CV – Mikael Fremling

Mikael Fremling

Date of Birth: 1985-03-26

Nationality: Swedish

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H-index: 6
https://scholar.google.com/citations?user=54xGp98AAAAJ&hl

Research interests

My research interest covers the field of topologically ordered states of matter. Most lately I have used calculations of transport observables to identity topology lattices with fractal symmetries.

I have a strong background in the fractional quantum Hall effect, especially with focus on constructing and studying representative wave functions. I have used both theoretical methods such as conformal field theory, as well as numerical techniques such as exact diagonalization and Monte Carlo methods.

I am looking forward to using my knowledge and broaden my research further into other topologically ordered states.

Research and work experience

2018/08 – Present Postdoctoral Fellow
Institute for Theoretical Physics, Utrecht University, The Netherlands,

2015/08 – 2018/07 Postdoctoral Fellow
Department of Mathematical Physics, Maynooth University, Ireland

2009/10 – 2015/06 PhD Researcher
Department of Physics, Faculty of Natural Sciences, Stockholm University, Sweden

2008/08 – 2009/09 Tester/Programmer
Klarna, Sweden

Theses

Fremling M., Quantum Hall Wave Functions on the Torus**,**

Doctoral thesis, Stockholm University, Sweden, 2015

Supervisors: Hans Hansson, Anders Karlhede

Fremling M., Coherent State Wave Functions on the Torus,

Licentiate[1] thesis, Stockholm University, Sweden, 2013

Supervisors: Hans Hansson, Anders Karlhede

Kardell M.[2], Dark Matter Halos in The Milky Way,

Master thesis, Stockholm University, Sweden, 2008

1: In Sweden, formally equivalent to half of a doctoral degree.
2: Changed name from Kardell to Fremling in 2011.

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Supervisors: Joakim Edsjö, Lars Bergström

Parental leave

2015/01 – 2015/05, 2015/07

Teaching

Super teaching assistant 2019-2020 at Utrecht University, The Netherlands

1. Statistical Field Theory, NS-TP402M (2019-2020, group leader for all the teaching assistants)

Lecturer 2015 – 2017 at Maynooth University, Ireland

2. Leaving certificate physics, MP003 (2017-2018, full responsibility)
3. Conformal field theory (2016-2017, informal lectures/study circle)
4. Classical mechanics, MP350 (2015-2016, full responsibility)
5. Solid state physics, MP464 (2016, 50% of lectures)

Teaching assistant 2009 – 2014 at Stockholm University, Sweden

Exercise instructor in undergraduate course in:

1. Quantum field theory (2010 – 2013)
2. Classical mechanics (2011 – 2014)
3. Electrodynamics (2011)
4. Quantum phenomena (2009 – 2012)
5. Physics part of the Science foundation year (2009 – 2010)

Publication list

1. Pu, S., **Fremling, M.**, Jain, J. K. *Hall Viscosity of Composite Fermions*, Phys. Rev. Research **2** 013139 (2020, Editors' Suggestion)
2. **Fremling, M.**, van Hooft, M., Smith, C. M., Fritz, L. *Existence of robust edge currents in Sierpinski Fractals*, Phys. Rev. Research **2** 013044 (2020)
3. **Fremling M**, Slingerland J. K. *An investigation of pre-crystalline order, ruling out Pauli crystals and introducing Pauli anti-crystals*, Scientific Reports **10** 3710 (2020)
4. **Fremling M.**, *On the modular covariance properties of composite fermions on the torus*, Phys. Rev. B 99 075126 (2019)
5. Sreejith G. J., **Fremling M.**, Jeon G. S., Jain J. K., *Search for exact local Hamiltonians for general fractional quantum Hall states*, Phys. Rev. B 98 235139 (2018, Kaleidoscope)
6. S. Pu, **Fremling M.**, Jain J. K., *Berry Phase of the Composite-Fermion Fermi Sea: Effect of Landau Level Mixing*, Phys. Rev. B 98 075304 (2018)
7. **Fremling M.**, Repellin C., Stéphan J.-M., Moran N., Slingerland J. K., Haque M., *Dynamics and level statistics of interacting fermions in the Lowest Landau Level*, New J.

Phys. 20 103036 (2018)

8. **Fremling M.**, Moran N., Slingerland J. K., Simon S. H., *Trial wave functions for a Composite Fermi liquid on a torus*, Phys. Rev. B **97** 035149 (2018, Editors' Suggestion)
9. **Fremling M.**, *Success and failure of the plasma analogy for Laughlin states on a torus*, J. Phys. A **50** 015201 (2016, IOP-Select)
10. **Fremling M.**, Fulsebakke J., Moran N., Slingerland J. K., *Energy projection and modified Laughlin states*, Phys. Rev. B **93** 235149 *(2016)*
11. **Fremling M.**, *Quantum Hall Wave Functions on the Torus*, ISBN: 978-91-7649-158-4 (2015)
12. **Fremling M.**, Hansson T. H., Suorsa J., *Hall viscosity of hierarchical quantum Hall states*, Phys. Rev. B **89** 125303 (2014, Editors' Suggestion)
13. **Fremling M.**, *Coherent State Wave Functions on the Torus*, *Licentiate thesis, see also arXiv: 1401.6834* (2013)
14. **Fremling M.**, *Coherent state wave functions on a torus with a constant magnetic field*, J. Phys. A **46** 275302 (2013)
15. **Kardell M^2.**, Karlhede A., *Exclusion statistics for quantum Hall states in the Tao-Thouless limit*, J. Stat. Mech **2011** P02037 (2011)

Education

2009 – 2015	Doctor of Philosophy in Physics, Stockholm University, Sweden
2004 – 2008	Master of Science in Physics, Stockholm University, Sweden

Supervised Students

1. Sonja Fisher, PhD in Physics, Utrecht University, Completed 2020
2. Twan van der Meijden, Master of Physics, Utrecht University, 2019 - 2020
3. Michal van Hooft, Master of Physics, Utrecht University, 2018 - 2019
4. Adam Tallon, Bachelor of Science, Maynooth University, 2017 - 2018
5. Kate Mulhall, Bachelor of Science, Maynooth University, 2016 - 2017
6. Ciaran Mc Donnel, Bachelor of Science, Maynooth University, 2016 – 2017

Current Research projects:

1. *Realization of the SYK model in stained Irridates – with Fritz L. Corboz F.*
2. *Topology in fractals. - with Fischer S, Fritz L.*
3. *Correlation functions in the FQHE – with Slingerland J. K,*
4. *Dimentionality of Political Parliaments – with* Tallon A, *de Wijn A.*
5. *Localization properties of Jain quasiparticles.– with Slingerland J. K, Ardonne E., Herrmanns M.*
6. *S-matrix from minimally entangled states – with* Moran N., Bergholtz E.
7. *Non-chiral hierarchy states and modified Pfaffian states on the torus*

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Oral conference and seminar presentations

1. Physics@Veldhoven, Eindhoven, Netherlands, 21 January 2020
2. University of Amsterdam, Amsterdam, Netherlands, 27 November 2019
3. Dublin Institute of advanced Sciences, Dublin, Ireland, 9 May 2019
4. Maynooth University, Maynooth, Ireland, 8 May 2019
5. Δ -ITP meeting, Leiden, Netherlands, 15 February 2019
6. Utrecht University, Utrecht, Netherlands, 11 January 2019
7. Irish quantum foundations, Dublin, Ireland, 28 – 29 May 2018
8. APS March Meeting, Los Angeles, USA, 5 – 9 March 2018
9. Nordita, Stockholm, Sweden, 12 December 2017
10. Utrecht University, Utrecht, Netherlands, 28 November 2017
11. Pennsylvania State University, University Park, USA, 3 October 2017
12. University of Cologne, Cologne, Germany 16 June 2017
13. Irish quantum foundations, Dublin, Ireland, 25 – 26 May 2017
14. Irish quantum foundations, Maynooth, Ireland, 26 – 27 May 2016
15. University of Gothenburg, Gothenburg, Sweden, 11 May 2016
16. From Quantum Field Theories to Numerical Methods, Nordita, Stockholm, Sweden, 2 May – 27 May 2016
17. APS March Meeting, San Antonio, USA, 2 – 6 March 2015
18. NUI Maynooth, Maynooth, Ireland, 18 November 2014
19. The Dublin Area Workshop on Nanoscience and Low-Dimensional Quantum Matter, Dublin, Ireland, 10-12 November 2014
20. Computational Challenges in Nuclear and Many-Body Physics, Nordita, Stockholm, Sweden, 15 September – 10 October 2014
21. APS March Meeting, Baltimore, USA, 18 – 22 March 2013

Poster conference presentations

1. Conference on Entanglement in Strongly Correlated Systems, Benasque, Spain, 25 February – 8 March 2019
2. Physics @ Veldhoven, Eindhoven, The Netherlands, 22 – 23 January 2019
3. Conference on Frontiers of topological quantum matter, Nordita, Stockholm, Sweden, 1 – 5 May 2017
4. Conference on Field Theory Methods in Low-Dimensional Strongly Correlated Quantum Systems, Trieste Italy, 25 – 29 August 2014
5. Conference on Quantum Engineering of States and Devices, Nordita , Stockholm Sweden, 18 – 23 August 2014
6. Physics by The lake summer school, St:Bees UK, 25 July – 5 August 2011

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Outreach and popular science presentations

1. IGNITE@Maynooth Univeristy, Maynooth University, 2017/10
2. The Lise Meitner days, Stockholm, Sweden, 2015/10
3. Researcher's day, Stockholm University, Sweden, 2015/10
4. Lecture at the Nobel museum, Stockholm, Sweden, *2013/12*
5. The podcast Kvacksnack Sommar 2013, Swedish Internet, 2013/07
6. Lecture at the Pop Science pub, Stockholm, Sweden , 2013/02
7. The popular science radio show Institutet, SR P3, Swedish Radio. *2012/12*

Programming skills, roughly in order of fluency

Python/Cython, Julia, Fortran 90/95, Octave/Matlab, R, Erlang, Mathematica, Make, C++, Java

Awards and grants

1. Cluster computing grant, Irish Centre for High-End Computing, Ireland (2018)
2. Best IGNITE@Maynooth Univeristy postdoctoral presentation award, Ireland (2017)
3. Cluster computing grant, Irish Centre for High-End Computing, Ireland (2016)
4. Travel grant, Liljevalch scholarship, Stockholm University, Sweden (2014)
5. Travel grant, Stockholm University donation scholarships, Stockholm University, Sweden (2014)

Open source software contributed to

Hammer: Exact diagonalization and trial wave functions for the fractional quantum Hall effect

Courses / workshops / summer schools

1. Tensor Network Summer School 2015 in Tensor Networks
   Ghent Belgium, 1 – 5 June 2015
2. Nordita Winter School 2014 in Condensed Matter Theory
   Stockholm Sweden, 6 – 17 January 2014
3. Les Houches Doctoral Training in Statistical Physics
   Les Houches France, 28 August – 7 September 2012
4. EPSRC/IOP UK Graduate Summer School in Condensed Matter Theory – Physics By The Lake
   St:Bees United Kingdom, 25 July – 5 August 2011

Management experience

Board of the housing society at Dellensvägen 15, Stockholm, Sweden

- Auditor (2010, 2013, 2018)

Organized the Theoretical Physics Seminars (2015 - 2018), Maynooth University, Ireland

PhD council at the Physics Department, Stockholm University, Sweden

- Vice chairman (2013 – 2014)

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- Chairman (2012 – 2013)
- Member (2011 – 2012)

Board of the Physics Department, Stockholm University, Sweden

- PhD representative (2013 – 2014)

Working committee of the Faculty of Sciences, Stockholm University, Sweden.

- PhD representative (2012 – 2014)

Board of the Olympic handball club GT/Söder, Sweden.

- Member (2009 – 2010)
- Substitute (2008 – 2009)

Board of Physics Student Association (Ämnesföreningen Quanta), Stockholm University, Sweden.

- Chairman (2007)
- Secretary (2005)

Welcoming committee for new students at Natural Sciences Student Association (Naturvetenskapliga föreningen), Stockholm University, Sweden.

- Member (2006)

Board of the Natural Sciences Student Association (Naturvetenskapliga föreningen), Stockholm University, Sweden.

- Member (2005 – 2006)

Sports Coach for Olympic handball club GT/Söder, Sweden

- Coach (2006 – 2008) of boys born 1995