

October 10, 2021

## JAKOB E. BJÖRNBERG

### CURRICULUM VITAE

Citizenship: Swedish  
Born February 1983

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#### Research interests

Mathematics of statistical physics, probability theory.

#### Publications

- *Heisenberg models and Schur–Weyl duality*. With H. Rosengren and K. Ryan.
- *Dimerization in quantum spin chains with  $O(n)$  symmetry*. With P. Mühlbacher, B. Nachtergaele and D. Ueltschi. *Comm Math Phys* 387 (2021)
- *Stable shredded spheres and causal random maps with large faces*. With N. Curien and S. Ö. Stefánsson, arXiv:1912.01378
- *Characterising random partitions by random colouring*. With C. Mailler, P. Mörters and D. Ueltschi. *Electronic Communications in Probability* 25 (2020)
- *The interchange process with reversals on the complete graph*. With M. Kotowski, B. Lees and P. Miłoś. *Electronic Journal of Probability* 24 (2019)
- *Quantum spins and random loops on the complete graph*. With J. Fröhlich and D. Ueltschi. *Comm Math Phys* 375 (2020)
- *Critical temperature of Heisenberg models on regular trees, via random loops*. With D. Ueltschi. *J. Stat. Phys.* 173, no 5 (2018).
- *Critical parameter of random loop model on trees*. With D. Ueltschi. *Annals of Applied Probability*, 8, no 4 (2018).
- *Fermionic observables in the transverse Ising chain*. *J. Math. Phys.* 58, no 5 (2017).
- *The free energy in a class of quantum spin systems and interchange processes* *J. Math. Phys.* 57 (2016)
- *Large cycles in random permutations related to the Heisenberg model* *Electr. Comm. Prob.* 20 (55) 2015.
- *Decay of transverse correlations in quantum Heisenberg models*. With D. Ueltschi. *J. Math. Phys.* 56, no 4 (2015).
- *On site percolation in random quadrangulations in the half-plane*. With S. Ö. Stefánsson. *J. Stat. Phys.* 160 (2015), no. 2, 336356.
- *Vanishing critical magnetization in the quantum Ising model*. *Comm. Math. Phys.* 337 (2015), no. 2, 879907.
- *Random walk on random infinite looptrees*. With S. Ö. Stefánsson. *J. Stat. Phys.* 158 (2015), no. 6, 12341261.

- *Recurrence of bipartite planar maps*. With S. Ö. Stefánsson. *Electronic Journal of Probability* **19** (2014), paper 31.
- *Sharpness versus robustness of the percolation transition in 2D contact processes*. With J. van den Berg and M. Heydenreich. *Stochastic Processes and their Applications* **125.2** (2015): 513-537.
- *Coexistence and non-coexistence of Markovian viruses and their hosts*. With E. I. Broman. *J. Appl. Probab.* **51** (2014), no. 1, 191208.
- *Infrared bound and mean-field behaviour in the quantum Ising model*. *Communications in Mathematical Physics* **323** (2013), no. 1, pp. 329
- *A stochastic model for virus growth in a cell population*. With T. Britton, E. I. Broman and E. Natan. *J. Appl. Probab.* **51** (2014), no. 3, 599612.
- *The phase transition of the quantum Ising model is sharp*. With G. R. Grimmett. *Journal of Statistical Physics* **136** (2009), no. 2, pp. 231.
- *Critical value of the quantum Ising model on star-like graphs*. *Journal of Statistical Physics* **135** (2009), no. 3, pp. 571.
- *Approximate dynamic programming for generation of robustly stable feedback controllers*. With M. Diehl. In *Proceedings the International Conference on High Performance Scientific Computing 2006*, Mar 6–10, 2006, Hanoi, Vietnam.
- *Approximate robust dynamic programming and robustly stable MPC*. With M. Diehl, *Automatica* **42** (2006), no. 5, pp. 777–782.
- *Robust dynamic programming for min-max model predictive control of constrained uncertain systems*. With M. Diehl. *IEEE Transactions on Automatic Control* **49** (2004), no. 12, pp. 2253–2257.

### Academic titles

Ph.D. Mathematics 2009. Swedish Docent (‘Reader’) in Mathematics, Uppsala University 2015.

### Grants

- GU Faculty of Science Sabbatical Program, 725 kSEK for 4+2 months visit to the University of Warwick during 2021 and 2022.
- *VR Project grant* 4 years funding, 2020–2024, 3.2 MSEK, ‘Kvantteoretiska spinnsystem via sannolikhets- och representationsteori’ grant number 2019-04185
- Funding to organize workshop ‘Probabilistic approaches to quantum spin systems’, 16–20 April, 2018: 30 kSEK from *Stiftelsen Olle Engkvist byggmästare* and 10 kSEK from *American Inst of Physics*
- *Stiftelsen Olle Engkvist byggmästare*, 80 kSEK to fund a 3-month postdoctoral fellowship at GU for Benjamin Lees, October – December 2016
- *Swedish research council (VR) Young Researcher Grant* 4 years funding, 2016–2020, 3.4 MSEK, ‘Slumplöpar och kvantteoretiska spinnsystem’ grant number 2015-05195
- *Marie Curie Skłodowska International Career Grant* Jointly funded by the Swedish research council VR and EU (FP7), 3 years funding, 2016–2019, 5.4 MSEK. Declined in favour of the Young researcher grant.

### **Prizes and awards**

- Stipend from Ruth och Nils-Erik Stenbäck's stiftelse, 20.000 euro, awarded by Finska Vetenskaps-Societetens in April, 2019.

### **Positions held**

- September 1st, 2020 – present: Associate lecturer (lektor), Department of Mathematics, Chalmers and Gothenburg University, Sweden
- September 1st, 2016 – August 31st, 2020: Assistant lecturer, tenure track (biträdande lektor), Department of Mathematics, Chalmers and Gothenburg University, Sweden
- October 1st, 2015 – August 31st, 2016: Postdoctoral researcher, Department of Mathematics, University of Copenhagen, Denmark
- October 1st, 2014 – Sept 30th 2015: Postdoctoral researcher, Department of Mathematics, Chalmers and Gothenburg University, Sweden
- October 1st, 2010 – September 30th, 2014: Postdoctoral researcher, Department of Mathematics, Uppsala University, Sweden
- October 1st, 2009 – September 30th, 2010: Postdoctoral researcher, Statistical Laboratory, University of Cambridge, UK

### **Thesis**

Graphical representations of Ising and Potts models. 2009.

### **University education**

- Ph.D. in Mathematics 2009, jointly from Cambridge University, UK, and KTH, Sweden. Supervisors Prof. Geoffrey Grimmett and Prof. Anders Björner. Thesis defended 17th September 2009 (Cambridge) and 18th November 2009 (KTH).
- Part III (Certificate of Advanced Studies) in Mathematics, with Distinction, June 2006. St Edmund's College, University of Cambridge.
- BSc (Hons) in Mathematics, class One. University of Warwick, July 2005.

### **Teaching**

- Lecturer and examiner, masters level course 'Stochastic processes', 2020.
- Lecturer, examiner and exercise leader, 'Sannolikhetsteori och statistik (7,5 hp)' TMS137, Chalmers University, September – October, 2017, 2018, 2019, 2020, 2021
- Lecturer and examiner, PhD course 'Classical and quantum particle systems (7,5 hp)' during spring term 2017. 11 lectures by me plus 4 lectures by Jules Lamers (each 2\*45 mins), examination via 3 homeworks plus oral presentations. Also created the lecture material.
- Lecturer, examiner and exercise leader, 'Dataanalys och statistik (7,5 hp)' TMS136, Chalmers University, September – October, 2016
- Exercise leader, Linear Algebra TMV141, Chalmers and Gothenburg University, January–March 2015 (2 sessions per week).
- Exercise leader, minicourse on 'Random tree ensembles and applications' (main lecturer T. Jonsson), ICTP-SAIFR School on Random Geometry and Random Matrices, Sao Paulo, Brazil, Aug 25 – Sep 2, 2014.

- Supervisor of Bachelor Theses in Mathematics: (i) ‘The Google Markov Chain: convergence speed and eigenvalues’ April—June 2012 by Fredrik Backåker, (ii) ‘The Brownian tree’ April—June 2013 by Christoffer Cambroner.
- Main lecturer and examiner ‘Stokastisk modellering (5hp)’ (‘Stochastic modelling for engineering students’), Uppsala University, on four occasions: January—March 2011, 2012, 2013 and 2014.
- Main lecturer and examiner ‘Sannolikhetsteori I (5hp)’ (‘Probability theory I’), Uppsala University, August—October 2013.
- Main lecturer and examiner ‘Sannolikhet och statistik (5hp)’ (‘Probability and statistics’), Uppsala University, on two occasions: August—October 2011 and 2012.
- Setting computational mathematics projects (CATAM, Cambridge Part II), ‘Percolation theory’ and ‘Importance sampling and fast simulation’, July 2010
- Supervisor for undergraduate courses in Cambridge: ‘Applied Probability’ (Part II, 2010), ‘Probability and Measure’ (Part II, 2008), ‘Markov Chains’ (Part IB, 2008 and 2007), ‘Advanced Probability’ (Part III, 2007)
- Personal tutor for high school mathematics student (2001–2002)

### **Pedagogical education and professional development**

- *Högskolepedagogik 3, Självtändigt arbete* (HPE103), GU, Spring 2019
- *Teaching and Learning in Higher Education 2: Faculty of Natural Sciences* HPE102, GU, Spring 2018
- *Leadership program for assistant professors* at Chalmers, 8 full day sessions during spring 2017.
- *Academic Teacher Training Course* (Högskolepedagogisk grundkurs), Uppsala University, Sweden, Spring 2013. Five weeks’ full-time equivalent.
- *Supervising PhD students* (Handledning av doktorander), Uppsala University, Sweden, Fall 2013. Three weeks’ full-time equivalent.

### **Other professional activities**

- Co-organizer of the Analysis and Probability seminar at Chalmers, since 2020.
- Organizer (with D. Ueltschi) ‘Workshop on probabilistic approaches to quantum spin systems’, Göteborg, Sweden, April 16 - 20, 2018
- Opponent Licentiate defense of Timo Hirscher 28th April 2014
- Organizer and leader of reading group ‘Conformal invariance in statistical physics’ (studying papers by S. Smirnov on conformal invariance in percolation and the Ising model, as well as SLE), February—December 2012.
- Joint organizer (with Sigurdur Stefánsson and Fredrik Viklund) of a reading group on planar maps, January 2014–April 2014.
- Referee for ‘Probability theory and related fields’, ‘Communications in mathematical physics’, ‘Physical review E’, ‘Electronic Journal of Probability’, ‘Advances in Applied Probability’, ‘Annals of Probability’ and ‘Markov processes and related fields’
- Reviewer for AMS

## Presentations at seminars and conferences

- Bernoulli-IMS One World Symposium 2020 (August 24th to August 28th 2020), contributed pre-recorded talk ‘Random colouring of residual allocations’
- University of Melbourne mathematical physics seminar, 5 March 2020, ‘Heisenberg models on complete graphs’
- Umeå, 15 Jan 2020, ‘The interchange process with reversals’
- Reykjavik, 6 Dec 2019, ‘Random permutations and the Heisenberg model’
- Warwick, statistical mechanics seminar 14 Nov 2019, ‘Random permutations and the Heisenberg model’
- Warwick, probability seminar 13 Nov 2019, ‘The interchange process with reversals’
- Göteborg, 7 Nov 2019, Analysis and probability seminar, ‘The interchange process with reversals’
- Warsaw, 28 March 2019, ‘Random permutations and the Heisenberg model’
- KTH probability seminar, 26 Feb 2019, ‘Random permutations and the Heisenberg model’
- Ume, 15 Jan 2019, ‘Random permutations and the Heisenberg model’
- Rhein–Main Kolloquium, Darmstadt, 7 Dec 2018, ‘Random permutations and the Heisenberg model’
- Workshop talk, 20 April 2018, ‘Interchange processes and symmetric functions’
- IHES, ‘Random loops and quantum spin systems’, December 7th, 2017
- University of Gothenburg Analysis and Probability seminar, February 14th 2017, ‘Probabilistic representations of quantum spin systems’
- Workshop on Quantum Spin Systems and Stochastic Representations, Bristol 16th January, 2017, ‘Poisson–Dirichlet distribution in the quantum Heisenberg model?’
- University of Warwick, Statistical Mechanics seminar, November 17th 2016, ‘Mean-field Heisenberg models and random permutations’
- University of Geneva, Probability and Mathematical Physics seminar, October 31st 2016, ‘Probabilistic methods for quantum spin systems’
- University of Gothenburg Probability and statistics seminar, October 6th, 2016, ‘Random loop models on trees’
- University of Gothenburg BIG meeting, Stenungsund, August 23rd 2016, ‘Two models, one critical value’
- University of Copenhagen Quantum Lunch Seminar, 1 June 2016, ‘Introduction to fermionic observables’
- Mathematics seminary, University of Iceland, 1 April 2016, ‘Random permutations and quantum Heisenberg models’
- University of Linköping mathematical statistics seminar, 1 Dec 2015, ‘Random permutations related to quantum Heisenberg models’
- University of Copenhagen Quantum Lunch Seminar, 21 Oct 2015, ‘Random permutations and the mean-field Heisenberg model’
- Chalmers/GU percolation meeting, Lerum 21–22 Sept 2015: ‘Continuity of the phase transition in Ising models’
- Chalmers BIG workshop, Särö, August 28th, 2015: Weighted interchange processes, the Poisson–Dirichlet distribution, and the quantum Heisenberg model

- Mathematical physics seminar, University of Copenhagen, January 21st, 2015: ‘Continuity of the phase transition in Ising models’
- Statistical mechanics seminar, University of Warwick, January 8th, 2015: ‘Continuity of the phase transition in Ising models’
- Probability seminar, University of Warwick, January 7th, 2015: ‘Local limits of random bipartite planar maps’
- Mathematics seminary, University of Iceland, November 17th 2014: ‘Percolation in random quadrangulations of the half-plane’
- ICTP-SAIFR Workshop on Random Geometry and Random Matrices, Sao Paulo, Brazil, Aug 3 – Sep 4, 2014: ‘Local limits of random bipartite planar maps and random trees’
- Workshop on Discrete Random Geometry, Varberg, August 2013: ‘Percolation in 2D contact processes: sharpness, robustness, and applications to vegetation patterns’
- 36th conference on Stochastic Processes and their Applications, Boulder, Colorado, August 2013: ‘Percolation in 2D contact processes: sharpness, robustness, and applications to vegetation patterns’
- Popular science presentation for Matematiska Föreningen, Uppsala universitet, November 22nd 2012, ‘Värdet av en divergent summa’
- Analysis and Stochastics Seminar, Uppsala University, January 31st 2012, ‘Conformal invariance in statistical physics’ (overview talk).
- Stockholm University Mathematical Statistics seminar 2nd November 2011, and Uppsala University Mathematical Statistics seminar 3rd November 2011, ‘A stochastic model for virus reproduction’.
- 13th annual StoUpp meeting, Uppsala, 24th May 2011, ‘Percolation in the contact process’.
- CWI (Amsterdam) probability seminar 29th March 2011, ‘A sharp transition in the quantum Ising model’.
- Poster presentation at ESF conference on ‘Combinatorics and Analysis in Spatial Probability’, Eindhoven December 14th, 2010, ‘The quantum Ising model’.
- Uppsala University Mathematical Statistics seminar 28th October 2010, ‘Critical exponents in the quantum Ising model’.
- Cambridge probability seminar 18th May 2010, ‘Stochastic geometry of the quantum Ising model’.
- Chalmers statistics seminar 15th October 2009, ‘The critical value on a book with  $k$  leaves’.
- Institut Mittag–Leffler seminar 10th March 2009, ‘Stochastic geometry of the space–time Ising model’
- KTH graduate student seminar 17th April 2008, ‘Ising-modellen och slumpgrafer’ (‘The Ising model and random graphs’)
- Cambridge DPMMS graduate student seminar 14th November 2007, ‘Delights of percolation’
- Cambridge Statistical Laboratory graduate student seminar 29th October 2007, ‘Cardy’s formula and Hex’
- KTH Combinatorics seminar 28th March 2007, ‘Random Poisson flows on graphs’