

Adrian E. Feiguin
CURRICULUM VITA

Personal Data

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HOMEPAGE	http://www.kitp.ucsb.edu/~afeiguin
DATE OF BIRTH	April 30th, 1971
PLACE OF BIRTH	Rosario, Argentina
CITIZENSHIP	Argentinean (Hispanic)
IMMIGRATION STATUS	U.S. Resident
MARITAL STATUS	Married

Education

DEGREES

- **Ph.D. in Physics.**

Facultad de Ciencias Exactas e Ingeniería. Universidad Nacional de Rosario (Argentina)
 Doctoral Thesis: "Numerical studies of electronic and magnetic systems in low dimensions"
 April 2000.

- **MS in Physics.**

Facultad de Ciencias Exactas e Ingeniería. Universidad Nacional de Rosario (Argentina)
 Master Thesis: "Spin-Peierls dimerization and frustration in two-dimensional antiferromagnets"
 August 1994.

SCHOLARSHIPS AND AWARDS

- 2005 - Ramon y Cajal Fellowship from the Government of Spain.
- 1999 - Postdoctoral Scholarship from Fundacion Antorchas, Argentina.
- 1994 - Doctoral Scholarship from the National Research Council of Argentina. (CONICET)

Research Interests:

My research focuses on the computational study of strongly correlated problems in Condensed Matter. My expertise covers a variety of techniques, such as the Density Matrix Renormalization Group (DMRG), Exact Diagonalization, Quantum Monte Carlo, as well as analytical approaches.

My interests cover a wide range of fields, with publications in all these areas:

- Ultracold atomic gases in optical lattices.
- Decoherence in quantum systems.
- Electronic and spin transport in Mesoscopic Systems.
- High Temperature Superconductors.
- Transition Metal Oxides.
- Quantum Magnetism in low dimensions.
- Exotic quantum phases of matter and topological order, including the Fractional Quantum Hall Effect.

Research Positions

2007-present Research Associate at the University of Maryland, College Park. Also affiliated to Microsoft Research.

2005-2007 Postdoctoral Researcher at Microsoft Research, Station Q. California Nano Systems Institute, University of California, Santa Barbara.

2002-2005 Postdoctoral Researcher at the University of California, Irvine. Irvine, California (USA).

Advisor: Prof. Steve White.

2000-2002 Postdoctoral Researcher at the National High Magnetic Field Laboratory, Florida State University. Tallahassee, Florida (USA).

Advisor: Prof. Elbio Dagotto.

1995-2000 Fellow of the National Research Council of Argentina (CONICET)

Advisor: Prof. H. Ceccatto.

Teaching Positions

Spring 2004 Lecturer, Department of Physics and Astronomy, University of California at Irvine. Computational Physics for senior undergraduates.

<http://eee.uci.edu/04s/47520/>

1998-1999 Lecturer at the School of Engineering and Exact Sciences, Universidad Nacional de Rosario (Argentina). Condensed Matter I and Numerical Analysis.

Duties: Designing, administering, and grading exams. Teaching seminar and lab.

1995-1998 Teaching Assistant at the School of Engineering and Exact Sciences, Universidad Nacional de Rosario (Argentina). Condensed Matter I, and Numerical Analysis.

Duties: Designing, administering, and grading exams. Teaching seminar and lab. Built and administered the computer lab network, designed the lab lectures, taught programming in Fortran and C, and the first course on the Linux operating system for Physics students.

1994-1996 Teaching Assistant at the School of Engineering and Exact Sciences, Universidad Nacional de Rosario (Argentina). Physics III (Electricity and Magnetism).

Duties: Designing, administering, and grading exams. Teaching lab.

1993-1995 Teaching assistant at the School of Biochemistry and Pharmacy, Universidad Nacional de Rosario (Argentina). Physics I and II.

Duties: Administering, and grading exams. Teaching lab.

Educational and Scientific Software

- **ALPS DMRG Project** The ALPS project (Algorithms and Libraries for Physics Simulations) is an open source effort aiming at providing high-end simulation codes for strongly correlated quantum mechanical systems as well as C++ libraries for simplifying the development of such code. ALPS strives to increase software reuse in the physics community. I contributed the Density Matrix Renormalization Group code for simulating low-dimensional strongly correlated systems.

- **SciGraphica** (<http://scigraphica.sourceforge.net>) An application for scientific graphics and data analysis. It features spreadsheets and interactive plots in a user-friendly graphic interface. It has been programmed from scratch using C and the GTK and GtkExtra toolkits. The spreadsheets evaluate expressions in Python, and the plots generate publication quality PostScript output. It has a native file format in XML and it is enhanced under GNOME. The project is open-source and continuously augmented in functionality by many users throughout the world. It is becoming very popular in the scientific community, and it is included in most of the Linux/BSD distributions. Moreover, SciGraphica is being used at places like Siemens, and Nasa (see for instance, the Shuttle Radar Topography Mission at <http://www.jpl.nasa.gov/srtm/>), and for ocean modeling (<http://www.mi.uib.no/BOM/>)

Invited talks and Presentations

July 2009 “Spectral properties of spin-incoherent Luttinger liquids”, Instituto de Ciencias Fotónicas (ICFO), Barcelona, Spain.

June 2009 “Density Matrix Renormalization Group Study of Incompressible Fractional Quantum Hall states”, EPQHS3 conference (Emergent Phenomena in Quantum Hall Systems), Lucca, Italy.

June 2009 “Spectral properties of spin-incoherent Luttinger liquids”, Ludwig-Maximilians-Universität, Munich, Germany.

- May 2009** “The density matrix renormalization group: past, present, future”, Moorea, French Polynesia.
- Feb 2009** “Real-time dynamics of strongly interacting quantum systems”. Boston University.
- Mar 2009** Invited talk at the March Meeting: “Ground state properties of Fractional Quantum Hall states in the second Landau Level”. Pittsburgh.
- Feb 2009** “Real-time dynamics of strongly interacting quantum systems”. Boston University.
- Dec 2008** “DMRG studies of FQH states in the second Landau level”. Microsoft Station Q Fall Meeting, KITP, University of California, Santa Barbara.
- Dec 2008** “Coherent dynamics of a single spin in diamond”. University of Wyoming.
- Aug 2008** “Pairing states of a polarized Fermi gas trapped in a one-dimensional optical lattice”. PUC University, Rio de Janeiro, Brazil.
- May 2008** “Spin-incoherent behavior in one-dimensional interacting systems”. University of California, Santa Barbara.
- June 2008** “Spin-incoherent behavior in one-dimensional interacting systems”. California Institute of technology.
- May 2008** “Density Matrix Renormalization Group Study of Incompressible Fractional Quantum Hall States”. University of California, Santa Cruz.
- Sept 2007** “Incompressible Fractional Quantum Hall states in the second Landau level”. University of Maryland, College Park.
- Dec 2006** “Density Matrix Renormalization Group study of Fractional Quantum Hall states”. Kavli Institute for Theoretical Physics.
- Mar 2005** “On adaptive time-dependent DMRG based on Runge-Kutta methods”. Invited speaker at the March 2005 Meeting of the APS, Los Angeles.
- Feb 2005** “Simulating quantum systems with the time-dependent density matrix renormalization group”. Oregon State University, Corvallis, Oregon.
- Feb 2005** “Simulating quantum systems with the time-dependent density matrix renormalization group”. Virginia Commonwealth University, Richmond, Virginia.
- Nov 2004** “Simulating quantum systems with the time-dependent density matrix renormalization group”, Quantum Lunch Seminar at the Quantum Information Research Institute. Los Alamos National Laboratory.
- Oct 2004** “Recent developments and applications of the time-dependent density matrix renormalization group”, second CSULA/USC mini-workshop on numerical and experimental studies in condensed matter physics. California State University, L.A.
- Mar 2003** “Real time evolution using the density matrix renormalization group”, Condensed Matter group seminar, University of Southern California.
- Jan 2003** “Application of the density matrix renormalization group to strongly correlated electron problems”, Physics Department Colloquium, California State University, Los Angeles.

Participation in Workshops and Conferences:

- 2009 - Emergent Phenomena in Quantum Hall Systems (EPQHS3), Lucca, Italy.
- 2009 - The next generations of quantum simulations. Moorea, French Polynesia.
- 2009 - APS March Meeting, Pittsburgh, USA.
- 2009 - Low Dimensional Electron Systems Kavli Institute for Theoretical Physics, UC Santa Barbara, USA.
- 2009 - New Directions in Low-Dimensional Electron Systems (Conference) Kavli Institute for Theoretical Physics, UC Santa Barbara, USA.
- 2008 - Quantum Spin Hall Effect and Topological Insulators. Kavli Institute for Theoretical Physics, UC Santa Barbara, USA.
- 2008 - California Condensed Matter Theory Meeting. University of California, Riverside.
- 2008 - Topological Phases in Condensed Matter. Institute for Condensed Matter Theory, University of Illinois at Urbana-Champaign.
- 2008 - Quantum Magnetism 2008. University of Minnesota.
- 2007 - Moments and multiplets in Mott materials. Kavli Institute for Theoretical Physics, UC Santa Barbara, USA.
- 2007 - 46th Summer program at the Aspen Center for Physics: Topological Quantum Computation. Aspen, USA.
- 2007 - Fourth International School and Conference on Spintronics and Quantum Information Technology (SPINTECH IV). Maui, Hawaii, USA.
- 2007 - Strongly Correlated Phases in Condensed Matter and Degenerate Atomic Systems. Kavli Institute for Theoretical Physics, UC Santa Barbara, USA.
- 2007 - APS March Meeting, Denver, USA.
- 2006 - Fractional Quantum Hall Effect and topological phases of matter. Station Q Fall meeting. Kavli Institute for Theoretical Physics, UC Santa Barbara, USA.
- 2006 - Topological phases and quantum computation. Workshop and conference. Kavli Institute for Theoretical Physics, UC Santa Barbara, USA.
- 2006 - APS March Meeting, Baltimore, USA.
- 2005 - APS March Meeting, Los Angeles, USA.
- 2004 - APS March Meeting, Montreal, Canada.
- 2003 - APS March Meeting, Austin, USA.
- 2002 - APS March Meeting, Indianapolis, USA.
- 2001 - APS March Meeting, Seattle, USA.
- 1998 - X Workshop on Open Problems in Strongly Correlated Electron Systems. International Centre for Theoretical Physics (ICTP), Trieste, Italy.
- 1996 - Workshop on Strong Electron Correlation. International Centre for Theoretical Physics (ICTP), Trieste, Italy.

Professional Society Activities

- Active member of the American Physical Society.
- Regular referee of manuscripts for Physical Review Letters and Physical Review B and A.
- Referee of manuscripts for Modern Physics Letters B.
- Referee of manuscripts for J. Phys. A: Math. Gen.

Scientific Publications (900+ citations; h-index:14)

1. “Decay of Rabi oscillations by dipolar-coupled dynamical spin environments”
V. V. Dobrovitski, A. E. Feiguin, R. Hanson, D. D. Awschalom
arXiv:0904.0263. Phys. Rev. Lett. **102**, 237601 (2009)
2. “Exotic paired states with anisotropic spin-dependent Fermi surfaces”
A. E. Feiguin and M. P. A. Fisher
arXiv:0903.2656. Phys. Rev. Lett. (accepted)
3. “Real-time simulations of nonequilibrium transport in the single-impurity Anderson model”
F. Heidrich-Meisner, A.E. Feiguin, E. Dagotto
arXiv:0903.2414. Phys. Rev. B **79**, 235336 (2009).
4. “Quantum distillation: dynamical generation of low-entropy states of strongly correlated fermions in an optical lattice”
F. Heidrich-Meisner, S. R. Manmana, M. Rigol, A. Muramatsu, A. E. Feiguin, and E. Dagotto.
arXiv:0903.2017. Submitted to Phys. Rev. Lett.
5. “Numerical evidence for a $p_x - ip_y$ paired fractional quantum Hall state at $\nu = 12/5$ ”
Parsa Bonderson, A. E. Feiguin, Gunnar Moller, and J. K. Slingerland.
arXiv:0901.4965. Submitted to Phys. Rev. Lett.
6. “Spin polarization of the $\nu = 5/2$ quantum Hall state”
A. E. Feiguin, E. Rezayi, Kun Yang, C. Nayak, S. Das Sarma.
Phys. Rev. B. **79**, 115322 (2009), arXiv: 0804.4502.
7. “Transport through quantum dots: A combined DMRG and cluster-embedding study”
F. Heidrich-Meisner, G.B. Martins, K.A. Al-Hassanieh, A.E. Feiguin, G. Chiappe, E.V. Anda, E. Dagotto
Eur. Phys. J. B **67**, 527 (2009).
8. “Spectral properties of a partially spin-polarized one-dimensional Hubbard/Luttinger superfluid”
A. E. Feiguin, David. A. Huse
Phys. Rev. B **79**, 100507(R) (2009), arXiv:0809.3024.
9. “Pair correlations of a spin-imbalanced Fermi gas on two-leg ladders”
A. E. Feiguin, F. Heidrich-Meisner
arXiv:0809.1539. Phys. Rev. Lett. **102**, 076403 (2009).
10. “Topological confinement and superconductivity”
K.A. Al-Hassanieh, C. D. Batista, P. Segupta, and A. E. Feiguin.
arXiv:0808.3735. Submitted to Phys. Rev. Lett.
11. “Non-equilibrium transport through a point contact in the $\nu = 5/2$ non-Abelian quantum Hall state”
Adrian Feiguin, Paul Fendley, Matthew P.A. Fisher, Chetan Nayak
arXiv:0809.1415. Phys. Rev. Lett. **101**, 236801 (2008).

12. "Transport properties and Kondo correlations in nanostructures: the time-dependent DMRG method applied to quantum dots coupled to Wilson chains"
Luis G.G.V. Dias da Silva, F. Heidrich-Meisner, A. E. Feiguin, C. A. Busser, G. B. Martins, E. V. Anda, and E. Dagotto
Phys. Rev. B **78**, 195317 (2008).
13. "Decoherence dynamics of a single spin versus spin ensemble"
V.V. Dobrovitski, A.E. Feiguin, D.D. Awschalom, R. Hanson.
Phys. Rev. B **77**, 245212 (2008).
14. "Ground-state reference systems for expanding correlated fermions in one dimension"
F. Heidrich-Meisner, M. Rigol, A. Muramatsu, A. E. Feiguin, and E. Dagotto
Phys. Rev. A **78**, 013620 (2008).
15. "Collective states of interacting anyons in topological quantum liquids"
S. Trebst, E. Ardonne, A. E. Feiguin, D. A. Huse, A. W. W. Ludwig, M. Troyer
Phys. Rev. Lett. **101**, 050401 (2008)
16. "Dynamics of a single spin interacting with an adjustable spin bath"
R. Hanson, V.V. Dobrovitski, A.E. Feiguin, O. Gywat and D.D. Awschalom
Science 18 April 2008 320: 352-355. Published on-line at Science DOI: 10.1126/science.1155400 (March 2008).
17. "Excitons in the one-dimensional Hubbard model: a real-time study"
K.A. Al-Hassanieh, F. Reboredo, A.E. Feiguin, I.Gonzalez, and E. Dagotto
Phys. Rev. Lett. **100**, 166403 (2008)
18. "Spin polaron in the $J_1 - J_2$ Heisenberg model"
I.J. Hamad, A.E. Trumper, A.E. Feiguin, L.O Manuel
Phys. Rev. B **77**, 014410 (2008). arXiv:0710.5720
19. "Pairing states of a polarized Fermi gas trapped in a one-dimensional optical lattice"
A. E. Feiguin, F. Heidrich-Meisner
Phys. Rev. B **76**, 220508(R) (2007). Preprint: arXiv:0707.4172
20. "Density Matrix Renormalization Group study of incompressible fractional quantum Hall states"
A. E. Feiguin, E. Rezayi, C. Nayak, S. Das Sarma
Phys. Rev. Lett. **100**, 166803 (2008) arXiv:0706.4469
21. "Probing the pairing symmetry and pair charge stiffness of doped $t - J$ ladders"
A. E. Feiguin, S. R. White, D. J. Scalapino, and I. Affleck
Phys. Rev. Lett. **101**, 217001 (2008). cond-mat/0612636
22. "Interacting anyons in topological quantum fluids: The golden chain"
A. E. Feiguin, S. Trebst, A. W. W. Ludwig, M. Troyer, A. Kitaev, Z. Wang, and M. Freedman
Phys. Rev. Lett. **98**, 160409 (2007), cond-mat/0612341

23. “Universal emergence of the one-third plateau in the magnetization process of frustrated quantum spin- S chains”
F. Heidrich-Meisner, I. A. Sergienko, A. E. Feiguin, and E. Dagotto.
Phys. Rev. B **75**, 064413 (2007), cond-mat/0609555
24. “Cooper-pair transport through a Hubbard chain sandwiched between two superconductors: Density matrix renormalization group calculations”
A. E. Feiguin, Steven R. White, and D.J. Scalapino
Phys. Rev. B. **75**, 024505 (2007), cond-mat/0611297
25. “Adaptive time-dependent density-matrix renormalization-group technique for calculating the conductance of strongly correlated nanostructures”
K. A. Al-Hassanieh, A. E. Feiguin, J. A. Riera, C. A. Büsser, and E. Dagotto
Phys. Rev. B **73**, 195304 (2006)
26. “Finite-temperature density matrix renormalization using an enlarged Hilbert space”
A. E. Feiguin and S. R. White
Phys. Rev. B **72**, 220401 (2005)
27. “Time-step targeting methods for real-time dynamics using the density matrix renormalization group”
A. E. Feiguin and S. R. White
Phys. Rev. B **72**, 020404 (2005)
28. “Real time evolution using the density matrix renormalization group”
Steven R. White and Adrian E. Feiguin
Phys. Rev. Lett. **93**, 076401 (2004) (**80+ citations**)
29. “Anisotropy-induced ordering in the quantum $J_1 - J_2$ antiferromagnet”
T. Roscilde, A. E. Feiguin, A. L. Chernyshev, S. Liu, and S. Haas
Phys. Rev. Lett. **93**, 017503 (2004)
30. “Unveiling New Magnetic Phases of Undoped and Doped Manganites”
T. Hotta, M. Moraghebi, A. Feiguin, A. Moreo, S. Yunoki, and E. Dagotto
Phys. Rev. Lett. **90**, 247203 (2003) (**27 citations**)
31. “The spectral function for Mott insulating surfaces”
L. O. Manuel, C. J. Gazza, A. E. Feiguin and A. E. Trumper
J. Phys.: Condens. Matter **15** 2435-2440 (2003).
32. “Stripes induced by orbital ordering in layered manganites”
T. Hotta, A. Feiguin, and E. Dagotto
Phys. Rev. Lett. **86**, 4922 (2001). (**29 citations**)
33. “Resistivity of mixed-phase manganites”
M. Mayr, A. Moreo, Jose A. Verges, J. Arispe, A. Feiguin, and E. Dagotto,
Phys. Rev. Lett. **86**, 135 (2001). (**130+ citations**)
34. “Doped stripes in models for the cuprates emerging from the one-hole properties of the insulator”

- G. Martins, C. Gazza, J. C. Xavier, A. Feiguin, and E. Dagotto,
Phys. Rev. Lett. **84**, 5844 (2000). (**39 citations**)
35. “Giant cluster coexistence in doped manganites and other compounds”
A. Moreo, M. Mayr, A. Feiguin, S. Yunoki and E. Dagotto,
Phys. Rev. Lett. **84**, 5568 (2000). (**210+ citations**)
36. “Influence of finite Hund rules and charge transfer on properties of Haldane systems”
A.E.Feiguin, L.Arrachea, and A.A.Aligia.
Phys. Rev. **B 59**, 9916 (1999).
37. “Numerical study of the incommensurate phase in spin-Peierls systems”
A.E.Feiguin, J.Riera, A.Dobry, and H.A.Ceccatto.
Phys. Rev **B 56**, 14607 (1997). (**30+ citations**)
38. “The Hubbard model on a non-bipartite lattice: A slave-boson study”
A.E.Feiguin, C.J.Gazza, A.E.Trumper, H.A.Ceccatto.
J.Phys:Condensed Matter, **9**, L27 (1996).
39. “Spin stiffness of frustrated Heisenberg antiferromagnets: Finite size scaling”
A.E.Feiguin, C.J.Gazza, A.E.Trumper, H.A.Ceccatto.
Phys. Rev. **B 52**, 15043 (1995).
40. “Spin-Peierls dimerization and frustration in two-dimensional antiferromagnets”
A.E.Feiguin, C.J.Gazza, A.E.Trumper, and H.A.Ceccatto.
J.Phys.:Condensed Matter **6**, L503 (1994).

ARTICLES IN COLLECTIONS:

1. “Finite-size scaling analysis of spin correlations and fluctuations of two quantum dots in a T-shape geometry”
F. Heidrich-Meisner, G.B. Martins, K.A. Al-Hassanieh, A.E. Feiguin, E. Dagotto
Physica B **403**, 1544 (2008). Proceedings of SCES 2007.
2. “The ALPS project release 1.3: open source software for strongly correlated systems”
A.F. Albuquerque, et al. Journal of Magnetism and Magnetic Materials, **310**, 1187 (2007)
3. “Theory of manganites: the key role of phase segregation”
E. Dagotto, A. Feiguin and A. Moreo
Published as part of the book ”Open problems in strongly correlated electron systems”,
NATO Science Series: B Physics

BOOKS AND CHAPTERS IN BOOKS

1. “Monte Carlo simulations and application to Manganite models”. Chapter written in collaboration with Elbio Dagotto and G. Alvarez as part of the book “Nanoscale Phase Separation and Colossal Magnetoresistance. The Physics of Manganites and Related Compounds”, Springer Series in Solid-State Sciences , Vol. 136 (2002) Author: Elbio Dagotto

IN THE PRESS:

1. “Diamond ‘Spin-Bath’ Gives Crystal View of Quantum Ripples”. Scientific American, March 20 (2008).
2. “Physicists learn how quantum mechanical states break down”. Science Daily (<http://www.sciencedaily.com/releases/2008/03/080320173602.htm>)
3. “Physicists discover how fundamental particles lose track of quantum mechanical properties”. Physorg, March 2008. <http://www.physorg.com/news124636936.html>
4. “Physicists Show How Fundamental Particles Lose Quantum Mechanical Properties Through Environmental Interactions”. AZoNano. <http://www.azonano.com/news.asp?newsID=6086>
5. “The equivalent of a new quantum liquid?”. Physorg, May 2004. <http://www.physorg.com/news97494826.html>

Professional References

1. Prof. Elbio Dagotto.
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University of Maryland
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