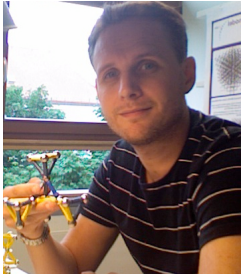




Curriculum vitae

of Emil Johansson Bergholtz,
MPI-PKS, Dresden



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Profile

I am a Swedish native, working as a postdoctoral researcher in theoretical physics at the Max Planck Institute for the Physics of Complex Systems in Dresden, Germany. My main focus is on strongly correlated phases of matter.

Experience and education

"Distinguished PKS Postdoctoral Fellow" at the Max Planck Institute for the Physics of Complex Systems, Dresden, Sept 2009 - Present

Independent position - one such position is awarded annually at the institute. Research in condensed matter theory, in particular on strongly correlated quantum matter.

Guest Scientist (Postdoc) at the Max Planck Institute for the Physics of Complex Systems, Dresden, Sept 2008 - Aug 2009

Research in the condensed matter division lead by Roderich Moessner. New directions in my research included frustrated (quantum) magnetism, spin chains/integrable models and concepts of quantum information in condensed matter systems. I also continued working on the fractional quantum Hall effect.

PhD student in theoretical physics at Stockholm University, 2003-2008

Awarded the only departmental PhD position offered in 2003 (this implied the freedom to do research in any field of my choice).

My main achievement was to, in collaboration with my supervisor A. Karlhede, establish an explicitly one-dimensional description of the fractional quantum Hall (QH) system. I also participated in generalizing the connection between fractional QH states and conformal field theory to include some recently observed states.

I successfully defended my doctoral thesis 'One-dimensional theory of the quantum Hall system' on May 28, 2008 (the opponent was Nick Read, Yale). The thesis was based on ten scientific papers, see below.

I was teaching about 350-400 hours per year at all levels of undergraduate as well as graduate courses.

Undergraduate student at Stockholm University, 1999-2003

Undergraduate studies in physics, mathematics, computer science and philosophy corresponding to more than 5 years of full time studies in terms of credits. Magister (MSc) awarded in physics (with the highest possible grade in all courses). My diploma thesis, which I defended on December 13, 2002, was entitled 'Density Matrix Renormalization Group Analysis of Spin Chains and Quantum Hall Systems'.

Teacher at the junior high school Oppebyskolan in Nyköping, 1998-1999

Worked full time as a high school teacher in mathematics, physics and technology during one year.

Undergraduate student at Mälardalen University, 1997-1998

Undergraduate studies in economics and law.

Gymnasium (high school) student at Gripenskolan in Nyköping, 1994-1997

High school studies at the natural science program.

Publications (articles)

1. **"Symmetry Breaking on the Three-dimensional Hyperkagome Lattice of $\text{Na}_4\text{Ir}_3\text{O}_8$ "**

E.J. Bergholtz, A. Läuchli and R. Moessner

Phys. Rev. Lett. **105**, 237202 [arXiv:1010.1345].

2. **"Effective spin chains for fractional quantum Hall states"**

E.J. Bergholtz, M. Nakamura and J. Suorsa

Physica E: Low-dimensional Systems and Nanostructures, (proceedings for nanoPHYS'09 in Tokyo), in press [arXiv:1006.3658].

3. **"Entanglement Scaling of Fractional Quantum Hall states through Geometric Deformations"**

A. Läuchli, **E.J. Bergholtz** and M. Haque

New J. Phys. **12**, 075004 (2010) [arXiv:1003.5656]

Also in: Virtual Journal of Quantum Information, Vol 10, Issue 8, (2010).

4. **"Disentangling Entanglement Spectra of Fractional Quantum Hall States on Torus Geometries"**

A. Läuchli, **E.J. Bergholtz**, J. Suorsa and M. Haque

Phys. Rev. Lett. **104**, 156404 (2010) [arXiv:0911.5477]

Also in: Virtual Journal of Quantum Information, Vol 10, Issue 5, (2010) and Virtual Journal of Nanoscale Science & Technology, Vol 21, Issue 18 (2010).

5. **"Link between the hierarchy of fractional quantum Hall states and Haldane's conjecture for quantum spin chains"**

M. Nakamura, **E.J. Bergholtz** and J. Suorsa

Phys. Rev. B **81**, 165102 (2010) [arXiv:0910.3662].

6. **"Spin chain description of rotating bosons at $\nu=1$ "**

E. Wikberg, **E.J. Bergholtz** and A. Karlhede

J. Stat. Mech. (2009) P07038 [arXiv:0903.4093].

7. **"Quantum Hall Circle"**
E.J. Bergholtz and A. Karlhede
J. Stat. Mech. (2009) P04015 [arXiv:0902.0167].
8. **"Degeneracy of non-abelian quantum Hall states on the torus: domain walls and conformal field theory"**
E. Ardonne, **E.J. Bergholtz**, J. Kailasvuori, and E. Wikberg
J. Stat. Mech. (2008) P04016, [arXiv:0802.0675].
9. **"Quantum Hall hierarchy wave functions--from conformal correlators to Tao-Thouless states"**
E.J. Bergholtz, M. Hermanns, T.H.Hansson, A. Karlhede and S.F Viefers
Phys. Rev. B **77**,165325 (2008) [arXiv:0712.3848].
10. **"Quantum Hall system in Tao-Thouless limit"**
E.J. Bergholtz and A. Karlhede
Phys. Rev. B **77**, 155308 (2008), [arXiv:0712.1927].
Also in: Virtual Journal of Nanoscale Science & Technology, Vol 17, Issue 16 (2008).
11. **"Quantum Hall wave functions on the torus"**
M. Hermanns, J. Soursa, **E.J. Bergholtz**, T.H. Hansson and A. Karlhede
Phys. Rev. B **77**,125321 (2008), [arXiv:0711.4684].
12. **"Microscopic theory of the quantum Hall hierarchy"**
E.J. Bergholtz, M. Hermanns, T.H.Hansson and A. Karlhede
Phys. Rev. Lett. **99**, 256803 (2007) [arXiv:cond-mat/0702516].
13. **"A simple view on the quantum Hall system"**
E.J. Bergholtz and A. Karlhede
Proceedings of the NATO Advanced Study Institute on Quantum Magnetism, Les Houches, France, 6-23 June 2006. Published 2008 by Springer. [arXiv:cond-mat/0611181].
14. **"Pfaffian quantum Hall state made simple: multiple vacua and domain walls on a thin torus"**
E.J. Bergholtz, J.Kailasvuori, E.Wikberg, T.H. Hansson and A. Karlhede
Phys. Rev. B **74**, 081308(R) (2006), [arXiv:cond-mat/0604251].
15. **"One-dimensional' theory of the quantum Hall system"**
E.J. Bergholtz and A. Karlhede
J. Stat. Mech. (2006) L04001, [arXiv:cond-mat/0509434].
16. **"Half-filled Landau level on a thin torus"**
E.J. Bergholtz and A. Karlhede
Phys. Rev. Lett. **94**, 026802 (2005) [arXiv:cond-mat/0406394].

17. **"Density Matrix Renormalization Group Study of a Lowest Landau Level Electron Gas on a Thin Cylinder"**
E.J. Bergholtz and A. Karlhede
[arXiv:cond-mat/0304517].

Publications (theses)

18. PhD thesis: **"One-dimensional theory of the quantum Hall system"** (May 2008)
Printed as book, ISBN: 978-91-7155-627-1
Opponent: Nick Read, Yale University.
19. Licentiate thesis: **"New Light on the Quantum Hall Effect"** (September 2005)
Opponent: Edwin Langmann, Royal Institute of Technology (KTH).
20. Diploma thesis: **"Density Matrix Renormalization Group Analysis of Spin Chains and Quantum Hall Systems"** (December 2002).

Conferences, talks and schools etc. (selection)

- Many seminars in Stockholm, at Stockholm University, the Royal Institute of Technology and at Nordita (2002-2010).
- Summer schools in Denmark: "Nordita Master Class" in Hilleröd, Denmark (2001 and 2002) and "Nordita summer school on strongly correlated electrons" also in Hilleröd, Denmark (2003).
- "3rd PSI summer school on condensed matter research" in Zuoz, Switzerland (2004). Presented a poster on "Half-filled Landau level on a thin torus".
- "NordForsk network meeting on low-dimensional physics" Many meetings: Copenhagen (June 2005), Oslo (2004, 2005), Stockholm (2003, 2004, 2006), Lofoten (2006), Jyväskylä (2006), Göteborg (2007), Trondheim (2008). I have given talks about the quantum Hall effect in Stockholm, Oslo and in Jyväskylä.
- APS March meeting in Baltimore (2006). I gave a talk "An Exact Solution for the Half-filled Lowest Landau Level".
- Summer school on "Quantum Magnetism" in Les Houches, France (2006).
- APS March meeting in Denver (2007). I gave a talk "A simple view on the quantum Hall system".
- Nordita program on Quantum Fluids (2007). I gave a talk "The Quantum Hall system: solvable limit and beyond".

- Invited seminar "Solvable limit of the quantum Hall system" at Freie Universität in Berlin (2007).
- Invited seminar "Solvable limit of the fractional quantum Hall system" at the Max Planck Institute for the Physics of Complex Systems in Dresden (2007).
- I gave two (invited) popular science talks ("Ordning och reda i kvantvätskor") at Stockholm University in October 2008.
- Invited seminar "One-dimensional theory of the quantum Hall system" at Ecole Normale Supérieure, Paris (2008).
- Several regular seminars in Dresden, 2008-2010.
- I gave a talk "One-dimensional theory of the quantum Hall system" at the workshop "Topological Order: From Quantum Hall Systems to Magnetic Materials" at MPI-PKS Dresden, July 2009.
- Invited talk "Valence bond solids and spin liquids in frustrated quantum magnets" on the NordForsk Nordic Network Meeting on Low-dimensional physics in Å, Lofoten Islands, Norway, August 2009.
- Invited talk at Nordita "Valence bond solids vs spin liquids in kagome based quantum magnets", March 2010.
- Talk at the "Quantum Matter in Low Dimensions: Opportunities and Challenges" workshop at Nordita in September 2010. Title: "Entanglement in Fractional Quantum Hall states"

Miscellaneous

- Member of the hiring committee for senior positions at the faculty of sciences (2004-2006).
- Member of the board of the physics department at Stockholm University (2006-2008).
- Member of several committees regarding graduate (eg designing the new Master program in theoretical physics and a new course in experimental methods) and undergraduate education at Stockholm University (2000-2008).
- Completed a course in University teaching and pedagogy (80 hours).
- Referee for Physical Review (PRL and PRB) and IOP.
- Fluent in Swedish and English. Conversational skills in German.