Curriculum Vitae

PERSONAL INFORMATION

Full name:	Douglas Björn Alexander Lundholm
Address:	Department of Mathematics KTH Royal Institute of Technology SE-100 44 Stockholm Sweden
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Date of birth:	August 31, 1982
Nationality:	Swedish
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DEGREES

2016	Docent in Mathematics (habilitation), KTH Royal Institute of Technology, Sweden
2010	PhD in Mathematics, KTH Royal Institute of Technology, Sweden Advisor: Prof. Jens Hoppe
2006	MSc in Engineering Physics, KTH Royal Institute of Technology, Sweden

CURRENT POSITION

2013–	Researcher (75% external grant funded, 25% teaching), Department of Mathematics, KTH Royal Institute of Technology, Sweden

PREVIOUS POSITIONS

2010–2011	Postdoc, Dept. of Mathematical Sciences, University of Copenhagen, Denmark
2006–2010	PhD student, Dept. of Mathematics, KTH, Sweden
2006	Research Engineer, Dept. of Mathematics, KTH, Sweden

FELLOWSHIPS AND AWARDS

2018	Awarded a Göran Gustafsson Prize for Young Researchers (500 kSEK $\approx$ 50 kEUR)
2013	Awarded a Swedish Research Council Junior Researcher Project Grant for the period 2014–2017 (3.2 MSEK $\approx$ 320 kEUR)
2013	LabEx CARMIN Fellowship (7 months), IHÉS, Bures-sur-Yvette and IHP, Paris, France
2012	Research Fellowship (fall program), Institut Mittag-Leffler, Djursholm, Sweden
2011–2012	EPDI Fellowship, with: 2 months at IHÉS, Bures-sur-Yvette, France 7 months at FIM, ETH Zurich, Switzerland 3 months at INIMS, Cambridge, UK

Other research grants for fellowships, research visits, conferences, etc. have been awarded from:
- The funds of the Royal Swedish Academy of Sciences
- The Knut and Alice Wallenberg Foundation
- The Marie Curie Training Network ENIGMA
- The European Science Foundation activity MISGAM

SUPERVISION

2017–2018	Supervisor for four BSc students in Engineering Physics with projects in Mathematics, Dept. of Mathematics, KTH, Sweden
2016–2017	Supervisor for one MSc project in Mathematics, Dept. of Mathematics, KTH, Sweden
2015–	Coadvisor for one PhD student, Dept. of Mathematics, KTH, Sweden
2015–2016	Supervisor for three BSc students in Engineering Physics, KTH, Sweden
2013–2014	Assisting advisor for one PhD student, Dept. of Mathematics, KTH, Sweden

TEACHING ACTIVITIES

2017	Main Instructor for one master-level course and one undergraduate course, KTH, Sweden
2015–2016	Main Instructor for one PhD course and one undergraduate course, KTH, Sweden
2013–2015	Coinstructor/Teaching Assistant for 5 undergraduate courses, KTH, Sweden
2010–2011	Coinstructor/Teaching Assistant for 2 courses, University of Copenhagen, Denmark
2006–2010	Main Instructor for one PhD course and Coinstructor/Teaching Assistant for 7 undergraduate courses, KTH, Sweden

PEDAGOGICAL DEVELOPMENT

2014	Completed course in Research Supervision, 3 ECTS credits, KTH, Sweden
2013	Completed course in Learning and Teaching in Higher Education, 7.5 ECTS credits, KTH, Sweden

ORGANIZATION OF SCIENTIFIC MEETINGS

2016	Co-organizer of the Mathematical Physics session at the 27th Nordic Congress of Mathematicians, in Stockholm
2013	Organizer of a one-day conference in honor of the 65th birthday of Lars Svensson, KTH, Sweden
2013	Co-organizer of the Young Seminar series of the IHP trimester program "Variational and Spectral Methods in Quantum Mechanics", IHP, Paris, France
2007	Co-organizer of the first bi-annual Problem Exchange Weekend for mathematics PhD students at KTH and Stockholm University, Sweden

INSTITUTIONAL RESPONSIBILITIES

2015–	Undergraduate and Graduate Student Advisor, Dept. of Mathematics, KTH, Sweden
2015–	Initiator and co-organizer of the learning seminar series "Talks in Mathematical Physics in the Stockholm area", KTH, Sweden

COMMISSIONS OF TRUST

Regular reviewer for AMS Mathematical Reviews, with ca 4 assignments per year. Have refereed for the following journals and book publishers:

· Annales Henri Poincaré
· Journal of Mathematical Physics
· Journal of Spectral Theory
· Letters in Mathematical Physics
· Mathematical Physics, Analysis and Geometry
· MIT Press
· Nuclear Physics B
· Rendiconti di Mathematica
· Reviews in Mathematical Physics

COOPERATION IN INTERNATIONAL NETWORKS

Participated in the following international research networks:

· The Marie Curie Training Network ENIGMA
· The European Science Foundation activity MISGAM
· The NordForsk Scandinavian networks "Analysis and applications" and "Random Geometry Network"

Member of the International Association of Mathematical Physics (IAMP) and the Swedish Mathematical Society (SMS).

RESEARCH INTERESTS

Mathematical physics, including: spectral theory of quantum mechanical systems (typically involving intermediate/fractional particle statistics — *anyons* — or supersymmetry, such as supermembrane matrix models), Clifford (geometric) algebras and their applications, quantum gravity and quantum geometry.

Publications

THESES AND MONOGRAPHS

[1] D. Lundholm, *Geometric (Clifford) algebra and its applications*, M.Sc. thesis, KTH, 2006, Trita-MAT. MA, ISSN 1401-2278; 2006:01, Supervisor: Lars Svensson, arXiv:math/0605280.

[2] D. Lundholm, *Zero-energy states in supersymmetric matrix models*, Ph.D. thesis, KTH, 2010, ISBN 978-91-7415-662-1, Supervisor: Jens Hoppe, Opponent: Jan Philip Solovej, http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-12846.

PUBLICATIONS IN JOURNALS

[3] V. Bach, J. Hoppe, and D. Lundholm, *Dynamical symmetries in supersymmetric matrix models*, Doc. Math. **13** (2008), 103–116, http://www.math.uiuc.edu/documenta/vol-13/06.html.

[4] D. Lundholm, *On the geometry of supersymmetric quantum mechanical systems*, J. Math. Phys. **49** (2008), no. 6, 062101, doi.

[5] J. Hoppe, D. Lundholm, and M. Trzetrzelewski, *Octonionic twists for supermembrane matrix models*, Ann. Henri Poincaré **10** (2009), no. 2, 339–356, doi.

[6] J. Hoppe, D. Lundholm, and M. Trzetrzelewski, *Construction of the zero-energy state of* $\mathrm{SU}(2)$*-matrix theory: near the origin*, Nuclear Phys. B **817** (2009), no. 3, 155–166, doi.

[7] J. Hoppe, D. Lundholm, and M. Trzetrzelewski, *Spin(9) average of* $\mathrm{SU}(N)$ *matrix models*, J. Math. Phys. **50** (2009), no. 4, 043510, 7, doi.

[8] D. Lundholm, *Weighted supermembrane toy model*, Lett. Math. Phys. **92** (2010), no. 2, 125–141, doi.

[9] J. de Woul, J. Hoppe, and D. Lundholm, *Partial Hamiltonian reduction of relativistic extended objects in light-cone gauge*, J. High Energy Phys. **2011** (2011), no. 1, 31, doi.

[10] J. de Woul, J. Hoppe, D. Lundholm, and M. Sundin, *A dynamical symmetry for supermembranes*, J. High Energy Phys. **2011** (2011), no. 3, 134, 6, doi.

[11] D. Lundholm and J. P. Solovej, *Hardy and Lieb-Thirring inequalities for anyons*, Comm. Math. Phys. **322** (2013), 883–908, doi.

[12] D. Lundholm and J. P. Solovej, *Local exclusion principle for identical particles obeying intermediate and fractional statistics*, Phys. Rev. A **88** (2013), 062106, doi.

[13] D. Lundholm and J. P. Solovej, *Local exclusion and Lieb-Thirring inequalities for intermediate and fractional statistics*, Ann. Henri Poincaré **15** (2014), 1061–1107, doi.

[14] D. Lundholm, F. Portmann, and J. P. Solovej, *Lieb-Thirring bounds for interacting Bose gases*, Comm. Math. Phys. **335** (2015), no. 2, 1019–1056, doi.

[15] D. Lundholm, *Geometric extensions of many-particle Hardy inequalities*, J. Phys. A: Math. Theor. **48** (2015), 175203, doi.

[16] D. Lundholm and N. Rougerie, *The average field approximation for almost bosonic extended anyons*, J. Stat. Phys. **161** (2015), no. 5, 1236–1267, doi.

[17] D. Lundholm, P. T. Nam, and F. Portmann, *Fractional Hardy-Lieb-Thirring and related inequalities for interacting systems*, Arch. Ration. Mech. Anal. **219** (2016), no. 3, 1343–1382, doi.

[18] D. Lundholm and N. Rougerie, *Emergence of fractional statistics for tracer particles in a Laughlin liquid*, Phys. Rev. Lett. **116** (2016), 170401, doi.

[19] D. Lundholm, *Many-anyon trial states*, Phys. Rev. A **96** (2017), 012116, doi.

[20] M. Correggi, D. Lundholm, and N. Rougerie, *Local density approximation for the almost-bosonic anyon gas*, Analysis & PDE **10** (2017), 1169–1200, doi.

[21] S. Larson and D. Lundholm, *Exclusion bounds for extended anyons*, Arch. Ration. Mech. Anal. **227** (2018), 309–365, doi.

[22] D. Lundholm and R. Seiringer, *Fermionic behavior of ideal anyons*, Lett. Math. Phys. **108** (2018), 2523–2541, doi.

PROCEEDINGS

[23] D. Lundholm, *Recent studies of anyons*, Many-Body Quantum Systems and Effective Theories (C. Hainzl, B. Schlein, and R. Seiringer, eds.), Oberwolfach Reports, vol. 13, 2016, pp. 2491–2493, doi.

[24] M. Correggi, D. Lundholm, and N. Rougerie, *Local density approximation for almost-bosonic anyons*, Proceedings of QMath13, Atlanta, October 8–11, 2016, Mathematical problems in quantum physics (F. Bonetto, D. Borthwick, E. Harrell, and M. Loss, eds.), Contemp. Math., vol. 717, 2018, pp. 77–92, doi.

PREPRINTS AND OTHER ACADEMIC ARTICLES

[25] J. Hoppe and D. Lundholm, *On the construction of zero energy states in supersymmetric matrix models IV*, arXiv e-prints, 2007, arXiv:0706.0353.

[26] D. Lundholm and L. Svensson, *Clifford algebra, geometric algebra, and applications*, KTH graduate course textbook, 2009, arXiv:0907.5356.

[27] D. Lundholm, *Some spectral bounds for Schrödinger operators with Hardy-type potentials*, arXiv e-prints, 2009, arXiv:0911.3386.

[28] D. Lundholm, *Anyon wave functions and probability distributions*, IHÉS preprint, IHES/P/13/25, 2013, http://preprints.ihes.fr/2013/P/P-13-25.pdf.

[29] D. Lundholm, *Methods of modern mathematical physics: Uncertainty and exclusion principles in quantum mechanics*, KTH graduate course textbook, 2018, arXiv:1805.03063.

[30] S. Larson, D. Lundholm, and P. T. Nam, *Lieb-thirring inequalities for wave functions vanishing on the diagonal set*, arXiv e-prints, 2019, arXiv:1901.04963.

PATENT

[P] D. Lundholm, *A method and arrangement for protecting software*, PCT/SE2003/000276, WO2003071404 A1, US20050160049 A1, 2003, http://www.google.com/patents/WO2003071404A1.

Other scientific merits

SUPERVISED THESES

1. O. Weinberger, *The braid group, representations and non-abelian anyons*, BSc thesis, KTH, 2015, http://urn.kb.se/resolve?urn=urn%3Anbn%3Ase%3Akth%3Adiva-167993.
2. E. Jacobsen and E. Lind, *Triangles in particle interactions and applications of clifford algebra*, BSc thesis, KTH, 2016, http://www.math.kth.se/~dogge/files/KEX2016-jacobsen-lind.pdf.
3. E. Riedel Gårding, *Geometric algebra, conformal geometry and the common curves problem*, BSc thesis, KTH, 2017, http://urn.kb.se/resolve?urn=urn%3Anbn%3Ase%3Akth%3Adiva-210866.
4. V. Qvarfordt, *Non-abelian anyons: Statistical repulsion and topological quantum computation*, MSc thesis, KTH, 2017, http://urn.kb.se/resolve?urn=urn%3Anbn%3Ase%3Akth%3Adiva-207177.
5. G. Brage and E. Sönnerlind, *Braid group statistics and exchange matrices of non-abelian anyons, with representations in Clifford algebra*, BSc thesis, KTH, 2018.
6. J. Wiklund, *Braiding non-abelian anyons with representations in Clifford algebra*, BSc thesis, KTH, 2018.

SELECTED TALKS

36. 2019, January, "Lieb-Thirring inequality for wave functions vanishing on the diagonal set", Institut Mittag-Leffler, Djursholm, Sweden.

35. 2018, September, "Anyons in the average-field approximation", University of Toronto, Canada.

34. 2018, September, "Exchange and exclusion for non-abelian anyons", at the "Workshop: Many-Body Quantum Mechanics", CRM Montreal, Canada.

33. 2018, August, "Anyons in the average-field approximation", at the conference "Solid Math 2018", McGill, Montreal, Canada.

32. 2018, May, "Fermionic behavior of ideal anyons", at the conference "Eigenvalues and Inequalities", Institut Mittag-Leffler, Djursholm, Sweden.

31. 2018, January, "Emergence of anyons and ground-state properties of the anyon gas", University of Oslo, Norway.

30. 2017, April, "A Thomas-Fermi model for magnetically self-interacting bosons", at the conference "Spectral Days 2017", University of Stuttgart, Germany.

29. 2017, January, "Ground-state properties of the anyon gas", IST Austria.

28. 2016, September, "Recent studies of anyons", at the workshop "Many-Body Quantum Systems and Effective Theories", MFO, Oberwolfach, Germany.

27. 2016, August, "Recent studies of anyons", at the "Conference on Methods of Modern Mathematical Physics, A Young Researcher Symposium on the occasion of the 70th Birthday of Barry Simon", Fields Institute, Toronto, Canada.

26. 2016, June, "Spectral properties of the (super)membrane matrix models", at the conference "Aspects of Membrane Dynamics", KTH / Nordita, Stockholm, Sweden.

25. 2015, October, "Energy bounds for interacting Bose gases", Statistical physics seminar, SISSA, Trieste.

24. 2015, September/October, "Anyons in the average field approximation", Quantum Lunch, University of Copenhagen, and Mathematical physics seminar, Roma Tre University, Rome.

23. 2015, July, "Rigorous studies of anyons", at the congress "ICMP 2015", Santiago.

22. 2015, April, "2D Coulomb gases and particles in magnetic fields", Talks in Mathematical Physics, KTH Stockholm.

21. 2015, January, "Lieb-Thirring bounds for interacting Bose gases", Mathematical physics seminar, Università di Roma "La Sapienza", Rome.

20. 2014, October, "Lieb-Thirring bounds for interacting Bose gases", at the workshop "Mathematical physics and quantum mechanics", ETH Zurich, Switzerland.

19. 2014, March, "The Golden-Thompson inequality and random matrix applications", Random Matrix Theory seminar, KTH Stockholm.

18. 2014, February, "Local exclusion and energy bounds for intermediate and fractional statistics", Theoretical physics seminar, LPMMC Grenoble.

17. 2014, January, "Lieb-Thirring inequalities for intermediate and fractional statistics", Analysis and Dynamical Systems seminar, KTH Stockholm.

16. 2013, June, "Local exclusion and Lieb-Thirring inequalities for intermediate and fractional statistics", at the conference "Mathematical properties of large quantum systems", IHP, Paris, France.

15. 2013, February, "Quantum mechanics for particles with exotic statistics", Short talk, IHÉS, France.

14. 2012, October, "Hardy and Lieb-Thirring inequalities for anyons" in the program "Hamiltonians in Magnetic Fields", Institut Mittag-Leffler, Djursholm, Sweden.

13. 2012, August, "Local exclusion and Lieb-Thirring inequalities for intermediate and fractional statistics", at the congress "ICMP 2012", Aalborg.

12. 2012, June, "Lieb-Thirring inequalities for intermediate and fractional statistics", at the workshop "Coarse graining and condensed matter physics", HIM Bonn, Germany.

11. 2012, March, "Zero-energy states in supermembrane matrix models", in the program "Mathematical Aspects of String and M-theory", INIMS Cambridge, UK.

10. 2011, November, "Local exclusion and Lieb-Thirring inequalities for anyons", Spectral theory seminar, KTH Stockholm, and Talks in mathematical physics, ETH Zurich.

9. 2011, September, "Hardy and Lieb-Thirring inequalities for anyons", at the conference "Partial differential equations and spectral theory", Imperial College London.

8. 2011, February, "Geometric extensions of many-particle Hardy inequalities", Spectral theory seminar, KTH Stockholm.

7. 2010, September, "Ground states of supersymmetric matrix models", at the conference "QMath11".

6. 2010, January, "Zero-energy ground states in supersymmetric matrix models", Geometry and analysis seminar, University of Copenhagen.

5. 2009, November, "Ground states of supersymmetric matrix models", Mathematical physics seminar, Harvard University and California Institute of Technology.

4. 2009, March, "Recent progress concerning zero energy states in supersymmetric matrix models, II", Talks in mathematical physics, ETH Zurich.

3. 2008, May, "On the geometry of supersymmetric quantum mechanical systems", at the conference "ICCA8", Campinas, Brazil.

2. 2007, June, "Dynamical symmetries in supersymmetric matrix models", at the conference "AMD", KTH Stockholm.

1. 2006, November, "Supersymmetric Matrix Models", University of Mainz, Germany.

ACTIVE PARTICIPATION IN NATIONAL AND INTERNATIONAL CONFERENCES

24. 2019, January, Kick-off Conference: Spectral Methods in Mathematical Physics, Institut Mittag-Leffler (invited speaker).

23. 2018, September, Workshop: Many-Body Quantum Mechanics, CRM Montreal, Canada (invited speaker).

22. 2018, August, Solid Math 2018 (Satellite of ICMP 2018), McGill, Montreal, Canada (invited speaker).

21. 2018, May, Eigenvalues and Inequalities, Institut Mittag-Leffler (invited speaker).

20. 2017, November, ICAMI 2017, San Andres, Colombia (contributing speaker).

19. 2017, April, Spectral Days 2017, University of Stuttgart, Germany (invited speaker).

18. 2016, September, Many-Body Quantum Systems and Effective Theories, MFO, Oberwolfach (invited speaker).

17. 2016, August, Conference on Methods of Modern Mathematical Physics, A Young Researcher Symposium on the Occasion of the 70th Birthday of Barry Simon, Fields Institute, Toronto (invited speaker).

16. 2016, June, Aspects of Membrane Dynamics, KTH / Nordita, Stockholm (invited speaker).

15. 2016, March, The mathematical physics session at the 27th Nordic Congress of Mathematicians, Stockholm (session organizer).

14. 2015, July, International Congress of Mathematical Physics 2015, Santiago, Chile (contributing speaker).

13. 2014, October, Mathematical physics and quantum mechanics, workshop, ETH Zurich (invited speaker).

12. 2014, January, A one-day conference in honor of the 65th birthday of Lars Svensson, KTH Stockholm (organizer).

11. 2013, April-July, Variational and Spectral Methods in Quantum Mechanics, Trimester program at Institut Henri Poincaré, Paris (invited speaker and co-organizer of the Young Seminar series).

10. 2012, September-December, Hamiltonians in Magnetic Fields, Fall program at Institut Mittag-Leffler (program participant and contributing speaker in the regular seminars).

9. 2012, August, International Congress of Mathematical Physics 2012, Aalborg, Denmark (contributing speaker).

8. 2012, June, Coarse graining and condensed matter physics, Hausdorff Research Institute for Mathematics, Bonn (invited speaker).

7. 2012, January-March, Mathematical Aspects of String and M-theory, INIMS Cambridge, UK (program participant and contributing speaker in the regular seminars).

6. 2011, September, Partial differential equations and spectral theory, Imperial College London, UK (contributing speaker).

5. 2010, September, QMath11 Mathematical Results in Quantum Physics, Hradec Kralove, Czech Republic (contributing speaker).

4. 2008, October, ENIGMA 2008 Conference on Integrable Systems, Geometry, Matrix Models and Applications, SISSA, Trieste, Italy (contributing with a poster).

3. 2008, May, The 8th International Conference on Clifford Algebras (ICCA8) and their Applications in Mathematical Physics, IMECC - UNICAMP, Campinas, Brazil (contributing speaker).

2. 2007, June, ENIGMA Conference on Mathematical Physics, KTH, Sweden (assisting the organizers).

1. 2007, June, Midsummer School: Aspects of Membrane Dynamics, KTH, Sweden (invited speaker and assisting the organizers).

Teaching

2017 fall: "SF1625 Calculus in One Variable", full course responsibility (lectures, exercises, seminars) for first-year students of electrical engineering and industrial engineering and management.

2017 spring: "SF2724 Topics in mathematics IV: Methods of modern mathematical physics", course development, lectures and literature for a master-level course.

2016 fall: "SF1626 Calculus in several variables", exercises and seminars for second-year students in information and communications technology.
Inspirational lecture for students from elementary school.

2016 spring: "SF3608 Clifford algebra, geometric algebra, and applications", course development, lectures and literature for a PhD-level course.
Inspirational lecture for high-school students about "Identical particles".

2015 fall: "SF1626 Calculus in several variables", course responsibility (lectures, exercises, seminars) for second-year students in information and communications technology.

2014 fall: "SF1602 Differential and integral calculus in one variable", exercises for first-year students in engineering physics and second-year students in mathematics teaching.
"SF1604 Linear algebra", exercises for first-year students in engineering physics and second-year students in mathematics teaching.

2014 spring: "SF1633 Differential equations", exercises for first-year engineering students.

2013 fall: "SF1602 Differential and integral calculus in one variable", exercises for first-year students in engineering physics and second-year students in mathematics teaching.
"SF1604 Linear algebra", exercises for first-year students in engineering physics and second-year students in mathematics teaching.

2011 spring: "DiffFun2 - Differential Operators and Function Spaces II", exercises and lectures for graduate-level students in mathematics.

2010 fall: "LinAlgMat - Linear algebra in the mathematical sciences", lectures and exercises for a class of Danish mathematics students.

2009 fall: "SF1625 One-variable analysis", exercises for electrical engineering and media students.
"SF1612 Mathematics base course", small-size lectures for computer science students and students of the OPEN programme.
Graduate student seminar about "Spectral Theory of the Weighted Supermembrane Toy Model".

2009 spring: "5B5107 Clifford algebra", course design, lectures and course material for a PhD-level course, co-organized together with Lars Svensson.

2008 fall: "SF1612 Mathematics base course", small-size lectures for computer science students.

2008 spring: Graduate student seminar about "Refined Algebraic Quantization".

2007 fall: "SF1624 Algebra and geometry", exercises for electrical engineering students.
"SF1624 Algebra and geometry", exercises for IT and microelectronics students.

2007 spring: "5B1219 Vector analysis and complex functions", exercises for electrical engineering students.
Graduate student seminar about "Geometry of simple supersymmetric systems".

2006 fall: "5B1121 Mathematics base course", small-size lectures for computer science students.
"5B1109 Linear algebra", exercises for computer science students.

2006 spring: Graduate student seminar about "Conformal geometry using geometric algebra".