Curriculum Vitae

Name:	Igor Khavkine
Qualifications:	PhD (Applied Mathematics & Theoretical Physics),
	Qualification (MCF 25), Abilitazione (II Fascia – 01/A4, MAT/07)
Current Position:	Researcher in Algebra, Geometry and Mathematical Physics
	Institute of Mathematics, Czech Academy of Sciences, Prague, Czech Republic
Address:	Žitná 25
	115 67 Praha 1, Czech Republic
Email:	khavkine@math.cas.cz, igor.kh@gmail.com
Web:	http://users.math.cas.cz/~khavkine/
Citizenship:	Canadian
Languages:	English, Russian, French, Italian (advanced), Dutch (basic)

Research Interests

mathematical physics, quantum field theory, general relativity, quantum gravity
differential geometry, supergeometry, geometry of PDEs, homological algebra

1. Geometry and PDEs.

    (a) Jets, variational calculus, exact and approximate conservation laws, involution and formal integrability.

    (b) PDEs on fermionic fields, supergeometry.

    (c) Applications of homological algebra and higher structures to the geometry of gauge theories.

2. Classical and quantum field theory in curved space-time.

    (a) Local sympletic/Poisson structure, symmetries, conservation laws.

    (b) Deformation quantization.

    (c) Algebraic quantum field theory, Epstein-Glaser renormalization, BV-BRST method.

    (d) Perturbative quantization of gauge theories and gravity.

3. Quantum gravity phenomenology.

    (a) Definition of diffeomorphism-invariant observables.

    (b) Relation of observables to (in principle) possible experiments.

    (c) Causal structure and non-linearity.

Work Experience

12/2017–	**Researcher** Institute of Mathematics, Czech Academy of Sciences (Prague, Czech Republic). Mathematical aspects of classical and quantum field theory.
12/2016–11/2017	**Postdoctoral Fellow** Department of Mathematics, University of Milan Statale (Italy). Mathematical aspects of classical and quantum field theory.
05/2016–11/2016	**Postdoctoral Fellow** Department of Mathematics, University of Rome 2 Tor Vergata (Italy). Mathematical aspects of classical and quantum field theory.
10/2013–10/2015	**Postdoctoral Fellow** Department of Mathematics, University of Trento (Italy). Mathematical Physics group. Mathematical aspects of classical and quantum field theory.
01/2011–10/2013	**NWO VENI Postdoctoral Fellow** ITF, Utrecht University (The Netherlands). Quantum Gravity group. Observables in quantum gravity and causal structure of classical and quantum gravity.
01/2009–12/2010	**NSERC Postdoctoral Fellow** ITF, Utrecht University (The Netherlands). Quantum Gravity group. Causality and observables in perturbative quantum gravity; issues of coupling localized matter to CDT models of quantum gravity.
09/2004–12/2007	**Teaching Assistant** Department of Applied Mathematics, University of Western Ontario (Canada).
09/2002–05/2004	**Teaching Assistant** Department of Physics, University of Toronto (Canada).
05/2001–08/2001, 05/2000–08/2000	**Research Assistant** Femtosecond Science Group, National Research Council (Canada).

Academic Background

09/2004–08/2008	**PhD, Applied Mathematics and Theoretical Physics**
	Department of Applied Mathematics, University of Western Ontario
	London, Ontario, Canada
	Thesis: Computer simulation of spin foam models of quantum gravity
	Advisor: Dr. J. Daniel Christensen
09/2002–08/2004	**MSc, Theoretical Physics**
	Department of Physics, University of Toronto
	Toronto, Ontario, Canada
	Thesis: Formation of electronic nematic phase in interacting systems
	Advisor: Dr. Hae-Young Kee
09/1999–05/2002	**BSc, Physics**
	Department of Physics, Concordia University
	Montreal, Quebec, Canada
	Graduating grade point average (GPA): *4.13/4.3*

Major Scholarships and Awards

Period Held	*Name of Award*	*Type*	*Value/yr*	*Location of Tenure*
01/2011–10/2013	NWO Veni Postdoctoral Fellowship	national	€ 76 300	Utrecht University
01/2009–12/2010	NSERC Postdoctoral Fellowship	national	C$ 40 000	Utrecht University
05/2008–08/2008	SHARCNET Fellowship	institutional	C$ 8 000	University of Western Ontario
09/2007–05/2008	OGSST	provincial	C$ 10 000	University of Western Ontario
09/2006–08/2007	Bourse de Doctorat en Recherche, FQRNT	provincial	C$ 20 000	University of Western Ontario
09/2004–08/2006	NSERC Postgraduate Scholarship D	national	C$ 21 000	University of Western Ontario
09/2002–08/2004	NSERC Postgraduate Scholarship A	national	C$ 17 400	University of Toronto

NWO: The Netherlands Organization for Scientific Research
NSERC: Natural Sciences and Engineering Research Council of Canada
SHARCNET: Shared Hierarchical Academic Research Computing Network of Canada
OGSST: Ontario Graduate Scholarship in Science and Technology
FQRNT: Fonds Québécois de la Recherche sur la Nature et les Technologies
C$ 1000 $\sim$ US$ 800 $\sim$ € 700

Other Academic Experience

1. Journal Referee: Annales Henri Poincaré, Classical and Quantum Gravity, General Relativity and Gravitation, International Journal of Geometric Methods in Modern Physics, Journal of Mathematical Physics, Mathematical Physics Analysis and Geometry, Physical Review D, SIGMA.

2. (2010–) Contributor to research mathematics Q&A site MathOverflow.net, focusing on mathematical physics.

3. (2014–2015) Organizer of the Mathematical Physics group's seminars, Department of Mathematics, University of Trento.

4. (2009–2012) Co-organizer of the Quantum Gravity group's seminars, Institute for Theoretical Physics, Utrecht University.

5. (2002–2003) Organizer of the Graduate Student Seminar in Theoretical Physics, University of Toronto.

6. (2003–2004) Member of Graduate Curriculum Committee, Department of Physics, University of Toronto.

Supervision of Projects and Theses

1. (01/2011, 04/2011) Supervision of undergraduate students from University College Utrecht; month-long independent study in relativity (*Twin Paradox*).

2. (2011–2012) **B. P. Bonga**, MSc thesis *Quantum Gravitational Fluctuations of Time Delay Observable in Minkowski Vacuum*. Officially co-supervised with Prof. Renate Loll, Utrecht University, The Netherlands. Bonga is now a PhD student with Prof. Abhay Ashtekar at Penn State, USA.

3. (2014–2015) **F. Bussola**, MSc thesis *De Donder gauge graviton Green's function in Schwarzschild spacetime with an outlook toward the Feynman propagator*. Officially co-supervised with Prof. Valter Moretti, University of Trento, Italy. Bussola is now a PhD student with Prof. Claudio Dappiaggi at the University of Pavia, Italy.

4. (2015–2016) **G. Canepa**, MSc thesis *An ideal characterization of Friedmann-Lemaître-Robertson-Walker space-times*. Officially co-supervised with Prof. Claudio Dappiaggi, University of Pavia, Italy. Canepa is now a PhD student with Prof. Alberto Cattaneo at the University of Zurich, Switzerland.

5. (2014–) **A. Melati**, PhD project *Renormalization of Wick powers of tensor and spinor fields on curved space-times*. Joint co-supervision with Prof. Valter Moretti, University of Trento, Italy.

6. (2015–) **F. Bussola**, PhD project *Linearized and perturbative quantum gravity on Schwarzschild spacetime*. Joint co-supervision with Prof. Claudio Dappiaggi, University of Pavia, Italy.

Preprints and Articles In Preparation

1. F. Bussola, **I. Khavkine** *De Donder gauge graviton propagator on a spherically symmetric black hole*

2. **I. Khavkine**, U. Schreiber *Lie n-algebras of higher Noether currents*

3. **I. Khavkine** *Explicit triangular decoupling of the separated vector wave equation on Schwarzschild into scalar Regge-Wheeler equations* [arXiv:1711.00585]

4. **I. Khavkine**, A. Melati, V. Moretti *On Wick polynomials of boson fields in locally covariant algebraic QFT* [arXiv:1710.01937]

5. G. Canepa, C. Dappiaggi, **I. Khavkine** (2017) *IDEAL characterization of isometry classes of FLRW and inflationary spacetimes* [arXiv:1704.05542]

6. **I. Khavkine**, U. Schreiber (2017) *Synthetic geometry of differential equations: I. Jets and comonad structure* [arXiv:701.06238] (submitted to Advances in Mathematics)

7. **I. Khavkine** (2015) *A polynomial action for gravity with matter, gauge fixing and ghosts* [arXiv:1512.08460]

8. **I. Khavkine** (2012) *Characteristics, conal geometry and causality in locally covariant field theory* (108 pages) [arXiv:1211.1914]

Refereed Publications

1. F. Bussola, C. Dappiaggi, H.R.C. Ferreira, **I. Khavkine** (2017) *Ground state for a massive scalar field in BTZ spacetime with Robin boundary conditions* Phys Rev D **96** 105016 [arXiv:1708.00271]

2. **I. Khavkine** (2017) *The Calabi complex and Killing sheaf cohomology* J Geom Phys **113** 131–169 [arXiv:1409.7212]

3. **I. Khavkine** (2016) *Cohomology with causally restricted supports* Ann H Poincaré **17** 3577–3603 [arXiv:1404.1932]

4. **I. Khavkine**, V. Moretti (2016) *Analytic dependence is an unnecessary requirement in renormalization of locally covariant QFT* Commun Math Phys **344** 581–620 [arXiv:1411.1302v2]

5. **I. Khavkine** (2015) *Local and gauge invariant observables in gravity* Class and Quantum Grav **32** 185019 [arXiv:1503.03754]

6. **I. Khavkine**, V. Moretti (2015) *Algebraic QFT in curved spacetime and quasifree Hadamard states: an introduction* Book chapter in *Advances in Algebraic Quantum Field Theory*, R. Brunetti, C. Dappiaggi, K. Fredenhagen, J. Yngvason (eds.) (Springer, 2015) [arXiv:1412.5945]

7. **I. Khavkine** (2015) *Topology, rigid cosymmetries and linearization instabilities in higher gauge theories* Ann H Poincaré **16** 255 [arXiv:1303.2406]

8. **I. Khavkine** (2014) *Covariant phase space, constraints, gauge and the Peierls formula* Int J Mod Phys A **29** 1430009 [arXiv:1402.1282]

9. B. Bonga, **I. Khavkine** (2014) *Quantum astrometric observables II: fluctuations of time delay in the quantum gravitational vacuum* Phys Rev D **89** 024039 [arXiv:1307.0256]

10. **I. Khavkine** (2013) *Presymplectic current and the inverse problem of the calculus of variations* J Math Phys **54** 111502 [arXiv:1210.0802]

11. **I. Khavkine** (2012) *Quantum astrometric observables: time delay in classical and quantum gravity* Phys Rev D **85** 124014 [arXiv:1111.7127]

12. **I. Khavkine** (2010) *Comment on 'Hawking radiation from fluctuating black holes'* Class Quantum Grav **28** 038001 [arXiv:1008.5059]

13. **I. Khavkine**, R. Loll, P. Reska (2010) *Coupling a point-like mass to quantum gravity with causal dynamical triangulations* Class Quantum Grav **27** 185025 [arXiv:1002.4618]

——————— PhD Work ———————

14. **I. Khavkine** (2015) *Recurrence relation for the $6j$-symbol of $su_q(2)$ from an eigenvalue problem* Int J Geom Methods Mod Phys **12** 1550117 [arXiv:1009.2261]

15. J. D. Christensen, **I. Khavkine**, E. R. Livine, S. Speziale (2010) *Sub-leading asymptotic behaviour of area correlations in the Barrett-Crane model*
Class Quantum Grav **27** 035012 [arXiv:0908.4476]

16. **I. Khavkine** (2009) *Evaluation of new spin foam vertex amplitudes* Class Quantum Grav **26** 125012 [arXiv:0809.3190]

17. J. Wade Cherrington, J. D. Christensen, **I. Khavkine** (2007) *Dual Computations of Non-abelian Yang-Mills on the Lattice* Phys Rev D **76** 3271 [arXiv:0705.2629]

18. **I. Khavkine**, J. D. Christensen (2007) *q-deformed spin foam models of Riemannian quantum gravity* Class Quantum Grav **24** 3271 [arXiv:0704.0278]

——————— MSc Work ———————

19. **I. Khavkine**, H.-Y. Kee, K. Maki (2004) *Supercurrent in nodal superconductors* Phys Rev B **70** 184521 [arXiv:cond-mat/0405236]

20. **I. Khavkine**, C.-H. Chung, V. Oganesyan, H.-Y. Kee (2004) *Formation of an electronic nematic phase in interacting fermion systems* Phys Rev B **70** 155110 [arXiv:cond-mat/0402565]

——————— Undergraduate Work ———————

21. E. A. Shapiro, **I. Khavkine**, M. Spanner, and M. Yu. Ivanov (2003) *Strong-field molecular alignment for quantum logic and quantum control* Phys Rev A **67** 013406

N.B.: It is worth noting that the papers that have resulted from my Undergraduate (1999–2002), Masters (2002–2004), PhD (2004–2008) and post-PhD periods all cover rather distinct and independent topics.

Organized Meetings and Schools

1. (Apr 2017) *QFT Day in Milan: mathematical aspects of renormalization* workshop, University of Milan, Italy. Organized jointly with *Prof. Vieri Mastropietro*.

Attended Meetings and Schools

1. (Sep 2017) *Advances in Mathematical and Theoretical Physics* conference, Accademia dei Lincei, Rome, Italy.

2. (Jul 2017) *Quantum Mathematical Physics Day* workshop, University of Pavia, Italy.

3. (Jun 2017) *Non-regular spacetime geometry* workshop, University of Florence, Italy.

4. (Jun 2017) *Geometry and Algebra of PDEs* conference, University of Tromsø, Norway.

5. (Jun 2017) *Foundational and structural aspects of gauge theories* workshop, Mainz Institute for Theoretical Physics, Mainz, Germany.

6. (Jan 2017) *Microlocal analysis: a tool to explore a quantum world* workshop, Genova, Italy.

7. (Aug 2016) *Geometry and Physics XIV: Graded geometry and applications to physics* workshop, Sheffield, UK.

8. (Jun 2016) *Operator Algebras and Quantum Field Theory Dedicated to the memory of John E. Roberts* workshop, INFN Frascati, Italy.

9. (Nov 2015) *General Relativity: A celebration of the 100th anniversary* conference, Paris, France.

10. (Oct 2015) *Integrable Nonlinear Equations* workshop, Mikulov, Czech Republic.

11. (Sep 2015) *Algebraic Quantum Field Theory of Lorentzian Manifolds* minisymposium at *DMV Annual Meeting 2015*, Hamburg, Germany.

12. (Sep 2015) *Hyperbolic Equations on Spacetimes: Stability, Microlocal Analysis and Quantum Field Theory* workshop, ESI, Vienna, Austria.

13. (Aug 2015) *20th International Summer School on Global Analysis and its Applications*, Stará Lesná, Slovakia.

14. (May 2015) *36th Foundations and Constructive Aspects of QFT* workshop, Leipzig, Germany.

15. (Feb 2015) *New Trends in Algebraic Quantum Field Theory (AQFT2015)* workshop, INFN Frascati, Italy.

16. (Sep 2014) *Operator and Geometric Analysis on Quantum Theory* conference, Levico Terme, Italy.

17. (Aug 2014) *Symmetries*, 19th Summer School on Global Analysis and its Applications, Lednice, Czech Republic.

18. (Jul 2014) *Trends in Poisson Geometry* workshop, University of Toronto, Toronto, Canada.

19. (Jul 2014) *Asymptotic Analysis in General Relativity* workshop, Institut Fourier, Grenoble, France.

20. (May 2014) *Algebraic quantum field theory: its status and its future* workshop, ESI, Vienna, Austria.

21. (Feb 2014) *Philosophy of Mechanics: Mathematical Foundations* workshop, Paris, France.

22. (Aug 2013) *The Local and Global Inverse Problem of the Calculus of Variations*, 18th International Summer School on Global Analysis and its Applications, Levoca, Slovakia.

23. (Jul 2013) *General Relativity and Gravitation 20* conference, Warsaw, Poland.

24. (May 2013) *Quantum Gravity in Perspective* workshop, Munich, Germany.

25. (Aug 2012) *Geometry and Algebra of PDEs* workshop, Tromsø, Norway.

26. (Aug 2012) *International Congress of Mathematical Physicists* conference, Aalborg, Denmark.

27. (Jul 2012) *Mathematical Aspects of Quantum Field Theory and Quantum Statistical Mechanics* workshop, Hamburg, Germany.

28. (Jul 2012) *Marcel Grossmann 13* conference, Stockholm, Sweden.

29. (Jun 2012) *100 years after Einstein in Prague* conference, Prague, Čech Republic.

30. (Jun 2012) *Integrable Systems and Quantum Symmetries* conference, Prague, Čech Republic.

31. (Sep 2011) *Modern Trends in Algebraic Quantum Field Theory* workshop, Pavia, Italy.

32. (Jun 2011) *Cosmological Frontiers in Fundamental Physics* workshop, Paris, France.

33. (Feb 2011) *Foundational Aspects of Cosmology* workshop, Hamburg, Germany.

34. (Nov 2010) *27th Foundations and Constructive Aspects of QFT* workshop, Leipzig, Germany.

35. (Sep 2010) *Quantum Field Theory and Gravity* conference, Regensburg University, Regensburg, Germany.

36. (Jul 2010) *Experimental Search for Quantum Gravity* workshop, NORDITA, Stockholm, Sweden.

37. (May 2008) *New Paths Toward Quantum Gravity* summer school, Holbæk, Denmark.

38. (Jun 2007) *LOOPS'07* conference, Instituto de Matemáticas Unidad Morelia, Morelia, Mexico.

39. (Oct 2005) *LOOPS'05* conference, Albert Einstein Institute, Golm, Germany.

40. (Apr 2005) *Quantum Gravity* workshop, University of New Brunswick, Fredericton, Canada.

41. (Oct 2004) *Quantum Gravity in the Americas* workshop, Perimeter Institute, Waterloo, Canada.

42. (Mar 2004) *APS March Meeting* conference, Montreal, Canada.

43. (May 2003) *Canadian Institute for Advanced Research Quantum Materials summer school*, University of British Columbia, Vancouver, Canada.

Invited Talks

1. *Local gauge invariant observables on spacetimes of sub-maximal symmetry* (Jul 2017) *Quantum Mathematical Physics Day* workshop, University of Pavia, Italy.

2. *Spectral theory of vector and tensor fields on Schwarzschild spacetime* (Jun 2017) *Non-regular spacetime geometry* workshop, University of Florence, Florence, Italy.

3. *An IDEAL characterization of FLRW spacetimes* (Jun 2017) *Foundational and structural aspects of gauge*

theories workshop, Mainz Institute for Theoretical Physics, Mainz, Germany.

4. *Spectral theory of vector and tensor fields on Schwarzschild spacetime*, (Jan 2017) *Microlocal analysis: a tool to explore a quantum world* workshop, Genova, Italy.

5. *Applications of compatibility complexes and their cohomology in relativity and gauge theories*, (20 Oct 2015) *Integrable Nonlinear Equations* workshop, Mikulov, Czech Republic.

6. *Supergeometry in classical field theory*, (24 Sep 2015) *Algebraic Quantum Field Theory of Lorentzian Manifolds* minisymposium at *DMV Annual Meeting 2015*, Hamburg, Germany.

7. *Graviton propagator on Schwarzschild spacetime*, (9 Sep 2015) *Hyperbolic Equations on Spacetimes: Stability, Microlocal Analysis and Quantum Field Theory* workshop, ESI, Vienna, Austria.

8. *Local and gauge invariant observables in gravity*, (17 Sep 2014) *Operator and Geometric Analysis on Quantum Theory* conference, Levico Terme, Italy.

9. *Covariant phase space symplectic form and Peierls inversion formula in the presence of constraints and gauge*, (23 Jul 2014) *Trends in Poisson Geometry* workshop, University of Toronto, Toronto, Canada.

10. *The Calabi complex: a case study in linear dynamical obstructions to isotony*, (23 May 2014) *Algebraic quantum field theory: its status and its future* workshop, ESI, Vienna, Austria.

11. *Topology, rigid cosymmetries and linearization instability in higher gauge theories* (21 Jun 2013) Quarterly seminar on Topology and Geometry, Utrecht University, Utrecht, The Netherlands.

Contributed Talks and Posters

1. *A synthetic approach to the formal theory of PDEs*, (09 Jun 2017) *Geometry and Algebra of PDEs* conference, University of Tromsø, Norway.

2. *Feynman Propagators and spectral theory of vector and tensor fields on Schwarzschild spacetime*, (07 Jul 2016) *Mathematics and Physics at the Crossroads* trimester program at Laboratori Nazionali di Frascati INFN, Italy.

3. *A polynomial action for gravity with matter, gauge fixing and ghosts*, (18 Aug 2015) *20th International Summer School on Global Analysis and its Applications*, Stará Lesná, Slovakia.

4. *Local and gauge invariant observables in gravity*, (30 May 2015) *36th Foundations and Constructive Aspects of QFT* workshop, Leipzig, Germany.

5. *Analyticity is an unnecessary hypothesis in the renormalization of locally covariant QFT on curved spacetime*, (11 Feb 2015) *New Trends in Algebraic Quantum Field Theory (AQFT2015)* workshop, INFN Frascati, Italy.

6. *Topology, rigid cosymmetries and linearization instability in higher gauge theories*, (25 Aug 2014) *19th Summer School on Global Analysis and its Applications*, Lednice, Czech Republic.

7. *Covariant phase space symplectic form and Peierls inversion formula in the presence of constraints and gauge* (15 Nov 2013) *33rd Foundations and Constructive Aspects of QFT* workshop, Mathematics Institute, University of Göttingen, Göttingen, Germany.

8. *Presymplectic current and the inverse problem of the calculus of variations* (13 Aug 2013) *18th International Summer School on Global Analysis and its Applications*, Levoca, Slovakia.

9. (poster) *Topology, rigid cosymmetries and linearization instability in higher gauge theories* (Jul 2013) *General Relativity and Gravitation 20* conference, Warsaw, Poland.

10. (poster) *Covariant phase space symplectic form and Peierls inversion formula in the presence of constraints and gauge* (Jul 2013) *General Relativity and Gravitation 20* conference, Warsaw, Poland.

11. *Gravity: an exercise in quantization* (31 May 2013) *Quantum Gravity in Perspective* workshop, Munich Center for Mathematical Philosophy, Munich, Germany.

12. (poster) *Characteristic geometry and causality in locally covariant field theory* (Aug 2012) *International Congress of Mathematical Physicists* conference, Aalborg, Denmark.

13. (poster) *Supergeometry and classical field theory with fermions* (Jul 2012) *Mathematical Aspects of Quantum Field Theory and Quantum Statistical Mechanics* workshop, DESY, Hamburg, Germany.

14. *Time delay observable in classical and quantum geometries* (3 Jul 2012) *Marcel Grossmann 13* conference, Stockholm, Sweden.

15. *Time delay observable in classical and quantum geometries* (25 Jun 2012) *100 years after Einstein in Prague* conference, Prague, Čech Republic.

16. *Recurrence relation for the $6j$-symbol of $su_q(2)$ from an eigenvalue problem* (18 Jun 2012) *Integrable Systems and Quantum Symmetries* conference, Prague, Čech Republic.

17. *Characteristic geometry and causality in locally covariant field theory* (14 Sep 2011) *Modern Trends in Algebraic Quantum Field Theory* workshop, University of Pavia, Pavia, Italy.

18. *Time delay observable in classical and quantum geometries* (19 Nov 2010) *27th Foundations and Constructive Aspects of QFT* workshop, Leipzig University, Leipzig, Germany.

19. *q-deformed spin foams for Riemannian quantum gravity* (26 Jun 2007) *LOOPS'07* conference, Instituto de Matemáticas Unidad Morelia, Morelia, Mexico.

20. (poster) *Efficient Evaluation of q-deformed Riemannian $10j$-symbols.* (Oct 2005) *LOOPS'05* conference, Albert Einstein Institute, Golm, Germany.

21. (22 Mar 2004) *Formation of an electronic nematic phase in interacting systems APS March Meeting* conference, Montreal, Canada.

Seminars

1. *Applications of PDE compatibility complexes in relativity* (14 Jun 2017) Geometry and Relativity Seminar, Albert Einstein Institute for Graviational Physics, Golm, Germany.

2. *Applications of PDE compatibility complexes in relativity* (16 May 2017) Algorithmic Algebra and Discrete Mathematics Seminar, University of Kassel, Germany.

3. *A synthetic approach to the formal theory of PDEs* (17 Feb 2017) Differengial Geometry Seminar, Charles University, Prague, Czech Republic.

4. *Applications of compatibility complexes and their cohomology in relativity and gauge theories* (17 Jan 2017) Mathematical Physics Seminar, Université d'Angers, Angers, France.

5. *Spectral theory of vector and tensor fields on Schwarzschild spacetime* (14 Dec 2016) Geometry and Relativity Seminar, Albert Einstein Institute for Graviational Physics, Golm, Germany.

6. *Spectral theory of vector and tensor fields on Schwarzschild spacetime* (08 Dec 2016) Mathematical Physics Seminar, Zürich, Switzerland.

7. *Applications of compatibility complexes and their cohomology in relativity and gauge theories* (10 Oct 2016) Department of Mathematics, University of Luxembourg, Luxembourg.

8. *The Noether map as an L-∞-algebra central extension of variational symmetries by higher topological conserved currents* (05 Oct 2016) Higher Differential Geometry Seminar, Max Planck Institute for Mathematics, Bonn, Germany.

9. *Local and gauge-invariant observables in gravity* (30 Sep 2016) Quantum Gravity Seminar, Institute for Mathematics, Astrophysics and Particle Physics, Radboud University, Nijmegen, The Netherlands.

10. *Spectral theory of vector and tensor fields on Schwarzschild spacetime* (21 Sep 2016) Mathematical Physics Seminar, Mathematics Institute, University of Göttingen, Göttingen, Germany.

11. *Spectral theory of vector and tensor fields on Schwarzschild spacetime* (21 Jun 2016) Department of Mathematics, University of Trento, Trento, Italy.

12. *Graviton propagator on Schwarzschild spacetime* (09 Mar 2016) Analysis seminar, Princeton University, Princeton, USA.

13. *Graviton propagator on Schwarzschild spacetime* (05 Feb 2016) Department of Physics, Bishop's University, Sherbrooke, Canada.

14. *Topology, rigid cosymmetries and linearization instability in higher gauge theories* (29 Jan 2016) Analysis seminar, McGill University, Montreal, Canada.

15. *Graviton propagator on Schwarzschild spacetime* (22 Jan 2016) Department of Physics, McGill University, Montreal, Canada.

16. *Local and gauge invariant observables in gravity* (19 Jan 2016) Department of Physics, UC Santa Barbara, Santa Barbara, USA.

17. *Local and gauge invariant observables in gravity* (1 Dec 2015) Department of Mathematics, University of Salerno, Salerno, Italy.

18. *Local and gauge invariant observables in gravity* (20 Nov 2015) Séminare de géométrie et physique mathématique, Université Paris 7, Paris, France.

19. *Covariant phase space, constraints, gauge and the Peierls formula* (13 May 2015) Mathematical Physics seminar, Department of Mathematics, University of Genova, Genova, Italy.

20. *Supergeometry in classical field theory* (2 Apr 2015) Geometry seminar, Department of Mathematics, University of Potsdam, Potsdam, Germany.

21. *Supergeometry in classical field theory* (26 Feb 2015) Mathematical Physics seminar, Department of Mathematics, University of York, York, UK.

22. *Analyticity is an unnecessary hypothesis in the renormalization of locally covariant QFT on curved spacetime* (22 Jan 2015) Graduate Colloquium, Mathematics Institute, University of Göttingen, Göttingen, Germany.

23. *Analyticity is an unnecessary hypothesis in the renormalization of locally covariant QFT on curved spacetime* (12 Jan 2015) High Energy Physics seminar, Department of Physics, McGill University, Montreal, Canada.

24. *Topology, rigid cosymmetries and linearization instability in higher gauge theories* (13 Aug 2014) Seminar, Albert Einstein Institute for Graviational Physics, Golm, Germany.

25. *Lagrangian field theory form the jet bundle point of view* (1 Apr 2014) Mathematical Physics seminar, University of Pavia, Pavia, Italy.

26. *Locality and Causality in Classical Field Theory* (16 Jan 2014) Quantum Gravity seminar, Perimeter Institute for Theoretical Physics, Waterloo, Canada.

27. *Locality and Causality in Classical Field Theory* (13 Jan 2014) Relativity seminar, University of Chicago, Chicago, USA.

28. *Presymplectic current and the inverse problem of the calculus of variations* (10 Jan 2014) Analysis seminar,

McGill University, Montreal, Canada.

29. *Topology, rigid cosymmetries and linearization instability in higher gauge theories* (16 Apr 2013) Seminar, Max Planck Institute for Mathematics, Bonn, Germany.

30. *Characteristics, conal geometry and causality in locally covariant field theory* (11 Apr 2013) Graduate Colloquium, Mathematics Institute, University of Göttingen, Göttingen, Germany.

31. *Covariant phase space symplectic form and Peierls inversion formula in the presence of constraints and gauge* (19 Feb 2013) Seminar, Mathematical Physics group, Université Libre de Bruxelles, Brussels, Belgium.

32. *Covariant phase space symplectic form and Peierls inversion formula in the presence of constraints and gauge* (22 Jan 2013) Seminar, II. Institute for Theoretical Physics, Hamburg University, Hamburg, Germany.

33. *Time delay in classical and quantum gravity* (14 Jan 2013) Joint Theory Seminar, Department of Physics, UC Davis, Davis, USA.

34. *Characteristics, conal geometry and causality in locally covariant field theory* (22 Nov 2012) Seminar, Department of Mathematics, University of York, York, UK.

35. *Time delay observable in classical and quantum geometries* (16 Nov 2012) Seminar, Institute of Theoretical Physics, University of Warsaw, Warsaw, Poland.

36. *Quantum gravity: an exercise in quantization* (16 Nov 2012) Seminar, Institute of Theoretical Physics, University of Warsaw, Warsaw, Poland.

37. *Characteristic geometry and causality in locally covariant field theory* (28 Apr 2012) II. Institute for Theoretical Physics, Hamburg University, Hamburg, Germany.

38. *Time delay observable in classical and quantum geometries* (5 Dec 2011) *Quist* seminar, Institute for Theoretical Physics, Utrecht University, Utrecht, The Netherlands.

39. *Time delay observable in classical and quantum geometries* (1 Dec 2011) Seminar, Department of Fundamental Physics, University of Barcelona, Barcelona, Spain.

40. *Characteristic geometry and causality in locally covariant field theory* (8 Sep 2011) *Quist* seminar, Institute for Theoretical Physics, Utrecht University, Utrecht, The Netherlands.

41. *Reductions, deformations and resolutions in the service of physics* (Jun 2011) Five part lecture reviewing mathematical aspects of classical gauge theory and BV-BRST cohomology. Derived Differential Geometry Seminar, Department of Mathematics, Utrecht University, Utrecht, The Netherlands.

42. *Time delay observable in classical and quantum geometries* (16 May 2011) Seminar, Albert Einstein Institute for Graviational Physics, Golm, Germany.

43. *Time delay observable in classical and quantum geometries* (29 Oct 2010) Seminar, II. Institute for Theoretical Physics, Hamburg University, Hamburg, Germany.

44. *Comment on 'Hawking radiation from fluctuating black holes'* (19 Oct 2010) *Quist* seminar, Institute for Theoretical Physics, Utrecht University, Utrecht, The Netherlands.

45. *Time delay in quantum and fluctuating geometries* (29 Jan 2009) *Quist* seminar, Institute for Theoretical Physics, Utrecht University, Utrecht, The Netherlands.

46. *Computation with spin foam models of quantum gravity* (19 May 2008) *Quist* seminar, Institute for Theoretical Physics, Utrecht University, Utrecht, The Netherlands.

47. *Numerical algorithms for new spin foam vertices* (30 Jul 2008) *Young Loops and Foams* workshop, Perimeter Institute, Waterloo, Canada.

48. *First Numerical Results on the New Spin Foam Vertices* (27 Sep 2007) *Quantum Gravity* seminar, Perimeter Institute, Waterloo, Canada.