

Chris H. Rycroft

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Personal details

Full name: Christopher Harley Rycroft

Gender: Male

Date of Birth: March 7th 1980

Place of Birth: Blackpool, Lancashire, United Kingdom

Nationality: British

Marital Status: Single

Positions

2007–present *Department of Mathematics, Lawrence Berkeley National Laboratory*
Department of Mathematics, University of California, Berkeley

Working with Prof. Jon Wilkening and Prof. James Sethian as a Visiting Postdoctoral Fellow.

Education

2002–2007 *Massachusetts Institute of Technology* *Ph.D. Mathematics*

Attended the graduate program at MIT on the Robert M. Rose Presidential Fellowship. Completed a doctorate in mathematics under the supervision of Prof. Martin Z. Bazant, carrying out research into granular flow and granular materials, with an emphasis on high-performance parallel simulation and multiscale modeling.

2001–2002 *Pembroke College, University of Cambridge* *Certificate of Advanced Studies in Mathematics*

Completed the Part III Mathematical Tripos: a one year course equivalent to a Masters. Specialized in general relativity, black holes, and cosmology and their links with differential geometry. Also took courses in population dynamics, quantum information theory, and computer aided geometric design. Attained grade of distinction.

1998–2001 *Pembroke College, University of Cambridge* *B.A. (Hons) Mathematics*

<i>Date</i>	<i>Examination</i>	<i>Grade</i>
June 1999	Part Ia Mathematics	First
June 2000	Part Ib Mathematics	First
June 2001	Part II(B) Mathematics	First

Awarded Legg Prize, Summer 1999. Elected to a Foundation Scholarship, Summer 2000. Awarded Foundress Prize, Summer 2001.

1991–1998 *Keswick School, Keswick, Cumbria*

Achieved five A-levels in Mathematics, Further Mathematics, Physics, Geography and General Studies, and one AS-level in Statistics: all grade A. Took STEP Mathematics papers II and III in June 1998: both grade S.

Experience

2007–2009 *Department of Physics, University of California – Santa Barbara* *Academic Visits*

Make regular visits to work with Prof. Jim Langer (Department of Physics) and Prof. Frederic Gibou (Departments of Mechanical Engineering and Computer Science). Carrying out continuum simulations using the STZ model of amorphous plasticity.

Spring 2008 *Quest Productions and Kikim Media* *Scientific Consulting*

Worked on the script for the NOVA documentary *Hunting the hidden dimension*, broadcast on PBS on October 28, 2008. (<http://www.pbs.org/wgbh/nova/fractals/>)

Summer 2006 *Idaho National Laboratory, Idaho Falls* *Academic Visit*

Participated in a month-long visit to the Idaho National Laboratory to collaborate on the modeling of granular flow in a pebble-bed nuclear reactor.

Summer 2001 *International Undergraduate Summer School, University of Cambridge* *Summer Student*

Participated in the PPARC-funded summer school in particle physics and astronomy based at the Institute of Astronomy, University of Cambridge. Attended a two week lecture program by distinguished professors from the Cavendish Laboratory and the Centre for Mathematical Sciences. Carried out a four week research project into numerical simulations of globular cluster interactions under the supervision of Dr. Sverre Aarseth.

Summer 1999 *West Lakes Research Institute, Cumbria, United Kingdom* *Employment*

Worked on an eight-week student placement in computational epidemiology. Studied the effect of 'errors in variables' whereby inaccuracies in radiation dose measurements can lead to an underestimate of cancer risk. Wrote a computer program to correct for this, which was applied to the Hiroshima and Nagasaki A-bomb survivor cohort, and dose records for workers in the UK nuclear industry.

Journal publications

Chris H. Rycroft, Yeelok Wong, and Martin Z. Bazant, *Fast spot-based multiscale simulations of granular flow*, submitted to Powder Technology.

Chris H. Rycroft, *Voro++: a three-dimensional Voronoi cell library in C++*, to appear in Chaos, December 2009.

Chris H. Rycroft, Ashish V. Orpe, and Arshad Kudrolli, *Physical test of a particle simulation model in a sheared granular system*, Phys. Rev. E. **80**, 031305 (2009).

Chris H. Rycroft, Ken Kamrin, and Martin Z. Bazant, *Assessing continuum relationships in simulations of granular flow*, J. Mech. Phys. Solids. **57**, 828–839 (2009).

Ken Kamrin, Chris H. Rycroft, and Martin Z. Bazant, *The Stochastic Flow Rule: A Multi-Scale Model for Granular Plasticity*, Modelling Simul. Mater. Sci. Eng. **15**, S449–S464 (2007).

Chris H. Rycroft, Gary S. Grest, James W. Landry, and Martin Z. Bazant, *Analysis of Granular Flow in a Pebble-Bed Nuclear Reactor*, Phys. Rev. E **74**, 021306 (2006).

Chris H. Rycroft, Martin Z. Bazant, James W. Landry, and Gary S. Grest, *Dynamics of Random Packings in Granular Flow*, Phys. Rev. E **73**, 051306 (2006).

Other publications

Chris H. Rycroft, Matthias Koeppel, and Fumei Lam, *Recombination Lower Bounds for Missing and Circular Data: A Branch and Bound Approach*, submitted to RECOMB 2010.

Chris H. Rycroft, *Voro++: a three-dimensional Voronoi cell library in C++*, January 23rd 2009, Lawrence Berkeley National Laboratory, Paper LBNL-1430E.

Software

Proficient in C++, C, Perl, Fortran 90, Pascal, Maple, and BASIC. Experienced in parallel programming using the MPI library. Proficient in molecular visualization via Raster3D and POV-Ray.

Author of Voro++ – a software library for three-dimensional cell-based calculations of the Voronoi tessellation. (<http://math.lbl.gov/voro++/>)

Coauthor of RCBranch – a software library for branch and bound calculations of lower recombination bounds. (<http://math.lbl.gov/rcbranch/>)

Contributing author of PSLIB – a library for pseudospectral methods. (<http://www.princeton.edu/~ktchu/software/pslib.html>)

Wrote serial and parallel simulations in C++ to provide a general framework for simulating the spot model. Extensive experience running granular simulations using the Large-scale Atomic/Molecular Massively Parallel Simulator developed at Sandia National Laboratories (<http://lammps.sandia.gov/>).

Good knowledge of HTML/CSS. Created and maintained the Dry Fluids group website (<http://math.mit.edu/dryfluids/>) and redesigned the Simple Person's Applied Math Seminar website (<http://math.mit.edu/spams/>).

Invited seminars

- Multiscale Modeling in Granular Flow*, Complex Fluids Seminar, University of Michigan, May 2, 2008.
- Multiscale Modeling in Granular Flow*, Department of Physics, University of California – Santa Barbara, April 4, 2007.
- Multiscale Modeling in Granular Flow*, Department of Applied and Computational Mathematics, Caltech, March 30, 2007.
- Multiscale Modeling in Granular Flow*, Department of Physics, Clark University, March 19, 2007.
- Multiscale Modeling in Granular Flow*, Department of Mathematics, University of California – Berkeley, February 28, 2007.

Invited conference talks

- Real-time control of mixing in dense granular flow*, Bay Area Scientific Computing Day, Lawrence Berkeley National Laboratory, Berkeley, May 9, 2009.
- A multiscale simulation technique for granular flow*, Canadian Mathematical Society Winter 2008 Meeting, Ottawa, December 6–8, 2008.
- A coupled continuum/discrete model of dense granular flow*, Bay Area Scientific Computing Day, MSRI, Berkeley, March 29, 2008.

Contributed conference talks

- Anisotropies in granular temperature in a dense sheared granular flow*, APS March Meeting, Pittsburgh, March 16–20, 2009.
- A multiscale simulation technique for granular flow*, IMA Conference on Dense Granular Flows, Isaac Newton Institute, University of Cambridge, January 5–9, 2009.
- A multiscale simulation of dense granular flow*, Greater Boston Statistical Mechanics Meeting, October 18, 2008.
- A multiscale simulation technique for optimization of granular mixing*, Applied Mathematics Principal Investigators Meeting, October 15–17, 2008.
- Defining and measuring a granular continuum element*, 5th Northeast Granular Workshop, University of Massachusetts, Amherst, June 1, 2007.
- Stress, Strain Rate, and Packing Fraction in Granular Flow*, APS March Meeting, Denver, March 2007.
- Stress, Strain Rate, and Packing Fraction in Granular Flow*, 29th New England Complex Fluids Workshop, Harvard University, December 1, 2006.
- Voronoi Volumes in Dense Granular Flow*, APS March Meeting, Baltimore, March 2006.
- Discrete Element Simulations of Granular Flow in a Pebble Bed Nuclear Reactor*, 24th New England Complex Fluids Workshop, Brandeis University, September 16, 2005.
- Dynamics of Random Packings in Granular Flow*, APS March Meeting, Los Angeles, March 2005.
- Toward a Theory of Diffusion in Dense Granular Flow*, 20th New England Complex Fluids Workshop, Brandeis University, September 24, 2004.
- Toward a Theory of Diffusion in Dense Granular Flow*, APS March Meeting, Montreal, Canada, March 2004.

Seminars at MIT

Multiscale Modeling in Granular Flow, Thesis Defense, MIT, June 26, 2007.

Understanding Granular Flow through the Intermediate Length Scale, Simple Person's Applied Math Seminar, MIT, February 22, 2007.

High Performance Parallel Computing: A Beginner's Guide, Simple Person's Applied Math Seminar, MIT, October 5, 2006.

The Lighter Side of Black Holes, Simple Person's Applied Math Seminar, MIT, March 23, 2006.

The Life of Pi, Simple Person's Applied Math Seminar, MIT, November 15, 2005.

Fractals and Chaos: A Graphical Overview, Simple Person's Applied Math Seminar, MIT, April 7, 2005.

Dynamics of Random Packings in Granular Flow, Applied Mathematics Brown Bag Seminar Series, MIT, November 11, 2004.

Quantum Computation and Information: A Simple Introduction, Simple Person's Applied Math Seminar, MIT, April 8, 2004.

Granular Drainage: Theory and Simulation, Applied Mathematics Brown Bag Seminar Series, MIT, October 17, 2003.

Poster presentations

Voro++: A three-dimensional Voronoi cell library in C++, Bay Area Scientific Computing Day, Lawrence Berkeley National Laboratory, Berkeley, May 9, 2009.

Voro++: A three-dimensional Voronoi cell library in C++, APS March Meeting, Pittsburgh, March 16–20, 2009. Selected as a winning entry in the APS Gallery of Nonlinear Images.

Toward a Theory of Diffusion in Dense Granular Flows, Gordon Research Conference on Granular and Granular-Fluid Flow, Colby College, June 2004.

Toward a Theory of Diffusion in Dense Granular Flows, 2nd New England Granular Materials Workshop, Yale University, June 3, 2004.

Diffusion and Mixing in Granular Flow: Theory and Experiment (with Jaehyuk Choi), October 28, 2003.

Analysis of Stochastic Models for Granular Drainage, 1st New England Granular Materials Workshop, July 18, 2003.

Teaching

Carried out teaching assistantships for six semesters at MIT, providing support to five graduate classes and two undergraduate classes:

<i>Semester</i>	<i>Class</i>	<i>Instructor</i>
Spring 2007	18.311 Principles of Applied Mathematics (undergraduate)	Prof. Martin Bazant
Fall 2006	18.366 Random Walks and Diffusion	Prof. Martin Bazant
Spring 2006	18.337 Applied Parallel Computing	Prof. Alan Edelman
Spring 2005	18.366 Random Walks and Diffusion	Prof. Martin Bazant
Spring 2005	18.311 Principles of Applied Mathematics (undergraduate)	Prof. Martin Bazant
Spring 2004	18.336 Numerical Methods of Applied Mathematics II	Dr. Plamen Koev
Fall 2003	18.435 Quantum Computation	Prof. Peter Shor

**Professional
activities**

Reviewer for *Physical Review E*, the *Journal of the Mechanics and Physics of Solids*, and *Physics of Fluids*. Member of American Physical Society.

Interests

Keen hiker, particularly in the English Lake District and the New Hampshire White Mountains. Strong interest in long distance running; completed Chicago Marathon in October 2005.

Organizer of the MIT Simple Person's Applied Math Seminar, 2005–2006. Organizer of the Berkeley Applied Math Seminar, 2008–2009.