Philip K. Schwartz

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Positions

since Oct 2020	**Leibniz University Hannover** Postdoctoral researcher (Wissenschaftlicher Mitarbeiter)
Aug 2016 – Sep 2020	**Leibniz University Hannover** Doctoral researcher (Wissenschaftlicher Mitarbeiter)

Education

2016 – 2020	**Leibniz University Hannover** Doctoral Studies Member of CRC 1227 Designed Quantum States of Matter (DQ-mat)
Sep 2020	Dr rer nat in Physics Thesis: *Post-Newtonian Description of Quantum Systems in Gravitational Fields* Advisor: Domenico Giulini Mark: *summa cum laude*
2015 – 2016	**University of Cambridge and Trinity College Cambridge** Part III of the Mathematical Tripos
Jun 2016	Master of Advanced Study (M A St) in Applied Mathematics Part III essay: *The Cauchy Problem in General Relativity* Mark: *Distinction*
2011 – 2015	**Leibniz University Hannover** Studies of Physics and Mathematics
Nov 2014	Bachelor of Science (B Sc) in Physics Thesis: *Kaluza-Klein-Geometrie stationärer Raumzeiten* Advisor: Domenico Giulini Mark: *1.0 (very good)*

Scholarships

2015 – 2016	**Trinity College Cambridge** *Trinity Studentship in Mathematics*
2014 – 2016	**German Academic Scholarship Foundation** *Scholarship*

Awards

2022   LEIBNIZ UNIVERSITY HANNOVER, FACULTY OF MATHEMATICS AND PHYSICS
Wilhelm und Else Heraeus Young Physicists Award

2022   LEIBNIZ UNIVERSITY HANNOVER, FACULTY OF MATHEMATICS AND PHYSICS
Prize for the best teaching

2016   TRINITY COLLEGE CAMBRIDGE
Elected to a *Senior Scholarship*

2016   TRINITY COLLEGE CAMBRIDGE
Examination Prize for excellent performance

2015   LEIBNIZ UNIVERSITY HANNOVER
Preis des Präsidiums for outstanding academic achievements

Publications

- P K Schwartz, *The classification of general affine connections in Newton–Cartan geometry: Towards metric-affine Newton–Cartan gravity*, arXiv:2403.15460

- A L von Blanckenburg, P K Schwartz, *On gauge transformations in twistless torsional Newton–Cartan geometry*, arXiv:2402.05105

- M Werner, P K Schwartz, J-N Kirsten-Siemß, N Gaaloul, D Giulini, K Hammerer, *Atom interferometers in weakly curved spacetimes using Bragg diffraction and Bloch oscillations*, Physical Review D **109**, 022008 (2024), arXiv:2310.03719

- A Alibabaei, P K Schwartz, D Giulini, *Geometric post-Newtonian description of massive spin-half particles in curved spacetime*, Classical and Quantum Gravity **40**, 235014 (2023), arXiv:2307.04743

- P K Schwartz, *Teleparallel Newton–Cartan gravity*, Classical and Quantum Gravity **40**, 105008 (2023), arXiv:2211.11796

- D Giulini, A Großardt, P K Schwartz, *Coupling Quantum Matter and Gravity*, in: C Pfeifer, C Lämmerzahl (eds.), *Modified and Quantum Gravity*, Lecture Notes in Physics **1017** (Springer, Cham, 2023), arXiv:2207.05029

- P K Schwartz, D Giulini, *Classical perspectives on the Newton–Wigner position observable*, International Journal of Geometric Methods in Modern Physics **17**, 2050176 (2020), arXiv:2004.09723

- P K Schwartz, D Giulini, *Post-Newtonian Hamiltonian description of an atom in a weak gravitational field*, Physical Review A **100**, 052116 (2019), arXiv:1908.06929

- P K Schwartz, D Giulini, *Post-Newtonian corrections to Schrödinger equations in gravitational fields*, Classical and Quantum Gravity **36**, 095016 (2019), arXiv:1812.05181

Talks

Feb 2024	*Teleparallel Newton–Cartan gravity*, 14th Central European Relativity Seminar, Tübingen
Nov 2023	*Coupling quantum matter to gravity: a systematic post-Newtonian approach* (invited), RQI Circuit Bremen, Bremen and online
Mar 2023	*Time in Newtonian physics from a spacetime perspective* (invited), 781st WE Heraeus Seminar, Bad Honnef
Nov 2022	*Coupling quantum matter to gravity: a systematic post-Newtonian approach* (invited), Vienna Central European Seminar on Particle Physics and Quantum Field Theory 2022, Vienna
Jun 2022	*Teleparallel Newton–Cartan gravity*, Metric-Affine Frameworks for Gravity 2022, Tartu
Apr 2022	*Systematic description of quantum systems under post-Newtonian gravity* (invited), Mini-workshop on wave function reduction via semiclassical gravity, Southampton
Nov 2021	*Post-Newtonian Hamiltonian description of quantum systems under gravity* (invited), Seminar series on relativistic effects in atomic clocks, Boulder–Innsbruck–Hannover (virtual)
Sep 2021	*Post-Newtonian Hamiltonians for quantum systems under gravity* (invited), Workshop of the Innsbruck University quantum optics group, Seefeld (virtual)
Sep 2021	*Teleparallel Newton–Cartan gravity*, DPG meeting of the Matter and Cosmos Section, virtual
Apr 2021	*Geometric characterisations of the Newton–Wigner position observable* (invited), TPI Jena (virtual)
Feb 2021	*The interface of classical gravity and quantum mechanics* (invited, joint with D Giulini), 740th WE Heraeus Seminar, Bad Honnef (virtual)
Mar 2019	*Post-Newtonian corrections to Schrödinger equations in gravitational fields*, DPG spring meeting of the Matter and Cosmos Section, Munich
Jul 2018	*A quantum equivalence principle – what could this even mean?*, l'Agape 2018, Mézeyrac

Conferences and Workshops attended

Feb 2024	14th Central European Relativity Seminar, Tübingen, contributed talk: see above
Nov 2023	RQI Circuit Bremen, Bremen and online, invited talk: see above
Jul 2023	School of General Relativity, Astrophysics and Cosmology, Warsaw, poster contribution: *Teleparallel Newton–Cartan gravity*
Mar 2023	781st WE Heraeus Seminar 'Time and Clocks', Bad Honnef, invited talk: see above

Nov 2022	Vienna Central European Seminar on Particle Physics and Quantum Field Theory 2022, Vienna, invited talk: see above
Oct 2022	Quantum Sensors and tests of New Physics, Hannover, poster contribution: *Geometric post-Newtonian description of massive spin-half particles in curved spacetime*
Sep 2022	Bad Honnef Physics School on Black Holes, Bad Honnef, poster contribution: *Geometric post-Newtonian description of massive spin-half particles in curved spacetime*
Jun 2022	Metric-Affine Frameworks for Gravity 2022, Tartu, contributed talk: see above
Apr 2022	Mini-workshop on wave function reduction via semiclassical gravity, Southampton, invited talk: see above
Sep 2021	DPG meeting of the Matter and Cosmos Section, virtual, contributed talk: see above
Feb 2021	740th WE Heraeus Seminar 'Experimental Tests and Signatures of Modified and Quantum Gravity', Bad Honnef (virtual), invited talk: see above
Sep 2020	Vienna Summer School 2020 on Gravitational Quantum Physics, Vienna (virtual), poster contribution: *Post-Newtonian description of quantum systems in gravitational fields*
Jun 2019	Quantum metrology and physics beyond the Standard Model, Hannover, poster contribution: *Post-Newtonian corrections to Schrödinger equations in gravitational fields*
Mar 2019	DPG spring meeting of the Matter and Cosmos Section, Munich, contributed talk: see above
Oct 2018	Progress and Visions in Quantum Theory in View of Gravity, Leipzig
Jul 2018	Summer School 'l'Agape 2018', Mézeyrac, contributed talk: see above
Jun 2017	646th WE Heraeus Seminar 'Gravitational decoherence', Bad Honnef
Sep 2016	DICE2016 Spacetime – Matter – Quantum Mechanics, Castiglioncello
Aug 2016	Gravity in the Lab 2016, Benasque

TEACHING

Winter 2023/24	*Theoretical Physics C*, Plenary tutorial, Hannover *Repetitorium Mathematical Methods of Physics*, Lecturer, Hannover *Repetitorium Theoretical Physics A*, Lecturer, Hannover
Summer 2023	*Modern developments in Newton–Cartan gravity*, Lecturer, Hannover *Introduction to Quantum Theory*, Assistant, Hannover
Winter 2022/23	*Newton–Cartan gravity*, Lecturer, Hannover *Analytical Mechanics and Special Relativity*, Assistant, Hannover
Summer 2022	*Modern developments in Newton–Cartan gravity*, Lecturer, Hannover *Seminar 'Theory of Fundamental Interactions'*, Assistant, Hannover
Winter 2021/22	*Newton–Cartan gravity*, Lecturer, Hannover

SUMMER 2021	*Repetitorium Theoretical Electrodynamics*, Lecturer, Hannover
	Repetitorium Theoretical Physics B, Lecturer, Hannover
	Advanced Quantum Theory, Tutor, Hannover
WINTER 2020/21	*Repetitorium Mathematical Methods of Physics*, Lecturer, Hannover
	Repetitorium Theoretical Physics A, Lecturer, Hannover
SUMMER 2020	*Proseminar Theoretical Physics*, Assistant, Hannover
SUMMER 2019	*Proseminar Theoretical Physics*, Assistant, Hannover
SUMMER 2018	*Introduction to General Relativity*, Assistant, Hannover
SUMMER 2017	*Introduction to General Relativity*, Assistant, Hannover
2012–2015	Student teaching assistant at Leibniz University Hannover for several courses

COURSES GIVEN AT ACADEMIES OF THE CLUB DER EHEMALIGEN DER DEUTSCHEN SCHÜLERAKADEMIEN E. V. (ALUMNI ORGANISATION OF THE *Deutsche SchülerAkademien*)

SUMMER 2022	*Differential Forms and basics of Symplectic Geometry*
SUMMER 2019	*Introduction to General Relativity*
WINTER 2018/19	*Introduction to Differential Geometry* (joint with B Haake)
SUMMER 2018	*Stories of Alice and Bob—an introduction to Quantum Mechanics*
SUMMER 2014	*Introduction to pure Mathematics* (joint with J Haferkamp)

STUDENT SUPERVISION AND GRADING

SINCE 2022	Co-supervision of a Master's project with D Giulini: A L von Blanckenburg, *Variational completion of Newton–Cartan gravity*
2021–2022	Co-supervision of a Master's project with D Giulini: A Alibabaei, *Geometric post-Newtonian description of spin-half particles in curved spacetime*
2021, 2022	2nd referee for Bachelor's theses in physics teaching degree programme

ACADEMIC SERVICE

SINCE 2021	Reviews for Classical and Quantum Gravity, SciPost Physics, International Journal of Modern Physics D, Journal of Physics A: Mathematical and Theoretical, European Journal of Physics