

### Research Interests

My interests are the description of space and time; classically, in the framework of General Relativity and more general theories, as well as in the domain of quantum field theory in curved spacetime. I am particularly interested in methods from effective field theory and modern differential geometry, and how they can help us to understand quantum effects and new physics involving black holes and gravity.

### Education

- 2016–present **Doctor of Philosophy (Ph.D.) in Physics**, *University of Alberta*, Edmonton, Canada.  
Vanier scholar; expected completion: Sept. 2020
- 2015–2016 **Master of Science in Physics**, *University of Waterloo*, Waterloo, Canada.  
**Perimeter Scholars International**, *Perimeter Institute*, Waterloo, Canada.
- 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.

### Submitted Papers

- S1. J.B., “Angle deficit & non-local gravitoelectromagnetism around a slowly spinning cosmic string,” arXiv:2003.13847 [gr-qc], honorable mention in the Gravity Research Foundation Essay Competition 2020.

### Publications

12. J.B., Jose Pinedo Soto, and Valeri P. Frolov, “Ultrarelativistic spinning objects in non-local ghost-free gravity,” *Phys. Rev. D* **101** (2020) no. 12, 124065; arXiv:2004.07420 [gr-qc].
11. J.B., Valeri P. Frolov, and Andrei Zelnikov, “Ghost-free modification of the Polyakov action and Hawking radiation,” *Phys. Rev. D* **100** (2019) no. 10, 104008; arXiv:1909.01494 [hep-th].
10. J.B., Valeri P. Frolov, and Andrei Zelnikov, “On thermal field fluctuations in ghost-free theories,” *Phys. Lett. B* **793** (2019) 290; arXiv:1904.07917 [hep-th].
9. J.B., Valeri P. Frolov, and Andrei Zelnikov, “Probing the vacuum fluctuations in scalar ghost-free theories,” *Phys. Rev. D* **99** (2019) no. 7, 076014; arXiv:1901.07096 [hep-th].
8. Yakov Itin, Yuri N. Obukhov, J.B., and Friedrich W. Hehl, “Premetric teleparallel theory of gravity and its local and linear constitutive law,” *Eur. Phys. J. C* **78** (2018) 907; arXiv:1808.08048 [gr-qc].

7. J.B., Valeri P. Frolov, and Andrei Zelnikov, “Quantum scattering on a delta potential in ghost-free theory,” *Phys. Lett. B* **782** (2018) 688; arXiv:1805.01875 [hep-th].
6. J.B., “Gravitational Friedel oscillations in higher-derivative and infinite-derivative gravity?,” *Int. J. Mod. Phys. D* **27** (2018) 1847022; arXiv:1804.00225 [gr-qc], honorable mention in the Gravity Research Foundation Essay Competition 2018.
5. J.B., Valeri P. Frolov, and Andrei Zelnikov, “The gravitational field of  $p$ -branes in linearized ghost-free gravity,” *Phys. Rev. D* **97** (2018) no. 8, 084021; arXiv:1802.09573 [gr-qc].
4. J.B. and Valeri P. Frolov, “Principal Killing strings in higher-dimensional Kerr–NUT–(A)dS spacetimes,” *Phys. Rev. D* **97** (2018) no. 8, 084015; arXiv:1801.00122 [gr-qc].
3. J.B. and Valeri P. Frolov, “Stationary black holes with stringy hair,” *Phys. Rev. D* **97** (2018) no. 2, 024024; arXiv:1711.06357 [gr-qc].
2. J.B. and Friedrich W. Hehl, “Gravity-induced four-fermion contact interaction implies gravitational intermediate  $W$  and  $Z$  type gauge bosons,” *Int. J. Theor. Phys.* **56** (2017) 751; arXiv:1606.09273 [gr-qc].
1. J.B., “Plebański–Demiański solution of general relativity and its expressions quadratic and cubic in curvature: analogies to electromagnetism,” *Int. J. Mod. Phys. D* **24** (2015) 1550079; arXiv:1412.1958 [gr-qc].

## Working Papers

- W1. J.B. and Alberto Favaro, “Kerr principal null directions from Bel–Robinson and Kummer surfaces,” arXiv:1703.10791 [gr-qc].

## Book Reviews

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

## Awards and Scholarships

- 2017–2020 Vanier Canada Graduate Scholarship  
*Natural Sciences and Engineering Research Council of Canada*  
 Golden Bell Jar Graduate Scholarship in Physics  
*University of Alberta*
- 2019 Andrew Stewart Memorial Graduate Prize  
 Graduate Student Travel Award  
*University of Alberta*
- 2017 President’s Doctoral Prize of Distinction  
*University of Alberta*
- 2016–2017 Dean’s Excellence Recruitment Scholarship Award  
 University of Alberta Doctoral Recruitment Scholarship  
*University of Alberta*
- 2015–2016 Perimeter Scholars International Award  
*Perimeter Institute for Theoretical Physics*
- 2013–2015 Member of Bonn–Cologne Graduate School Honor’s Branch  
*University of Cologne*

---

## Honors and Distinctions

- 2020 Honorable Mention, Essay Competition 2020  
*Gravity Research Foundation*  
Semi-finalist prize, Images of Research Competition 2020 (link)  
*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  
*Graduate Physics Student Association, University of Alberta*  
Semi-finalist prize, Images of Research Competition 2018 (link)  
*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<sup>†</sup> graduates  
*Patron: prime minister of North Rhine-Westfalia, Germany*  
Manfred Lennings medal for best Abitur<sup>†</sup> grade  
*Rotary Club Oberhausen*
- <sup>†</sup>Diploma from German secondary schools qualifying for university admission or matriculation.

---

## Attended Conferences and Schools

- 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<sup>th</sup> Marcel Grossmann Meeting  
*University of Rome (La Sapienza), Italy*

*Theoretical Physics Institute, University of Alberta  
4-181 CCIS, Edmonton, Alberta T6G 2E1, Canada*

✉ [boos@ualberta.ca](mailto:boos@ualberta.ca) • 🌐 [www.spintwo.net](http://www.spintwo.net) • [in jens-boos](https://www.linkedin.com/company/injens-boos)

- DPG (German Physical Society) Spring Meeting  
*Technical University Berlin, Germany*
- 2014 569<sup>th</sup> 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

- 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*
- 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 GRRRA 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<sup>th</sup> 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

- 2016–present Annals of Physics (Berlin)

- 2018–present Zeitschrift für Naturforschung A
- 2018–present International Journal of Modern Physics D
- 2019–present European Physical Journal C

## Memberships

- 2014–present DPG (German Physical Society), Division of Gravitation and Relativity
- 2018–present CAP (Canadian Association of Physicists), Division of Theoretical Physics
- 2018–present APS (American Physical Society), Division of Gravitation, Division of Astrophysics

## Teaching Experience

- 2020 Differential Geometry Student Meetings<sup>‡</sup>
- 2019 Black Hole Student Meetings<sup>‡</sup>  
Conformal Field Theory Student Meetings<sup>‡</sup>
- 2018 Gauge Theory Student Meetings<sup>‡</sup>  
Quantum Field Theory Student Meetings<sup>‡</sup>  
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.*

<sup>‡</sup>Independently organized events outside the department's regular curriculum.

## Organized Conferences

- 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–present 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](http://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*

*Theoretical Physics Institute, University of Alberta  
4-181 CCIS, Edmonton, Alberta T6G 2E1, Canada*

✉ [boos@ualberta.ca](mailto:boos@ualberta.ca) • 🌐 [www.spintwo.net](http://www.spintwo.net) • **in** [jens-boos](#)

2013 Supervision of physics department website (physik.uni-koeln.de)  
*Department of Physics, University of Cologne*

## Computer Skills

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

## Other Interests

digital microcontroller electronics (see educational blog [www.friendlywire.com](http://www.friendlywire.com)), programming, collecting vintage vacuum “Nixie” tubes (see personal website [www.jb-electronics.de](http://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  
Study and construction of gas discharge electron tubes at the I. Physical Institute B, Prof. Lutz Feld

## Languages

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

## References

Prof. Valeri P. Frolov  
*Ph.D. supervisor, University of Alberta, Canada*  
Prof. David Kubiznak  
*Mentor, Perimeter Institute for Theoretical Physics, Canada*  
Prof. Friedrich W. Hehl  
*M.Sc. supervisor, Institute for Theoretical Physics, University of Cologne, Germany*

Further information available upon request. Last update: June 2020