

# David C. Roberts

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MS-B213, Center for Nonlinear Studies

Los Alamos National Laboratory

Los Alamos, NM 87544

USA

## EDUCATION

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- **Doctor of Philosophy, Physics**  
Advisor: Keith Burnett  
Merton College, Oxford University, U.K. (1999 – 2003)
- **Master of Engineering, Environmental Geophysics**  
Advisor: Donald Turcotte  
College of Engineering, Cornell University, Ithaca, NY, U.S. (1998 – 1999)  
Completed concurrently with Bachelor's degree.
- **Bachelor of Science, Engineering Physics**  
**Summa cum Laude**  
College of Engineering, Cornell University, Ithaca, NY, U.S. (1995 – 1999)

## SELECTED HONORS

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- **Feynman Fellowship** (2008 – Present)  
- Fellowship for independent research at Los Alamos National Laboratory
- **Director-funded Fellowship** (2006 – 2008)  
- Fellowship for independent research at Los Alamos National Laboratory
- **Marie Curie Fellowship** (2004 – 2006)  
- Two-year fellowship for independent research at a European University
- **Fondation des Treilles Scholarship** (2004)  
- Rewards outstanding scientific research in France
- **Marshall Scholarship** (1999 – 2002)  
- Awarded to 40 students per year in the U.S. to study in the U.K.
- **Cornell Tradition Fellowship** (1999)  
- Rewards commitment to work, community service, and academic achievement
- **Barry M. Goldwater Scholarship** (1997)  
- National undergraduate science scholarship

## RESEARCH EXPERIENCE

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### LONG TERM

- **Feynman Fellow, Director-funded Fellow** (2006 – Present)  
Theoretical Division / Center for Nonlinear Studies  
Los Alamos National Laboratory, Los Alamos, NM, U.S.
- **Research Associate** (2006)  
Lewis-Sigler Institute  
Princeton University, Princeton, NJ, U.S.
- **Marie Curie Fellow** (2004 – 2006)  
Laboratoire de Physique Statistique  
Ecole Normale Supérieure, Paris, France
- **PhD Candidate** (1999 – 2003)  
Department of Physics  
Oxford University, Oxford, U.K.
- **Research Assistant** (1996 – 1999)  
Cornell University, Ithaca, NY, U.S.
  - 1997 – 1999: Department of Earth and Atmospheric Sciences
  - 1996 – 1997: Department of Astronomy

### SHORT TERM

- **Kavli Institute for Theoretical Physics**, Santa Barbara (October – November 2008)
- **Universidad de Chile**, Santiago, Chile (October 2007)  
Department of Physics, Dr Sergio Rica
- **University of Queensland**, Brisbane, Australia (June 2006)  
ARC Centre of Excellence for Quantum Atom Physics, Dr Matthew Davis
- **Tokyo Institute of Technology**, Tokyo, Japan (October – November 2005)  
Department of Physics, Prof. Masahito Ueda
- **University of Arizona**, Tucson, AZ, U.S. (January – March 2005)  
Department of Mathematics, Prof. Yves Pomeau
- **University of Capetown**, Capetown, South Africa (June – September 1999)  
Relativity and Cosmology group, Prof. George F. Ellis
- **Oxford University**, Oxford, U.K. (June – August 1998)  
Department of Applied Mathematics, Dr. Lenny Smith
- **University of Colorado**, Boulder, CO, U.S. (June – August 1997)  
Center for Astrophysics and Space Astronomy, Prof. J. Michael Shull

- **University of Sussex**, Brighton, U.K. (September – December 1996)  
Department of Physics and Astronomy, Dr. Peter Thomas
- **NASA**, Huntsville, AL, U.S. (June – August 1996)  
Marshall Space Flight Center, Dr. Martin Sulkanen

## TEACHING EXPERIENCE

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- **Student Mentor** at Los Alamos National Laboratory for:
  - Andrew Sykes (graduate), September 2007 – Present  
“Superfluidity in one dimension”
  - Mark Herrera (undergraduate), Summer 2007, Summer 2008  
“A network physics approach to the evolution of scientific ideas”
- **Lecturer** on “Spontaneous synchronization of coupled oscillators” for the Los Alamos National Laboratory Summer School Program, Los Alamos National Laboratory, Los Alamos, U.S. (2008)
- **Lecturer** on “Quantum weirdness at zero temperature” for the Los Alamos National Laboratory Summer School Program, Los Alamos National Laboratory, Los Alamos, U.S. (2007)
- **College Lecturer** for Thermodynamics/Kinetic Theory sequence at St Peter’s and St Hilda’s Colleges at Oxford University, Oxford, U.K. (Fall 2000)
- **Course Assistant** for ‘Physics for Engineers’ sequence comprised of mechanics, electricity and magnetism, and waves and optics, Cornell University, Ithaca, NY, U.S. (1997 – 1999)
- **Lecturer** for AP physics classes on the evolution of the universe and black holes, Ithaca High School, Ithaca, NY, U.S. (1997)
- **Teaching Assistant** for low income primary schoolchildren with learning disabilities, Falmer School, Falmer, U.K. (1996)

## ACADEMIC SERVICE

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- **Member, review team for the Laboratory Directed Research and Development – Exploratory Research; Atomic, Molecular, and Quantum Physics Category** (2008)  
Los Alamos National Laboratory, Los Alamos, NM, U.S.
- **Member, Center for Nonlinear Studies colloquium committee** (2007 – 2008)  
Los Alamos National Laboratory, Los Alamos, NM, U.S.
- **Organizer, Center for Nonlinear Studies student seminar series** (Summer 2007)  
Los Alamos National Laboratory, Los Alamos, NM, U.S.
- **Section Editor, Journal of Young Investigators** (1997 – 1998)
  - Served as section editor in the physical sciences and mathematics section, overseeing 10 associate editors

- **U.S. Representative, IAPS** (Summer 1998)  
- A position on the International Association of Physics Students (IAPS) Board in Coimbra, Portugal, obtained through a competitive selection process
- **President, Society of Physics Students, Cornell University Chapter** (1997 – 1999)  
- Organized lectures, planned social activities, and collected resources for students in the society

#### SELECTED SEMINARS AND PRESENTATIONS

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- Workshop on “The Theory and Practice of Fluctuation-induced Interactions”, Kavli Institute for Theoretical Physics, Santa Barbara (October – November 2008).
- Workshop on “Supersolids: recent results”, Fondation des Treilles, Tourtour, France (July 2008). Invited speaker.
- Conference on “Network Synchronization: From dynamical systems to neuroscience”, Lorentz Center, Leiden University, Netherlands (May 2008)
- Department of Physics, Universidad de Chile, Santiago, Chile (October 2007)
- Conference on “Nonlinear Dynamics and Chaos: Advances and perspectives”, University of Aberdeen, U.K. (September 2007)
- Dynamics Days, Boston, MA, U.S. (January 2007)
- ARC Centre of Excellence for Quantum Atom Optics, University of Queensland, Australia (June 2006)
- Lewis-Sigler Institute for Integrative Genomics, Princeton University, NJ, U.S. (April 2006)
- Department of Physics, University of Kaiserslautern, Germany (December 2005)
- Department of Physics, Kyoto University, Japan (November 2005)
- Department of Physics, Tokyo Institute of Technology, Japan (October 2005)
- EuroConference on “Ultracold Gases and their Applications”, San Feliu de Guixols, Spain (September 2005)
- Conference on “Few and Many-body Physics in Quantum Liquids and Gases”, Institute for Nuclear Theory, University of Washington, WA, U.S. (August 2005)
- Department of Physics, Harvard University, MA, U.S. (June 2005)
- Ultracold Atom Group, Laboratoire Kastler Brossel, Ecole Normale Supérieure, France (June 2005)
- Laboratoire de Physique Théorique et Modèles Statistiques, Université Paris-Sud (Orsay), France (May 2005)

- Mathematical Physics Group, Department of Mathematics, University of Arizona, AZ, U.S. (February 2005)
- Journées du LPS (Laboratoire de Physique Statistique), Institut Henri Poincaré, France (September 2004)
- Relativity and Cosmology Group, University of Capetown, South Africa (1999)  
- Seminar: A solution to the graceful exit problem in string cosmology
- ICPS (International Conference of Physics Students), Coimbra, Portugal (1998)  
- Seminar: Chaos in the Forest Fire Model

## PUBLICATIONS

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### PRE-PRINTS

27. *Induced interaction and crystallization of self-localized impurity fields in a Bose-Einstein condensate.*  
S. Rica and D.C.R. arXiv:0904.1569.
26. *Mapping the evolution of scientific ideas.*  
M. Herrera, D.C.R. and N. Gulbahce. arXiv:0904.1234.
25. *Drag force on an impurity below the superfluid critical velocity in a quasi-one-dimensional Bose-Einstein condensate.*  
A.G. Sykes, M.J. Davis and D.C.R. arXiv:0904.0995.
24. *Predicting individual drug response in a panel of 104 genotyped and expression-profiled yeast strains.*  
D.M. Ruderfer, D.C.R., E.O. Perlstein, S.L. Schreiber and L. Kruglyak.

### PEER-REVIEWED JOURNAL ARTICLES

23. *When superfluids are a drag..*  
D.C.R. Accepted to Contemporary Physics.
22. *Impurity crystal in a Bose-Einstein condensate..*  
D.C.R. and S. Rica. Accepted to Phys. Rev. Lett. arXiv:0812.0079.
21. *A linear path toward synchronization: Anomalous scaling in a new class of exactly solvable Kuramoto models.*  
D.C.R. and R. Teodorescu. Eur. Phys. J. S. T. 165, 103-109 (2008).
20. *On the hydrodynamic boundary condition for superfluid flow.*  
Y. Pomeau and D.C.R. Phys. Rev. B 77, 144508 (2008).
19. *A linear reformulation of the Kuramoto model of self-synchronizing oscillators.*  
D.C.R. Phys. Rev. E 77, 031114 (2008).
18. *Genetic basis of individual differences in the response to small molecule drugs.*  
E.O. Perlstein, D.M. Ruderfer, D.C.R., S.L. Schreiber and L. Kruglyak. Nature Genetics, 39, 496 (2007).

17. *Finite-time collapse of  $N$  classical fields described by coupled nonlinear Schrödinger equations.*  
D.C.R. and A. Newell. Phys. Rev. E. 74, 047602 (2006).
16. *Force on a moving point impurity due to quantum fluctuations in a Bose-Einstein condensate.*  
D.C.R. Phys. Rev. A. 74, 013613 (2006).
15. *Stability analysis for  $n$ -component Bose-Einstein condensate.*  
D.C.R. and M. Ueda. Phys. Rev. A. 73, 053611 (2006).
14. *Probing temperature and damping rates in Bose-Einstein condensates through dephasing in electromagnetically induced transparency conditions.*  
D.C.R. Phys. Rev. A. 72, 065602 (2005).
13. *Casimir-like force arising from quantum fluctuations in a slow-moving dilute Bose-Einstein condensate.*  
D.C.R. and Y. Pomeau. Phys. Rev. Lett. 95, 145303 (2005).
12. *Probing states in the Mott insulator regime in the case of coherent bosons trapped in an optical lattice.*  
D.C.R. and K. Burnett. Phys. Rev. Lett. 90, 150401 (2003).
11. *Limitations of light delay and storage times in EIT experiments with condensates.*  
D.C.R., T. Gasenzer and K. Burnett. Phys. Rev. A. 66, 023801 (2002).
10. *Exciting relative number squeezed particles from condensates using stimulated light scattering.*  
D.C.R., T. Gasenzer and K. Burnett. J. Phys. B. 35, L113 (2002).
9. *Limitations of entanglement between photons and atoms coupled out from a Bose-Einstein condensate.*  
T. Gasenzer, D.C.R. and K. Burnett. Phys. Rev. A. 65, 021605 (R) (2002).
8. *A solution to the graceful exit problem in pre-big bang cosmology.*  
G.F.R. Ellis, D.C.R., D. Solomons and P. Dunsby. Phys. Rev. D, 62 (8), 084004 (2000).
7. *The metagalactic ionizing radiation at low redshift.*  
J.M. Shull, D.C.R., M. Giroux and S. Penton. Astron. Journal, 118, 1450 (1999).
6. *Catastrophic resurfacing and episodic subduction of Venus.*  
D.L. Turcotte, G. Morein, D.C.R. and B. Malamud. Icarus, 139, 49 (1999).
5. *Fractality and self-organized criticality of wars.*  
D.C.R. and D.L. Turcotte. Fractals, 6, n. 4, 351-357 (1998).

#### PEER-REVIEWED BOOK CONTRIBUTIONS

4. *Casimir Friction I: Friction of the vacuum on a spinning dielectric.*  
Y. Pomeau and D.C.R. Modern Encyclopedia of Mathematical Physics (MEMPhys), Irina Aref'eva and Daniel Sternheimer, Eds. Heidelberg: Springer Verlag (To appear in 2009). arXiv:0704.2194.
3. *Casimir Friction II: Casimir effect on drag in zero temperature superfluids.*  
D.C.R. and Y. Pomeau. Modern Encyclopedia of Mathematical Physics (MEMPhys), Irina Aref'eva and Daniel Sternheimer, Eds. Heidelberg: Springer Verlag (To appear in 2009). cond-mat/0503757.
2. *A linear path towards self-synchronization: Analysis of the fully locked transition of the Kuramoto model.*  
D.C.R and R. Teodorescu. Proceedings of the First International Workshop on Nonlinear Dynamics and Synchronization INDS'08, Kyandoghere Kyamakya, Ed. Aachen: Shaker Verlag (2008). pp 184-187.
1. *Earthquakes: friction or a plastic instability?*  
D.C.R. and D.L. Turcotte. Geocomplexity and the physics of earthquakes, J.B. Rundle, D.L. Turcotte and W. Klein, Eds. Washington, DC: American Geophysical Union (2000). pp 97-103.