

## Rupert L. Frank

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CONTACT INFORMATION	Department of Mathematics Princeton University Princeton, NJ 08544	<i>Telephone:</i> +1 609 258 4369 <i>Fax:</i> +1 609 258 1549 <i>E-mail:</i> <a href="mailto:rlfrank@math.princeton.edu">rlfrank@math.princeton.edu</a> <i>WWW:</i> <a href="http://www.math.princeton.edu/~rlfrank/">www.math.princeton.edu/~rlfrank/</a>
PERSONAL DATA	Born August 29, 1978 in Munich, Germany Citizenship: German	
EDUCATION	Princeton University, USA Postdoctoral Research Fellowship, as of September 2007 <ul style="list-style-type: none"><li>• Advisor: Elliott Lieb</li></ul> Royal Institute of Technology Stockholm, Sweden Ph.D. in Mathematics, May 2007 <ul style="list-style-type: none"><li>• Dissertation Topic: <i>Hardy-Lieb-Thirring inequalities for eigenvalues of Schrödinger operators</i></li><li>• Advisor: Ari Laptev</li></ul> Ludwig-Maximilians-Universität Munich, Germany Diplom (MS) in Mathematics, October 2003 <ul style="list-style-type: none"><li>• Grade: very good (passed with distinction)</li><li>• Diplomarbeit (Master Thesis) Topic: <i>On the spectral analysis and the scattering theory of the Laplacian on the halfplane with a periodic perturbation on the boundary</i></li><li>• Advisors: Heinz Siedentop and Mikhail Sh. Birman</li></ul> Gymnasium Ottobrunn, Germany Abitur (A-levels), June 1997 <ul style="list-style-type: none"><li>• Grade: 1.0 (highest possible grade)</li></ul>	
RESEARCH EXPERIENCE	Research stay at Princeton University (five months in 2006) Advisor: Elliott H. Lieb Research stay at Université Paris Sud XI (four months in 2004 and 2006) Advisor: Bernard Helffer Research stay at Mittag-Leffler Institute and KTH Stockholm (four months in 2002) Advisors: Ari Laptev and Mikhail Sh. Birman In addition several short term visits at Caltech (2008), Atlanta (2006 and 2007), Stuttgart (2006 and 2007), Munich (2005, 2006, 2007 and 2008), Prague (2005).	

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- GRANTS                      Scholarship of the Deutsche Forschungsgemeinschaft (German Research Foundation), 2008 – 2009
- Scholarship of the Deutscher Akademischer Auslandsdienst (German Academic Exchange Service), 2007 – 2008
- Marie Curie Fellowship, 2004
- Scholarship of the Studienstiftung des Deutschen Volkes (German National Merit Foundation), 1999 – 2003
- Research grant of the Studienstiftung des Deutschen Volkes, 2002
- Scholarship of the Deutscher Akademischer Auslandsdienst (German Academic Exchange Service), 2000 – 2001
- TEACHING                      Substitute lecturer at Princeton University, April and May 2008
- EXPERIENCE                      Course on *Complex Analysis*
- Teaching assistant at KTH Stockholm, 2004 – 2007
- Courses on *Calculus*, *Linear Algebra* and *Ordinary Differential Equations*
- Teaching assistant at LMU Munich, 1999 – 2003
- Courses on *Calculus*, *Analysis*, *Ordinary Differential Equations* and *Sobolev Spaces and Distributions*
- FURTHER                      Referee for Annals of Mathematics, Archiv der Mathematik, Arkiv för
- MATHEMATICAL                      Matematik, Communications in Mathematical Physics, Documenta Math-
- ACTIVITY                      ematica, Journal of Functional Analysis, Letters in Mathematical Physics,
- Mathematical Research Letters, Reviews in Mathematical Physics and Re-
- vista Matemática Complutense.
- Reviewer for Mathematical Reviews
- Co-organizer of the Seminar ‘Spectral Theory’ at KTH Stockholm, spring 2007
- RESEARCH                      Analysis, Spectral Theory, Mathematical Physics, in particular
- INTERESTS
  - Spectral estimates for differential operators
  - Lieb-Thirring inequalities and the problem of stability of matter
  - Sobolev and Hardy inequalities
  - Ginzburg-Landau equations and superconductivity
  - Spectral theory of periodic and partially periodic operators
  - Scattering theory for deterministic and random systems
- PUBLICATIONS                      J. Breuer, R. L. Frank, *Singular spectrum for radial trees*. Submitted.
- R. L. Frank, H. Siedentop, S. Warzel, *The energy of heavy atoms according to Brown and Ravenhall: the Scott correction*. Submitted.

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- R. L. Frank, R. Seiringer, *Non-linear ground state representations and sharp Hardy inequalities*. J. Funct. Anal., to appear.
- R. L. Frank, A. Laptev, *Spectral inequalities for Schrödinger operators with surface potentials*. Amer. Math. Soc. Transl., to appear.
- T. Ekholm, R. L. Frank, H. Kovarik, *Remarks about Hardy inequalities on metric trees*. Proc. Sympos. Pure Math., to appear.
- T. Ekholm, R. L. Frank, H. Kovarik, *Eigenvalue estimates for Schrödinger operators on metric trees*. Submitted.
- R. L. Frank, E. H. Lieb, R. Seiringer, *Number of bound states of Schrödinger operators with matrix-valued potentials*. Lett. Math. Phys. **82** (2007), 107–116.
- R. L. Frank, M. Loss, T. Weidl, *Pólya's conjecture in the presence of a constant magnetic field*. J. Eur. Math. Soc., to appear.
- R. L. Frank, B. Simon, T. Weidl, *Eigenvalue bounds for perturbations of Schrödinger operators and Jacobi matrices with regular ground states*. Comm. Math. Phys., to appear.
- R. L. Frank, A. Laptev, S. Molchanov, *Eigenvalue estimates for magnetic Schrödinger operators in domains*. Proc. Amer. Math. Soc., to appear.
- R. L. Frank, E. H. Lieb, R. Seiringer and H. Siedentop, *Müller's exchange-correlation energy in density-matrix-functional theory*. Phys. Rev. A **76** (2007), 052517.
- R. D. Benguria, R. L. Frank, M. Loss, *The sharp constant in the Hardy-Sobolev-Maz'ya inequality in the three dimensional upper half-space*. Math. Res. Lett., to appear.
- R. L. Frank, C. Hainzl, S. Naboko and R. Seiringer, *The critical temperature in the BCS model at weak coupling*. J. Geom. Anal. **17** (2007), no. 4, 559–568.
- R. L. Frank, H. Siedentop, S. Warzel, *The ground state energy of heavy atoms: relativistic lowering of the leading energy correction*. Comm. Math. Phys. **278** (2008), no. 2, 549–566.
- R. L. Frank, A. M. Hansson *Eigenvalue estimates for the Aharonov-Bohm operator in a domain*. In: Oper. Theory Adv. Appl., to appear.

- T. Ekholm, R. L. Frank, *Lieb-Thirring inequalities on the half-line with critical exponent*. J. Eur. Math. Soc., to appear.
- R. L. Frank, E. H. Lieb, R. Seiringer, *Stability of relativistic matter with magnetic fields for nuclear charges up to the critical value*. Comm. Math. Phys. **275** (2007), no. 2, 479–489.
- R. L. Frank, E. H. Lieb, R. Seiringer, *Hardy-Lieb-Thirring inequalities for fractional Schrödinger operators*. J. Amer. Math. Soc., to appear.
- R. L. Frank, A. Laptev, E. H. Lieb, R. Seiringer, *Lieb-Thirring inequalities for Schrödinger operators with complex-valued potentials*. Lett. Math. Phys. **77** (2006), 309–316.
- R. L. Frank, *On the asymptotic number of edge states for magnetic Schrödinger operators*. Proc. London Math. Soc. (3) **95** (2007), no. 1, 1–19.
- T. Ekholm, R. L. Frank, *On Lieb-Thirring inequalities for Schrödinger operators with virtual level*. Comm. Math. Phys. **264** (2006), no. 3, 725–740.
- P. Exner, R. L. Frank, *Absolute continuity of the spectrum for periodically modulated leaky wires in  $\mathbb{R}^3$* . Ann. Henri Poincaré **8** (2007), no. 2, 241–263.
- R. L. Frank, O. Safronov, *Absolutely continuous spectrum of a class of random non-ergodic Schrödinger operators*, Int. Math. Res. Not. (2005), no. 42, 2559–2577.
- R. L. Frank, *On the tunneling effect for magnetic Schrödinger operators in antidot lattices*. Asymptot. Anal. **48** (2006), no. 1-2, 91–120.
- R. L. Frank, R. G. Shterenberg, *On the spectrum of partially periodic operators*. In: Operator Theory, Analysis and Mathematical Physics, J. Janas, et al. (eds.), 35–50, Oper. Theory Adv. Appl. **174**, Birkhäuser, Basel, 2007.
- R. L. Frank, *On the Laplacian in the halfspace with a periodic boundary condition*. Ark. Mat. **44** (2006), no. 2, 277–298.
- R. L. Frank, R. G. Shterenberg, *On the scattering theory of the Laplacian with a periodic boundary condition. II. Additional channels of scattering*, Doc. Math. **9** (2004), 57–77.
- R. L. Frank, *On the scattering theory of the Laplacian with a periodic boundary condition. I. Existence of wave operators*. Doc. Math. **8** (2003), 547–565.

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- CONFERENCE CONTRIBUTIONS
- Lieb-Thirring and Hardy-Sobolev inequalities*, European Congress of Mathematics, Amsterdam, July 2008
- Semi-classical spectral estimates for magnetic Schrödinger operators*, Conference ‘Spectral and Scattering Theory for Quantum Magnetic Systems’, Luminy, July 2008
- Non-linear ground state representations and sharp Hardy inequalities*, Conference ‘Operator Theory, Analysis and Mathematical Physics’ (OTAMP 2008), Bedlewo, June 2008
- The magnetic Pólya conjecture*, Workshop ‘Spectral Theory and Partial Differential Equations’, Vienna, Dec. 2007.
- Hardy-Lieb-Thirring inequalities and the stability of relativistic matter*, Danish Symposium on Applied Analysis, Copenhagen, Aug. 2007
- Absolute continuity of the spectrum for periodically modulated leaky wires*, Conference ‘Waves 2007’, Reading, July 2007
- The relativistic Scott correction*, ‘Enigma Conference on Mathematical Physics’, Stockholm, June 2007
- The sharp constant in the Hardy-Littlewood-Maz’ya inequality in the three-dimensional upper half-space*, Workshop ‘Geometric inequalities’, Banff, June 2007
- Eigenvalue estimates for Schrödinger operators on regular metric trees*, Workshop ‘Quantum Graphs, their spectra and applications’, Cambridge, April 2007
- Hardy-Lieb-Thirring inequalities and the stability of relativistic matter*, DMV Minisymposium ‘Mathematical models of complex quantum systems’, Berlin, March 2007
- On Lieb-Thirring-Hardy inequalities*, Workshop ‘Spectral Theory and its Applications’, Cambridge, July 2006
- On Lieb-Thirring-Hardy inequalities*, Conference ‘Operator Theory, Analysis and Mathematical Physics’ (OTAMP 2006), Lund, June 2006
- On Lieb-Thirring-Hardy inequalities*, Workshop ‘Low eigenvalues of Laplace and Schrödinger operators’, Palo Alto, May 2006
- On Lieb-Thirring inequalities for Schrödinger operators with virtual level*, Network meeting ‘Analysis and Quantum’, Vienna, March 2006

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*On Lieb-Thirring inequalities for Schrödinger operators with virtual level*, Workshop ‘Spectral Theory of PDE’, Stockholm, Sep. 2005

*On the Laplacian on the halfplane with a periodic boundary condition*, Workshop ‘Spectral analysis of partial differential equations’, Oberwolfach, Dec. 2004

*On the Laplacian on the halfplane with a periodic boundary condition*, Conference ‘Operator Theory, Analysis and Mathematical Physics’ (OTAMP 2004), Bedlewo, July 2004

*On the Laplacian on the halfplane with a periodic boundary condition*, Network meeting ‘Analysis and Quantum’, Vienna, Dec. 2003

### INVITED SEMINAR TALKS

*Non-linear ground state representations and sharp Hardy inequalities*, Munich, June 2008

*Non-linear ground state representations and sharp Hardy inequalities*, Pasadena, Caltech, March 2008

*The magnetic Pólya conjecture*, Munich, Dec. 2007

*Stability of matter and Lieb-Thirring inequalities in the magnetic case*, New York, Courant Institute, Dec. 2007

*Hardy-Sobolev and Lieb-Thirring inequalities*, Princeton, Oct. 2007

*The Pólya’s conjecture in the presence of a magnetic field*, Stuttgart, July 2007

*Hardy-Sobolev and Lieb-Thirring inequalities*, Munich, May 2007

*Hardy-Sobolev and Lieb-Thirring inequalities*, Birmingham, March 2007

*The relativistic Scott correction*, Birmingham, March 2007

*Hardy-Sobolev and Lieb-Thirring inequalities*, Atlanta, Feb. 2007

*Semi-classical spectral estimates for magnetic Laplacians*, Stockholm, Jan. 2007

*Semi-classical spectral estimates for magnetic Laplacians*, Grenoble, Jan. 2007

*On Lieb-Thirring-Hardy inequalities and the stability of relativistic matter*, Davis, Nov. 2006

*On Lieb-Thirring-Hardy inequalities and the stability of relativistic matter*, Atlanta, Nov. 2006

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*On Lieb-Thirring inequalities for surface potentials*, Stuttgart, Sep. 2006

*On Lieb-Thirring-Hardy inequalities for relativistic Schrödinger operators*, Munich, July 2006

*On the asymptotic number of edge states for magnetic Schrödinger operators*, Paris, Feb. 2006

*On Lieb-Thirring inequalities for Schrödinger operators with virtual level*, Munich, Dec. 2005

*On the asymptotic number of edge states for magnetic Schrödinger operators*, Stockholm, Oct. 2005

*Absolutely continuous spectrum for non-ergodic random operators*, Stockholm, June 2005

*On Lieb-Thirring inequalities for Schrödinger operators with virtual level*, Prague, April 2005

*On the absolute continuity of the spectrum of partially periodic operators*, Prague, April 2005

*On the magnetic Schrödinger operator in an antidot lattice and applications to superconductivity*, Paris, Nov. 2004

*On the tunneling effect for magnetic Schrödinger operators in antidot lattices*, Paris, June 2004

*On the Laplacian on the halfplane with a periodic boundary condition*, Paris, May 2004

*On the Laplacian on the halfplane with a periodic boundary condition*, Munich, July 2003