAL INFORMATION

*address* Munich Center for Mathematical Philosophy  
Ludwig Maximilian University of Munich  
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## CURRENT POSITION

Research Associate at Munich Center for Mathematical Philosophy

## AREA OF SPECIALIZATION

Mathematical Physics, Calculus of Variations, Mathematical Consciousness Science

## ACADEMIC CREDENTIALS

<i>Research Associate</i>	<i>Since 2020</i>	Munich Center for Mathematical Philosophy, Ludwig Maximilian University of Munich
<i>Postdoctoral Researcher</i>	<i>2017-2019</i>	Institute for Theoretical Physics, Department of Mathematics and Physics, Leibniz University Hannover  Group of Prof. Domenico Giulini.
<i>Research Visit</i>	<i>April-June 2017</i>	Department of Computer Science, Oxford University  Group of Prof. Bob Coecke, University of Oxford, Oxford, UK
<i>Research Visit</i>	<i>Sept.-Nov. 2016</i>	Center of Mathematical Sciences and Applications, Harvard University  Group of Prof. Shing-Tung Yau, Harvard University, Boston, USA
<i>Research Visit</i>	<i>May-June 2016</i>	Centre de Physique Théorique, Marseille  Group of Prof. Carlo Rovelli, Aix-Marseille Université, Marseille, France
<i>PhD</i>	<i>2013-2017</i>	Department of Mathematics, Regensburg  Title: <i>Dynamics of Causal Fermion Systems - Field Equations and Correction Terms for a New Unified Physical Theory.</i> (Received summa cum laude.) Advisor: Prof. Felix Finster, University of Regensburg, Germany Supported by the Studienstiftung des Deutschen Volkes.
<i>Master's Thesis</i>	<i>2011-2012</i>	University of Freiburg  Carried out at the University of Freiburg and the University of Heidelberg. Title: <i>The mathematical structure of measurements, observables and states on neural networks</i> Advisors: Prof. Thomas Filk, Dr. Harald Atmanspacher, Prof. Ion-Olimpiu Stamatescu. Supported by the Studienstiftung des Deutschen Volkes and by the Institute for Frontier Areas of Psychology and Mental Health, Freiburg.

Master of Science  
Physics

2010-2012

University of Heidelberg

Specialization: Theoretical Physics: GR, QFT, QM, Cosmology, Theoretical Astrophysics, Neural Networks; Grade: 1.0 ("Excellent")

Thesis: *The mathematical structure of measurements, observables and states on neural networks* (cf. above)

Bachelor of Science  
Physics

2007-2010

University of Regensburg

Specialization: Theoretical Physics and Philosophy; Grade: 1.2 ("Sehr gut" (A))

Thesis: *Dissipative dynamics of a driven quantum oscillator-qubit system*

Thesis Advisor: Prof. Milena Grifoni

#### GRANTS, HONORS & AWARDS

2017 · PhD awarded 'With Highest Honor' (summa cum laude).

2014-2017 · Studienstiftung des Deutschen Volkes PhD Grant

2010-2012 · Studienstiftung des Deutschen Volkes Scholarship

2006 · Recognition of extraordinary achievements in mathematics and physics by the Günther-Uber-Foundation

2006 · Award for social commitment by the Hildegardis-Gymnasium Kempten

#### PUBLICATIONS

##### **Falsification and Consciousness**

Johannes Kleiner and Erik Hoel

Preprint, [arXiv:2004.03541](https://arxiv.org/abs/2004.03541) (Link)

##### **The Mathematical Structure of Integrated Information Theory**

Johannes Kleiner and Sean Tull

Preprint, [arXiv:2002.07655](https://arxiv.org/abs/2002.07655) (Link)

##### **Integrated Information in Process Theories**

Sean Tull and Johannes Kleiner

Preprint, [2002.07654](https://arxiv.org/abs/2002.07654) (Link)

##### **Special Issue 'Models of Consciousness'**

Eds. Ian Durham, Johannes Kleiner, Yakov Kremnitzer,

Jonathan Mason, Robert Prentner

*Entropy*, 2019, ISSN 1099-4300 (Link)

##### **Progress and Visions in Quantum Theory in View of Gravity - Bridging Foundations of Physics and Mathematics**

Eds. Felix Finster, Domenico Giulini, Johannes Kleiner, Jürgen Tolksdorf

*Birkhäuser Basel*, 2019, ISBN 978-3-030-38940-6 (Link)

##### **Brain states matter. A reply to the unfolding argument**

Johannes Kleiner

Preprint, [10.31234/osf.io/jdcfh](https://arxiv.org/abs/10.31234/osf.io/jdcfh) (Link)

##### **Mathematical Models of Consciousness**

Johannes Kleiner

Forthcoming in *Entropy*, [arXiv:1907.03223](https://arxiv.org/abs/1907.03223) (Link)

##### **A Class of Conserved Surface Layer Integrals for Causal Variational Principles**

Felix Finster, Johannes Kleiner

*Calc. Var.* (2019) 58:38 (Link) – [arXiv:1801.08715](https://arxiv.org/abs/1801.08715)

**Dynamics of Causal Fermion Systems - Field Equations and Correction Terms for a New Unified Physical Theory**

Johannes Kleiner

*PhD Thesis, University of Regensburg, urn:nbn:de:bvb:355-epub-362894 (Link)*

**A Hamiltonian Formulation of Causal Variational Principles**

Felix Finster, Johannes Kleiner

*Calc. Var. (2017) 56:73 (Link) – arXiv:1612.07192*

**Quantum Mathematical Physics - A Bridge between Mathematics and Physics**

Eds. Felix Finster, Johannes Kleiner, Christian Rößen, Jürgen Tolksdorf

*Birkhäuser Basel, 2015, ISBN 978-3-319-26902-3 (Link)*

**Noether-Like Theorems for Causal Variational Principles**

Felix Finster, Johannes Kleiner

*Calc. Var. (2016) 55:35 (Link) – arXiv:1506.09076*

**Causal Fermion Systems as a Candidate for a Unified Physical Theory**

Felix Finster, Johannes Kleiner

*2015 J. Phys.: Conf. Ser. 626 012020 (Link) – arXiv:1502.03587*

**TALKS**

2020 · *The Mathematical Structure of Integrated Information Theory* (Modelling Consciousness Workshop, Online, March 2020)

2019 · *On Mathematical Approaches in the Scientific Study of Consciousness* (Department of Mathematics, Instituto Superior Técnico Lisboa, Lisbon, November 2019)

2019 · *Models of Consciousness – Perspectives on an emerging field of applied mathematics* (Department of Mathematics, University of Regensburg, October 2019)

2019 · *Stochastic and Non-Linear Correction Terms for the Linearized Field Equations of Causal Fermion Systems* (Working Seminar Mathematical Physics, Regensburg University, October 2019)

2019 · *On the Mathematical Basis of Models of Consciousness* (Mathematical Institute, University of Oxford, September 2019)

2019 · *Key Ideas of the Theory of Causal Fermion Systems* (L'Agape Summer School on Theoretical Physics, Mézeryrac, France, July 2019)

2019 · *Models of Consciousness* (Mathematical Institute, University of Göttingen, April 2019)

2019 · *Groundings of the Scientific Study of Consciousness* (Modelling Consciousness Workshop, Dorfgastein, March 2019)

2018 · *Qualia and Symmetries* (Munich Center for Mathematical Philosophy, LPS Colloquium, October 2018)

2018 · *Qualia and Symmetries* (Seminar Progress and Visions in the Scientific Study of the Mind-Matter Relation, November 2018)

2018 · *Integrated Information Theory 3.0* (L'Agape Summer School on Theoretical Physics, Mézeryrac, France, July 2018)

2018 · *On Modelling Dual Aspect Monism* (Workshop Models for Dual-Aspect Monism, Johanneshof, Germany, June 2018)

- 2018 · Lecturer at the *International Spring School on Causal Fermion Systems* (Regensburg University, February 2018)
- 2017 · *Quantum Einstein Equivalence: So close, no matter how far?* (Revising Foundations of Physics Workshop, UCL, December 2017)
- 2017 · *Dynamics of Causal Fermion Systems* (PhD Defence, Colloquium of Department for Mathematics, Regensburg University, September 2017)
- 2017 · *Correction Terms for Field Equations from Causal Fermion Systems* (Working Seminar Mathematical Physics, Regensburg University, July 2017)
- 2017 · *La cuisine différente. Impressions from a new approach to fundamental physics* (Quantum Lunch Seminar, University of Oxford, June 2017)
- 2017 · *Causal Variational Principles* (PDE CDT Student Seminar, University of Oxford, June 2017)
- 2017 · *Causal Fermion Systems as a Candidate for a Unified Physical Theory* (Lobster Lunch Seminar, University of Oxford, May 2017)
- 2017 · *Reductionism, ad absurdum?* (Rethinking Foundations of Physics Workshop 2017, Dorfgastein, Austria, March 2017)
- 2017 · *Naked Singularities and the Penrose Inequality II* (Working Seminar Mathematical Physics, Regensburg University, January 2017)
- 2016 · *Naked Singularities and the Penrose Inequality I* (Working Seminar Mathematical Physics, Regensburg University, December 2016)
- 2016 · *Hamiltonian Time Evolution for Causal Variational Principles* (McGill University, Montreal, Canada, November 2016)
- 2016 · *Hamiltonian Time Evolution for Causal Variational Principles* (Harvard University, Center of Mathematical Sciences and Applications, Members' Seminar, USA, September 2016)
- 2016 · *A New Candidate for a Unified Physical Theory* (Harvard University, Center of Mathematical Sciences and Applications, Mathematical Physics Seminar, USA, September 2016)
- 2016 · *Towards a Connection between Loop Quantum Gravity and Causal Fermion Systems* (Working Seminar Mathematical Physics, University of Regensburg, July 2016)
- 2016 · Lecturer of the *International Spring School on Causal Fermion Systems* (Regensburg, March 2016)
- 2015 · *The Jet Bundle Dynamics of Causal Fermion Systems* (Seminar Partial Differential Equations on Globally Hyperbolic Spacetimes and Working Seminar Mathematical Physics, Regensburg, October 2015)
- 2015 · *Physik und Transzendenz* (Doktorandentagung Studienstiftung des Deutschen Volkes, Bonn, November 2015)
- 2015 · *Noether-Like Theorems for Causal Variational Principles* (Seminar Partial Differential Equations on Globally Hyperbolic Spacetimes and Working Seminar Mathematical Physics, Regensburg, October 2015)
- 2015 · *The Jet Bundle Dynamics of Causal Fermion Systems* (Seminar Partial Differential Equations on Globally Hyperbolic Spacetimes and Working Seminar Mathematical Physics, Regensburg, October 2015)

- 2015 · *Causal Fermion Systems as a Candidate for a Unified Physical Theory* (Conference 'Quantum Theory: from Foundations to Technologies', Växjö, Sweden, 2015)
- 2015 · *Noether-like Theorems for Causal Variational Principles* (Working Seminar Mathematical Physics, Regensburg, June 2015)
- 2015 · *Imre Lakatos' Conception of Science* (Doktorandentagung Studienstiftung des Deutschen Volkes, Heidelberg, April 2015)
- 2015 · *Measuring measurement? and On finding new physics* (Rethinking Foundations of Physics Workshop 2015, Dorfgastein, Austria, March 2015)
- 2014 · *Physik und Transzendenz* (A series of three talks "Albert Einstein - Naturwissenschaft und Religion", "Arthur Eddington - Wissenschaft und Mystizismus", "Carl Friedrich von Weizsäcker - Naturgesetz und Theodizee", based on essays by these physicists, Neupfarrkirche Regensburg, October & November 2014)
- 2014 · *Causal Fermion Systems: A Dynamical Collapse Theory?* (Workshop DICE2014, Castiglioncello, Italy, September 2014)
- 2014 · *Introduction to the Theory of Causal Fermion Systems* (Seminar Mathematical Physics, Ludwig Maximilian University of Munich, July 2014)
- 2014 · *QT and GR united? An Introduction to Causal Fermion Systems* (Conference 'Quantum Roundabout', Nottingham UK, July 2014)
- 2014 · *Paradigms of Modern Physics and Causal Fermion Systems* (Lecture series "Zurück zu den Zusammenhängen", Erlangen, April 2014)
- 2014 · *QT and GR united? A Review of Causal Fermion Systems* (Working Seminar Mathematical Physics, Regensburg, May 2014)
- 2014 · *Causal Fermion Systems: Idea and Paradigms Behind* (Paradigms of Modern Physics Workshop, Dorfgastein, Austria, March 2014)
- 2013 · *Mass and Momentum of Asymptotically Flat Manifolds* (Seminar Recent mathematical progress in General Relativity, Regensburg, September 2013)
- 2013 · *The Measurement Problem in Linear (Quantum) Theories* (Working Seminar Mathematical Physics, Regensburg, May 2013)
- 2013 · *Locality in Quantum Theory - A Critical Analysis of Quantum No-Signaling Proofs* (Philosophy of Quantum Theory Cabin Workshop, Black Forest, March 2013)
- 2011 · *Experimental Status of Foundations of Gravity* (Seminar Modern Experiments in Special and General Relativity, Heidelberg University, May 2011)

## ORGANIZATIONAL ACTIVITIES

- 2020 · Organization of the *Mathematical Consciousness Science* online seminar series ([Link](#))
- 2020 · Organization of the 2020 workshop *Modelling Consciousness* (Dorfgastein, Austria) ([Link](#))
- 2019 · Organization of the conference *Models of Consciousness* (Mathematical Institute, University of Oxford, United Kingdom) ([Link](#))
- 2019 · Organization of the 2019 workshop *Modelling Consciousness* (Dorfgastein, Austria) ([Link](#))

2018 · Organization of the conference *Progress and Visions in Quantum Theory in View of Gravity - Bridging Foundations of Physics and Mathematics* (Max Planck Institute for Mathematics in the Sciences, Leipzig) ([Link](#))

2018 · Organization of the online seminar *Progress and Visions in the Scientific Study of the Mind-Matter Relation* ([Link](#))

2018 · Organization of the workshop *Models for Dual-Aspect Monism* (Herrisried, Germany)

2018 · Organization of the *Rethinking Foundations of Physics 2018 Workshop* (Dorfgastein, Austria) ([Link](#))

2018 · Organization of the *International Spring School on Causal Fermion Systems* (Regensburg, Germany) ([Link](#))

2017 · Organization of the *Rethinking Foundations of Physics 2017 Workshop* (Dorfgastein, Austria) ([Link](#))

2016 · Foundation of the *Basic Research Community for Physics e.V.* ([Link](#))

2016 · Organization of the *International Spring School on Causal Fermion Systems* (Regensburg, Germany) ([Link](#))

2016 · Organization of the *Rethinking Foundations of Physics 2016 Workshop* (Dorfgastein, Austria) ([Link](#))

2015 · Organization of the *Rethinking Foundations of Physics 2015 Workshop* (Dorfgastein, Austria) ([Link](#))

2014 - 2015 · Students' representative of the DFG Graduate School GRK 1692 *Curvature, Cycles, and Cohomology* ([Link](#))

2014-now · Organization of the public lecture-series *Was ist wirklich? - Expertengespräche aus dem Spannungsfeld von Naturwissenschaft, Kultur und Religion* (Invited speakers.) ([Link](#))

2014 · Organization of the workshop *Paradigms of Modern Physics* (Dorfgastein, Austria) ([Link](#))

2013 · Organization of the *Philosophy of Quantum Theory Cabin Workshop* (Hammerlochhäusle, Black Forest, Germany) ([Link](#))

2012/13 · Organization of the public lecture-series *Leben - Interdisziplinäre Zugänge zum Rätsel des Organischen* (Invited speakers.) ([Link](#))

## TEACHING EXPERIENCE

2019 · Assistant for *Introduction to Quantum Theory* at the Leibniz University Hannover. Lecturer: Prof. Klemens Hammerer

2018/19 · Assistant for *Quantum Field Theory* at the Leibniz University Hannover. Lecturer: Prof. Tobias J. Osborne

2018 · Assistant for *General Relativity* at the Leibniz University Hannover. Lecturer: Prof. Domenico Giulini

2018 · Seminar *Seminal Papers in Physics* at the Leibniz University Hannover

2017/18 · Plenary Tutorial for *Analytical Mechanics and Special Relativity* at the Leibniz University Hannover. Lecturer: Prof. Domenico Giulini

2014-2016 · Seminar *Partial Differential Equations on Globally Hyperbolic Spacetimes* at the University of Regensburg, together with Jan-Hendrik Treude and Prof. Felix Finster

2015/16 · Assistant for the lecture *Functional Analysis* at the University of Regensburg. Lecturer: Prof. Felix Finster

2014 · Assistant for the lecture *Partial Differential Equations III: The Fermionic Projector and Causal Variational Principles* at the University of Regensburg. Lecturer: Prof. Felix Finster

2014 · Organization, layout and teaching of the seminar *Philosophy and Physics of Space and Time* at the University of Regensburg together with Dr. Holger Leuz

2013/14 · Organization, layout and teaching of the seminar *Foundational Problems of Quantum Theory* at the University of Regensburg. Co-organizers: Prof. Klaus Richter and Prof. Felix Finster

2013 · Tutor for the lecture *Probability Theory and Stochastics* at the University of Regensburg. Lecturer: Prof. Harald Garcke

2012 · Tutor for the lecture *Quantum Theory for Prospective Teachers* at the University of Freiburg. Lecturer: Prof. Thomas Filk (honorary/unsalaried)