Jens Boos

Curriculum Vitae

Research Interests

I am interested in modeling and constraining new physics at the intersection of high energy theory and gravity.

In Brief

25 publications, $h_{HEP} = 12$, Ph.D. thesis published in Springer Theses, 3 single-authored honorable mentions in Gravity Research Foundation Essay Competition (2023, 2020, 2018), 1 book review, 41 talks (10 invited), 17 attended conferences, taught 6 graduate courses, $456,724 of funding from 9 awards/scholarships/fellowships.

Positions

2023 – **Fellow; Young Investigator Group Preparation Program**, *Institute for Theoretical Physics, Karlsruhe Institute of Technology*, Karlsruhe, Germany

2020 – 2023 **Postdoctoral Research Associate of Physics**, *High Energy Theory Group, Department of Physics, William & Mary*, Williamsburg, VA, United States

Education

2016 – 2020 **Doctor of Philosophy (Ph.D.) in Physics**, *University of Alberta*, Edmonton, Canada
Vanier scholar, Faculty of Science Dissertation Award.

2015 – 2016 **Master of Science in Physics**, *University of Waterloo*, Waterloo, Canada
Perimeter Scholars International, *Perimeter Institute*, Waterloo, Canada
GPA – PSI program is traditionally not graded.

2012 – 2015 **Master of Science in Physics**, *University of Cologne*, Cologne, Germany
GPA – 1.0 (honor's branch)*

2009 – 2012 **Bachelor of Science in Physics**, *RWTH Aachen University*, Aachen, Germany
GPA – 1.1 excellent*

2000 – 2009 **Abitur**, *Heinrich-Heine Gymnasium*, Oberhausen, Germany
*GPA – 1.0**

*German grading system: 1.0 corresponds to the highest possible grade.

Recent Submissions

S2 *Kilometer-scale ultraviolet regulators and astrophysical black holes* 2311.16319 [gr-qc]
J. Boos, C. D. Carone

Institute for Theoretical Physics, Karlsruhe Institute of Technology
Wolfgang–Gaede Str. 1, D-76131 Karlsruhe, Germany
jens.boos@kit.edu • *www.spintwo.net*

Research Papers Published in Peer-Reviewed Journals

26 *Regular black hole from a confined spin connection in Poincaré gauge gravity* — PLB **848**, 138403 (2024) — 2308.13017 [gr-qc]
J. Boos

25 *Black hole entropy contributions from Euclidean cores* — IJMPD **32**, 2342011 (2023) — 2305.06834 [gr-qc]
J. Boos
Honorable mention, 2023 GRF Essay Competition.

24 *Asymptotically nonlocal gravity* — JHEP **06**, 017 (2023) — 2212.00861 [hep-th]
J. Boos, C. D. Carone

23 *Asymptotically safe dark matter with gauged baryon number* — PRD **107**, 035018 (2023) — 2209.14268 [hep-ph]
J. Boos, C. D. Carone, N. L. Donald, M. R. Musser

22 *Asymptotic safety and gauged baryon number* — PRD **106**, 035015 (2022) — 2206.02686 [hep-ph]
J. Boos, C. D. Carone, N. L. Donald, M. R. Musser

21 *Asymptotic non-locality in non-Abelian gauge theories* — PRD **105**, 035034 (2022) — 2112.052701 [hep-ph]
J. Boos, C. D. Carone

20 *Asymptotic non-locality in gauge theories* — PRD **104**, 095020 (2021) — 2109.06261 [hep-th]
J. Boos, C. D. Carone

19 *Asymptotic non-locality* — PRD **104**, 015028 (2021) — 2104.11195 [hep-th]
J. Boos, C. D. Carone

18 *Non-locality and gravitoelectromagnetic duality* — PRD **104**, 024018 (2021) — 2103.10555 [gr-qc]
J. Boos, I. Kolář

17 *Effects of non-locality in gravity and quantum theory* — Springer Theses (2020) — 2009.10856 [gr-qc]
J. Boos
Ph.D. thesis, 234 pages, University of Alberta, 2020.

16 *Retarded potential of a uniformly accelerated source in non-local scalar field theory* — PRD **103**, 105004 (2021) — 2102.07843 [hep-th]
J. Boos, I. Kolář

15 *Resonant particle creation by a time-dependent potential in a non-local theory* — PLB **816**, 136252 (2021) — 2011.12929 [hep-th]
J. Boos, V. P. Frolov, A. Zelnikov

14 *Ultrarelativistic charged and magnetized objects in non-local ghost-free electrodynamics* — PRD **103**, 045013 (2021) — 2012.05347 [hep-th]
J. Boos, V. P. Frolov, J. Pinedo Soto

13 *Angle deficit & non-local gravitoelectromagnetism around a slowly spinning cosmic string* — IJMPD **29**, 2043027 (2020)

J. Boos 2003.13847 [gr-qc]
Honorable mention, 2020 GRF Essay Competition.

12 *Ultrarelativistic spinning objects in non-local ghost-free gravity* PRD **101**, 124065 (2020)
J. Boos, V. P. Frolov, J. Pinedo Soto 2004.07420 [gr-qc]

11 *'Ghost-free modification of the Polyakov action and Hawking radiation* PRD **100**, 104008 (2019) 1909.01494 [hep-th]
J. Boos, V. P. Frolov, A. Zelnikov

10 *On thermal field fluctuations in ghost-free theories* PLB **793**, 290 (2019)
J. Boos, V. P. Frolov, A. Zelnikov 1904.07917 [hep-th]

9 *Probing the vacuum fluctuations in scalar ghost-free theories* PRD **99**, 076014 (2019)
J. Boos, V. P. Frolov, A. Zelnikov 1901.07096 [hep-th]

8 *Premetric teleparallel theory of gravity and its local and linear constitutive law* EPJC **78**, 907 (2018) 1808.08048 [gr-qc]
Y. Itin, Y. N. Obukhov, **J. Boos**, F. W. Hehl

7 *Quantum scattering on a delta potential in ghost-free theory* PLB **782**, 688 (2018)
J. Boos, V. P. Frolov, A. Zelnikov 1805.01875 [hep-th]

6 *Gravitational Friedel oscillations in higher-derivative and infinite-derivative gravity?* IJMPD **27**, 1847022 (2018) 1804.00225 [gr-qc]
J. Boos
Honorable mention, 2018 GRF Essay Competition.

5 *Gravitational field of p-branes in linearized ghost-free gravity* PRD **97**, 084021 (2018)
J. Boos, V. P. Frolov, A. Zelnikov 1802.09573 [gr-qc]

4 *Principal Killing strings in higher-dimensional Kerr–NUT–(A)dS spacetimes* PRD **97**, 084015 (2018) 1801.00122 [gr-qc]
J. Boos, V. P. Frolov

3 *Stationary black holes with stringy hair* PRD **97**, 024024 (2018)
J. Boos, V. P. Frolov 1711.06357 [gr-qc]

2 *Gravity-induced four-fermion contact interaction implies gravitational intermediate W and Z type gauge bosons* IJTP **56**, 751 (2017) 1606.09273 [gr-qc]
J. Boos, F. W. Hehl

1 *Plebański–Demiański solution of general relativity and its expressions quadratic and cubic in curvature: analogies to electromagnetism* IJMPD **24**, 1550079 (2015) 1412.1958 [gr-qc]
J. Boos

Working Papers

W2 *Non-singular 'Gauss' black hole from non-locality: a simple model with a de Sitter core, mass gap, and no inner horizon* 2104.00555 [gr-qc]
J. Boos

W1 *Kerr principal null directions from Bel–Robinson and Kummer surfaces* 1703.10791 [gr-qc]
J. Boos, A. Favaro

Book Reviews

R1 Review of "On Gravity: A Brief Tour of a Weighty Subject," (Princeton University Press, 2018), Physics in Canada, Canadian Association of Physicists, 2019.

Funding

2024 – 2025 Young Investigator Group Preparation Program $100,000
Karlsruhe Institute of Technology & state of Baden–Württemberg, Germany

Awards and Scholarships ($n = 9$, $\Sigma = \$356{,}724$)

2017 – 2020 Vanier Canada Graduate Scholarship $166,667
Natural Sciences and Engineering Research Council of Canada
Golden Bell Jar Graduate Scholarship in Physics $90,000
University of Alberta
2019 Andrew Stewart Memorial Graduate Prize $5,000
Graduate Student Travel Award $457.78
University of Alberta
2017 President's Doctoral Prize of Distinction $21,600
University of Alberta
2016 – 2017 Dean's Excellence Recruitment Scholarship Award $5,000
University of Alberta Doctoral Recruitment Scholarship $20,000
University of Alberta
2015 – 2016 Perimeter Scholars International Award $30,000
Perimeter Institute for Theoretical Physics
2013 – 2015 Member of Bonn–Cologne Graduate School Honor's Branch $18,000
University of Cologne

Honors and Distinctions

2023 Honorable Mention, Essay Competition 2023
Gravity Research Foundation
2021 P. R. Wallace Thesis Prize $500
Canadian Association of Physicists, Division of Theoretical Physics
Winnipeg Institute for Theoretical Physics, Canada

Springer Thesis Award $500
Springer Nature, Switzerland

2020 Faculty of Science Doctoral Dissertation Award
Faculty of Science, University of Alberta

Honorable Mention, Essay Competition 2020
Gravity Research Foundation

Semi-finalist prize, Images of Research Competition 2020
University of Alberta

2019 Finalist, three-minute thesis (3MT) competition
Faculty of Graduate Studies and Research, University of Alberta

2018 Honorable Mention, Essay Competition 2018
Gravity Research Foundation

First prize, Annual Symposium for Graduate Physics Research $250
Graduate Physics Student Association, University of Alberta

Semi-finalist prize, Images of Research Competition 2018
University of Alberta

2013 Selected for Dean's List 2013
RWTH Aachen University

2012 becoMINT graduate prize
Robert Bosch corporation

2009 State distinction for best Abitur[†] graduates
Patron: prime minister of North Rhine-Westfalia, Germany

Manfred Lennings medal for best Abitur[†] grade
Rotary Club Oberhausen

[†]Diploma from German secondary schools qualifying for university admission or matriculation.

Teaching Experience

2021 PHYS 581: Differential Geometry for Physicists
Graduate course, William & Mary, http://www.spintwo.net/Courses/

PHYS 101H: guest lecturer on black hole physics
Undergraduate course, William & Mary

2020 Differential Geometry Student Meetings[‡]

2019 Black Hole Student Meetings[‡]

Conformal Field Theory Student Meetings[‡]

2018 Gauge Theory Student Meetings[‡]

Quantum Field Theory Student Meetings[‡]
Graduate seminars, University of Alberta, http://www.spintwo.net/Courses/

2015 Geometry in Physics

Teaching assistant, graduate course, University of Cologne, Prof. Alexander Altland.

2014 Advanced Seminar on General Relativity & Cosmology

General Relativity & Cosmology II

Teaching assistant, graduate course, University of Cologne, Prof. Claus Kiefer.

‡Independently organized events outside the department's regular curriculum.

Attended Conferences and Schools

2023 Puzzles in the Quantum Gravity Landscape: Viewpoints from Different Approaches

Perimeter Institute for Theoretical Physics, Waterloo, Canada (online participation)

2022 Snowmass Theory Frontier Conference

Kavli Institute for Theoretical Physics, UC Santa Barbara, United States (online participation)

2022 Bad Honnef Physics School on Black Holes

Physikzentrum German Physical Society, Bad Honnef, Germany

2021 16$^{\text{th}}$ Marcel Grossmann Meeting

University of Rome (La Sapienza), Italy (online conference)

Quantum Gravity, Higher Derivatives, and Nonlocality

Tokyo Institute of Technology, Japan (online conference)

2020 Nobel Laureate Discussion Panel on "The Greatest Physics Discoveries of the 20th Century"

HAPP Centre, University of Oxford, UK (online participation)

2019 25th Saalburg Summer School – Foundations and New Methods in Theoretical Physics

Heigenbrücken, Germany

2018 Hundred Years of Gauge Theory

Physikzentrum German Physical Society, Bad Honnef, Germany

Prospects in Theoretical Physics – From Qubits to Spacetime

Institute for Advanced Study, Princeton, USA

Joint Canada-Asia Pacific Conf. on General Relativity and Relativistic Astrophysics

University of Alberta, Edmonton, Canada

2017 Geometric Foundations of Gravity

University of Tartu, Estonia

Mathematical Physics and General Relativity Symposium in Honor of Professor Ivor Robinson

University of Texas at Dallas, USA

2016 Time in Cosmology

Perimeter Institute for Theoretical Physics, Waterloo, Canada

Black Holes' New Horizons

Casa Matemática Oaxaca, Mexico

2015 14$^{\text{th}}$ Marcel Grossmann Meeting

University of Rome (La Sapienza), Italy

DPG (German Physical Society) Spring Meeting

Technical University Berlin, Germany

2014 569th Wilhelm and Else Heraeus Seminar on Quantum Cosmology
Physikzentrum German Physical Society, Bad Honnef, Germany
Graduate School "From Classical to Quantum GR: Applications to Cosmology"
University of Sussex, United Kingdom

2013 Second Erlangen Fall School on Quantum Geometry
University of Erlangen–Nuremberg, Germany
Jürgen Ehlers Spring School "Gravitational Physics"
Max Planck Institute for Gravitational Physics, Potsdam, Germany

Talks and Invited Seminars

Jan 2022 Asymptotic nonlocality
Invited talk, Van Swinderen Institute, University of Groningen, Netherlands

Oct 2021 So black holes exist. Now what?
Invited symposium, Department of Physics, William & Mary, United States

Jul 2021 Ultrarelativistic spinning objects in non-local ghost-free gravity
16th Marcel Grossmann Meeting, University of Rome (La Sapienza), Italy (online talk)

Jun 2021 Effects of non-locality in gravity and quantum theory
Invited talk, Canadian Association of Physicists (online talk)

Mar 2021 Regular solutions in weak-field infinite-derivative theories: Green function approach
Invited talk, Tokyo Institute of Technology, Japan (online conference)
Unexpected features of non-locality: resonant particle production
William & Mary, United States

Sep 2020 Effects of non-locality in gravity and quantum theory
Ph.D. Defense, University of Alberta, Canada

Jun 2020 Ultrarelativistic objects in non-local infinite-derivative gravity
Invited talk, William & Mary, United States

Dec 2019 What is a black hole?
Invited talk, Rotary Club Oberhausen, Germany

Sep 2019 Black holes and mathematical sandpaper
Graduate research symposium, University of Alberta, Canada

Aug 2019 Black holes, strings, and hidden symmetries
Invited talk, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, UK
Towards surface charges in spacetimes with curvature and torsion
Invited talk, Université Libre de Bruxelles, Belgium
Non-local "ghost-free" gravity
University of Cologne, Germany

Apr 2019 An exact Kerr–(A)dS black hole solution with torsion and curvature
Gravity seminar, University of Alberta, Canada

Black holes and Einstein's end of eternity
3MT Finals 2019, University of Alberta, Canada

Nov 2018 Quantum-mechanical scattering on a delta potential in ghost-free theory
Gravity seminar, University of Alberta, Canada

Oct 2018 An exact stationary string configuration attached to a rotating black hole
Graduate research symposium, University of Alberta, Canada

Jun 2018 Principal Killing strings in higher-dimensional Kerr–NUT–(A)dS spacetimes
JCAPC GRRA 2018, University of Alberta, Canada

Mar 2018 Linearized short-distance modifications of Einstein's General Relativity
Graduate weekend, University of Alberta, Canada

Jan 2018 Cosmic strings in stationary BH geometries: stringy matter, principal Killing strings
Invited talk, University of Cologne, Germany

Aug 2017 Curvature tensors in a 4D Riemann–Cartan space: decompositions and superenergy
Geometric Foundations of Gravity, University of Tartu, Estonia

May 2017 The Bel–Robinson tensor as an irreducible piece of the Bel tensor
Mathematical Physics and General Relativity Symposium in Honor of Professor Ivor Robinson, University of Texas at Dallas, USA

Sep 2016 Quasi-normal modes: what can ringing black holes tell us about quantum gravity?
Symposium for Graduate Physics Research, University of Alberta, Canada

May 2016 Quasi-normal modes of the BTZ black hole and (2+1)D Poincaré gauge theory of gravity
Invited talk, Black Holes' New Horizons, Casa Matemática Oaxaca, Mexico

Mar 2016 Gauge structures in gravity
Gravity seminar, University of Alberta, Canada

Dec 2015 Poincaré gauge theory and its deformed Lie algebra – mass-spin classification of elementary particles
PSI seminar, Perimeter Institute for Theoretical Physics, Canada

Nov 2015 Classical aspects of Poincaré gauge theory of gravity
Quantum gravity seminar, Perimeter Institute for Theoretical Physics, Canada

Sep 2015 Differential forms: from classical force to the Wilson loop
PSI seminar, Perimeter Institute for Theoretical Physics, Canada

Jul 2015 Plebański–Demiański solution of general relativity and its expressions quadratic and cubic in curvature: analogies to electromagnetism
14^{th} Marcel Grossmann Meeting, University of Rome (La Sapienza), Italy

Mar 2015 Plebański–Demiański solution of general relativity and its expressions quadratic and cubic in curvature: analogies to electromagnetism
DPG (German Physical Society) Spring Meeting, Berlin, Germany

Apr 2015 Poincaré gauge theory of gravity — an introduction
Invited talk, BCGS seminar, Physikzentrum German Physical Society, Bad Honnef, Germany

Feb 2015 Quasi-normal modes of the BTZ black hole with torsion

Gravitation and Relativity seminar, University of Cologne, Germany

Nov 2014 Second order curvature invariants for the Plebański–Demiański solution
Gravitation and Relativity seminar, University of Cologne, Germany

Jun 2014 Poincaré gauge theory of gravity
Gravitation and Relativity seminar, University of Cologne, Germany

Jun 2014 Exterior calculus and Einstein–Cartan theory
Gravitation and Relativity seminar, University of Cologne, Germany

Aug 2012 Physics inside the Schwarzschild radius
Department for Theoretical Particle Physics, RWTH Aachen University, Germany

Master's Theses

Title *Symplectic boundary degrees of freedom in Poincaré gauge theory of gravity*
Supervisors Prof. Lee Smolin & Prof. Laurent Freidel

Title *Quasi-normal modes of the the BTZ black hole solution of* $(2+1)$*-dimensional Poincaré gauge theory of gravity*
Supervisors Prof. Friedrich W. Hehl & Prof. Claus Kiefer

Bachelor's Thesis

Title *Physics inside the Schwarzschild radius*
Supervisor Prof. Yvonne Y. Wong

Refereeing

2023 – Journal of High Energy Physics (JHEP)
2022 – Physical Review D; Physics Letters B; Journal of Cosmology and Astroparticle Physics; General Relativity and Gravitation; International Journal of Modern Physics A; Symmetry; Universe
2021 – Europhysics Letters
2019 – European Physical Journal C
2018 – International Journal of Modern Physics D; Zeitschrift für Naturforschung A
2016 – Annals of Physics (Berlin)

Memberships

2018 – CAP (Canadian Association of Physicists), Division of Theoretical Physics
2018 – APS (American Physical Society), Division of Gravitation, Division of Astrophysics
2014 – DPG (German Physical Society), Division of Gravitation and Relativity
2014 – WWF (World Wide Fund for Nature)
2014 – Welthungerhilfe Germany (NGO for development cooperation and emergency aid)

Organized Conferences

2021 PhD/Early Postdoc Symposium on Non-locality

Main organizer, recurring online symposium, http://www.spintwo.net/Symposium/

2021 Meeting of the Division of Particles and Fields of the American Physical Society (DPF21)

Parallel Session Chair

2018 Joint Canada-Asia Pacific Conference on General Relativity and Relativistic Astrophysics, University of Alberta, Edmonton, Canada

Member of local organizing committee, chairperson in afternoon session.

2014 569th Wilhelm and Else Heraeus Seminar on Quantum Cosmology, German Physical Society, Bad Honnef, Germany

Development of conference website and database backend for participant management.

Work Experience

2009 – freelance web developer

2014 – 2015 teaching assistant for various graduate-level courses

Institute for Theoretical Physics, University of Cologne

2014 Development and implementation of registration interface for the conference "569th Wilhelm and Else Heraeus Seminar on Quantum Cosmology" (see above)

Institute for Theoretical Physics, University of Cologne, Prof. Claus Kiefer

2013 – 2014 Development of website content management system (www.loosdrecht.net)

II. Physical Institute, University of Cologne, Prof. Paul van Loosdrecht

2013 – 2014 Graphic design and poster supervision for the Physical Colloquium

Department of Physics, University of Cologne

2013 Supervision of physics department website (physik.uni-koeln.de)

Department of Physics, University of Cologne

Computer Skills

algebra	Mathematica, Maple, Reduce with Excalc
programming	C, Java, Python, BASIC, FreeBasic
data analysis	ROOT data analysis framework
media	LaTeX, GIMP, Inkscape, Adobe InDesign, Adobe Premiere Pro, DaVinci Resolve 15
office	LibreOffice Writer, Calc, Impress; Microsoft Word, Excel, Powerpoint
web	HTML, CSS, PHP, JavaScript, Ajax, MySQL, jQuery, Typo3, webdesign

Other Interests

digital microcontroller electronics (see educational blog www.friendlywire.com), programming, collecting vintage vacuum "Nixie" tubes (see personal website www.jb-electronics.de), webdesign, piano (Boogie Woogie, Rock'n'Roll), ballroom dancing, running

Other Projects

2012 Development of data analysis software optoScale, RWTH Aachen University

2011 – 2012 Undergraduate Fund Project, RWTH Aachen University $5,000

Study and construction of gas discharge tubes at the I. Physical Institute B, Prof. Lutz Feld

Languages

English (fluent), German (native), French (basic), Latin (basic), Turkish (basic)

References

Prof. Christopher D. Carone (cdcaro@wm.edu)
Postdoc advisor, 2020–2023, William & Mary, Virginia, United States
Prof. Valeri P. Frolov (vfrolov@ualberta.ca)
Ph.D. supervisor, 2016–2020, University of Alberta, Canada
Prof. Don N. Page (dpage@ualberta.ca)
Ph.D. committee member, 2016–2020, University of Alberta, Canada
Prof. David Kubiznak (david.kubiznak@mff.cuni.cz)
M.Sc. mentor, 2015–2016, Perimeter Institute for Theoretical Physics, Canada
Prof. Friedrich W. Hehl (hehl@thp.uni-koeln.de)
M.Sc. supervisor, 2013–2015, Institute for Theoretical Physics, University of Cologne, Germany

Further information available upon request. Last update: January 2024