

Seungoh Ryu is a physicist with expertise in the area of theoretical condensed matter & statistical physics, diffusion, fluid flow and interfacial phenomena in complex porous media and micro-fluidic devices. He developed massively parallelized random walks and Lattice Boltzmann simulation codes for fluid in rocks. Earlier, he had experimental training in thermal properties of superconductors at one of the top groups in the field. He has a long history of close and fruitful collaboration with experimental colleagues in both academia and industry. He coauthored patents in the geophysical applications of NMR and MEMS devices, and is proficient in the objected-oriented programming, parallel computation and visualization techniques on various platforms. He is a published software developer for Macintosh and iOS mobile platforms.

## EXPERIENCE

**Founder & Chief Programmer**, iStormApps, 2011–Present

[www.istormapps.com](http://www.istormapps.com); Development of mobile Apps for the iOS platform (iPhone & iPad).

**Senior Research Scientist**, Porous Media and Bio-inspired Systems, Schlumberger Doll Research, 2007–2010

Massively parallel Lattice Boltzmann simulation on a BlueGene/P machine. Modeling of transport through porous media using high resolution X-ray microtomography. Parallelized random walk modeling of diffusion in porous media. Theory of relaxation dynamics in porous media under inhomogeneous, mixed boundary conditions. Modeling of micro-fluidic MEMS device in confined geometries. Led a group of experimental and theoretical colleagues in a systematic investigation of NMR relaxometry in various rocks and its temperature dependence.

**Senior Research Scientist**, NMR, Schlumberger Doll Research, 2000–2007

Developed novel Non-resonant NMR probe for bore-hole application. Developed random fractal model of carbonate pore geometry. Developed theory for interpreting stimulated spin echo/ NMR relaxometry as a probe of pore geometry and restricted diffusion.

**Research Scientist**, EMG, Schlumberger Doll Research, 1997–2000

# Seungoh Ryu

# Curriculum Vitae

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Initiated numerical modeling project for geophysical applications. Developed microscopic theory of interface enhanced relaxation of proton spin magnetization in porous media.

**Postdoctoral Research Fellow**, Ohio State University, Columbus, 1995–1997

Langevin dynamics of flux lattice melting transition. Dynamics of driven vortices in 2D/layered superconductors.

**University President's Postdoctoral Fellow**, Ohio State University, Columbus, 1994–1995

Nonlinear dynamics of Josephson junction arrays. Theoretical study on the nature of disordered vortex glass phase in high temperature superconductors.

**Visiting Scientist** Theoretical division (T11), Los Alamos Lab, Los Alamos, 1994

## EDUCATION

**Stanford University, Applied Physics, PhD in Theoretical Condensed Matter Physics**

Computer Simulation Studies of Flux Lines in Model Layered Superconductor, Advisors: Sebastian Doniach/Aharon Kapitulnik

**Seoul National University, Physics, MS in Experimental Condensed Matter Physics**

Electronic structure of Thorium- and Uranium Compounds studied by Photoelectron Spectroscopy, Advisor: Professor Se-Jung Oh

**Seoul National University, Physics, BS**

## SKILLS

Objective oriented programming using C++, obj-C & Cocoa; Large scale visualization/animations using OpenGL, QuickTime; GUI commercial software development (iStorm, iChalk: realtime collaboration) on OS X platform; Parallelization using Distributed Objects, MPI, and pthreads; Large scale parallel simulations using C/MPI on BlueGene/P system using 1000+ processors; iOS mobile App development.

## REFERENCES

Dr. David Linton Johnson, Schlumberger Doll Research  
Dr. Larry Schwartz, Schlumberger Doll Research (retired)  
Professor Aharon Kapitulnik, Stanford University  
Professor Sebastian Doniach, Stanford University

## PUBLICATIONS [ pdf of select papers are available from [www.istormapps.com/cv/](http://www.istormapps.com/cv/) ]

S. Ryu, W. Zhao, G. Leu, P. Singer, H. Cho, Y. Keehm, Numerical modeling of complex porous media for borehole application, in Advances in Computed Tomography for Geomaterials, Edited by K. Alshibli and A. Reed, Wiley, 2010. [pdf] [[amazon.com](http://amazon.com)]

S. Ryu, D. L. Johnson, Aspects of diffusion relaxation dynamics with a non-uniform, partially absorbing boundary in general porous media, **Physical Review Letters**, 103, 118701, 2009. [pdf]

S. Ryu, Effects of inhomogeneous partial absorption and the geometry of the boundary on the population evolution of molecules diffusing in general porous media, **Physical Review E**, 80, 026109, 2009. [pdf]

S. Ryu, Effects of inhomogeneous surface relaxivity, pore geometry and internal field gradient on NMR logging: exact and perturbative theories and numerical investigations, paper JJJ, proceedings **SPWLA**, 2009. [pdf]

H. Cho, S. Ryu, J. Ackerman, Y. Song, Visualization of inhomogeneous local magnetic field gradient due to susceptibility contrast, **J. Mag. Res.**, 198, 88, 2009. [pdf]

S. Ryu, Numerical modeling of the carbonate and the sandstone formations, **Diffusion Fundamentals**, 10, 17.1-3, 2009. [pdf]

Y. Song, L. Zielinski, S. Ryu, Two-dimensional NMR of diffusion systems, **Physical Review Letters**, 100, 248002, 2008. [pdf]

S. Ryu, Effects of spatially varying surface relaxivity and pore shape on NMR logging, paper BB, Proceedings **SPWLA**, 2008. [pdf]

C. Harrison, A. Fornari, H. Chen, S. Ryu, A. Goodwin, K. Hsu, F. Marty, I. Papautsky, W. Wang, A microfluidic MEMS sensor for measurement of density and viscosity at high pressure, **SPIE** 6465, U-13, 2007. [[pdf](#)]

C. Harrison, S. Ryu, A. Goodwin, K. Hsu, E. Donzier, F. Marty, B. Mercier, D. Tanner, R. Ramesham, A MEMS sensor for the measurement of density-viscosity for oilfield applications, **SPIE** 6111, D-11, 2006. [[pdf](#)]

B. Audoly, P. N. Sen, S. Ryu, Y.-Q. Song, Correlation functions for inhomogeneous magnetic field in random media with application to a dense random pack of spheres, **J. of Mag. Res.**, 164, 154, 2003. [[pdf](#)]

L. J. Zielinski, Y. Song, S. Ryu, P. N. Sen, Characterization of coupled pore systems from the diffusion eigenspectrum, **J. Chem. Phys.**, 117, 5361, 2002. [[pdf](#)]

T. Brill, S. Ryu, R. Gaylor, J. Jundt, D. Griffin, Y. Song, P. Sen, M. Hurlimann, Nonresonant multiple spin echoes, **Science**, 297, 369, 2002. [[pdf](#)]

S. Ryu, Probing pores using elementary Quantum mechanics, **Mag. Res. Imag**, 19, 411, 2001. [[pdf](#)]

Y. Song, S. Ryu, P. Sen, Determining multiple length scales in rocks, **Nature**, 406, 178, 2000. [[pdf](#)]

S. Ryu, D. Stroud, Nature of the Low Field Transition in the Mixed State of High Temperature Superconductors, **Physical Review B**, 57, 14476, 1998. [[pdf](#)]

S. Ryu, D. Stroud, Numerical simulations of magnetic properties of high temperature superconductors, invited contribution to Superconducting state in magnetic fields, edited by C. de Melo, World Scientific, Singapore, 1998. [[google books](#)] [[amazon.com](#)]

B. J. Kim, M. Y. Choi, S. Ryu, D. Stroud, Anomalous relaxation in the XY gauge glass, **Physical Review B**, 1997.

S. Ryu, D. Stroud, Magnetization Jump in a Model for Flux Lattice Melting at Low Magnetic Fields, **Physical Review Letters**, 78, 4629, 1997. [[pdf](#)]

S. Ryu, M. Hellerqvist, S. Doniach, A. Kapitulnik, D. Stroud, Dynamical Phase Transition in a Driven Disordered Vortex Lattice, **Physical Review Letters**, 77, 5114, 1996. [[pdf](#)]

S. Ryu, A. Kapitulnik, S. Doniach, Field-driven topological glass transition in a model flux line lattice, **Physical Review Letters**, 77, 2300, 1996. [[pdf](#)]

I. J. Hwang, S. Ryu, D. Stroud, Screening in Josephson junction ladders, **Physical Review B**, 53, R506, 1996. [[pdf](#)]

D. Stroud, I. J. Hwang, S. Ryu, Simulations of Shapiro steps in Josephson junction arrays, **Physica B**, 222, 331, 1996.

S. Ryu, D. Stroud, First order melting and dynamics of flux lines in a model for YBCO, **Physical Review B**, 54, 1320, 1996. [[pdf](#)]

S. Ryu, W. Yu, D. Stroud, Dynamics of an underdamped Josephson junction ladder, **Physical Review E**, 53, 2190, 1996.

S. Doniach, S. Ryu, A. Kapitulnik, Vortex lattice melting, pinning and kinetics, **J. Low Temp. Phys.**, 95, 353, 1994.

S. Ryu, A. Kapitulnik, S. Doniach, The nature of long range order in the vortex lattice of high T<sub>c</sub> superconductors, Invited Paper, **SPIE**, 2157, 12, 1994.

S. Ryu, A. Kapitulnik, S. Doniach, Effects of Columnar Pins on the Flux Line Dynamics, **Physical Review Letters**, 71, 4245, 1993. [[pdf](#)]

S. Ryu, S. Doniach, G. Deutcher, A. Kapitulnik, Monte Carlo Simulation of Flux Lattice Melting in a Model High Superconductor, **Physical Review Letters**, 68, 710, 1992. [[pdf](#)]

M. Hellerqvist, S. Ryu, L. W. Lombardo, A. Kapitulnik, Vortex decoupling crossover in BSCCO, **Physica C**, 230, 170, 1994.

X. D. Xu, J. G. Fanton, G. S. Kino, S. Ryu, D. B. Mitzi, A. Kapitulnik, Thermal diffusivity of BSCCO Single crystals, **Physica C**, 218, 417, 1993.

S. Ryu, S. Doniach, A. Kapitulnik, G. Deutcher, Simulations of vortex lattice melting: evidence for two melting transitions, **Phenomenology and applications of high temperature superconductors**, edited by K. S. Bendell et al, Addison-Wesley, 1991.

C. B. Eom, J. Z. Sun, S. Ryu, S. S. Laderman, K. Yamamoto, A. Kapitulnik, T. Geballe, Orientation dependent resistive transition broadening in magnetic field of YBCO thin films, **Physica C**, 162, 605, 1989.

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J. Park, S. Ryu, M. Han, S. Oh, Charge transfer satellite in the 2p core level photoelectron spectra of heavy transition-metal dihalides, **Physical Review B**, 37, 10867, 1988.

## PATENTS

Harrison, Goodwin, Chen, Angelescu, Fornari, Giroux, Etchart, Ryu, Hsu, Jundt, Sullivan, Microfluidic downhole density and viscosity sensor, 60.1620.US NP, 2008. under review, (US filed in 2007; PCT filed in 2008) [[pdf](#)]

Song, Ryu, Nuclear magnetic resonance method and apparatus for determining pore characteristics of rocks and other porous materials, awarded US **6369567 B1**. [[pdf](#)]

Hurlimann, Song, Ryu, Sen, Magnetic resonance logging method and apparatus, awarded US **6133735 A**. [[pdf](#)]

## PRESENTATIONS

Numerical Modeling of Complex Porous Media For Borehole Applications: NMR-response and Transport in the Carbonate and Sandstone Rock, S. Ryu, W. Zhao, G. Leu, P. Singer, H. Cho, Y. Keehm, GEOX2010, New Orleans, USA, 2010.

Numerical modeling of the carbonate and the sandstone formations, Magnetic Resonance in Porous Media 9, Cambridge, USA, 2008.

Effects of spatially varying surface relaxivity and pore shape on NMR logging, SPWLA 2008, Edinburgh, UK, 2008.

Pore-scale parallel simulations of NMR and transport in carbonates, ERL, MIT, Cambridge, USA, 2007.

Probing pore geometry and related physical properties, Physics Dept, Boston University, Boston, USA, 2007.

Flow and random walks through porous media and loosely coupled computers, Gordon Conference 06 on Flow through porous media, Andover, USA, 2006.

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Parallel simulations of fluid transport in 3D porous media, World wide developers conference, 2006, San Francisco, USA.

Probing pore geometry using NMR and numerical simulations, presentation given in EUG XI, Strassbourg, France, 2001.

Magnetic Resonance in Porous Media, NMR, Pore Geometry and Quantum Mechanical Analogues : A New Perspective, Fifth International Meeting on Recent Advances in Magnetic Resonance Applications to Porous Media, Bologna, Italy, 2000.

Magnetic Relaxation in an Inhomogeneous Field in Porous Rocks, APS, Atlanta, USA, 1999.

Gordon Conference on Frontiers of Condensed matter physics, Tilton School, NH, USA, 1996.

Numerical modeling of phase transitions in vortex lattice systems in HTSC, **invited speaker**, Workshop on computational superconductivity, Argonne National Laboratory, Chicago, 1996.

Gordon Conference on Non-equilibrium aspects of type II superconductors, Brewster Academy, New Hampshire, USA, 1995.

The nature of long range order in the vortex lattice of high Tc superconductors, **invited talk**, SPIE, USA, 1994.

NATO Advanced School on Vortices in Superfluids, Cargese, France, 1993.

EPRI Workshop on High Tc superconductivity, **invited presentation**, Half Moon Bay, CA, 1993.

Gordon Conference on Strongly Correlated Systems, Brewster Academy, New Hampshire, 1990.

Annual APS meeting presentations, 1989 – 1999, 2008.

## FELLOWSHIPS AND AWARDS

1994–1995 Presidential Fellow, Ohio State University

## JOURNALS REFEREED

Physical Review Letters; Physical Review B; Physical Review E; Europhysics Letters; Journal of Physics; Geophysics; Journal of Water Resource Research