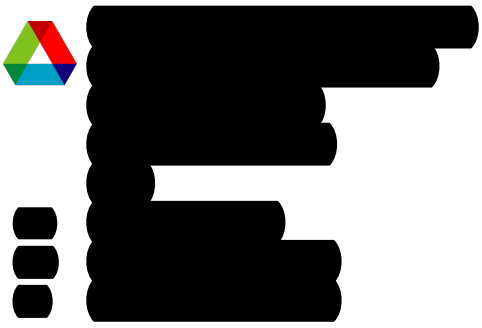
CURRICULUM VITAE
DR. ANDREAS GLATZ

CONTACT INFORMATION



RESEARCH INTERESTS

- time dependent Ginzburg-Landau equations for multi-physics systems
- non-linear dynamics in non-equilibrium systems
- thermoelectric and transport properties of granular meta-materials for, e.g., energy conversion applications
- quantum macrophysics and coherent quantum devices
- noise and glassy behavior in non-equilibrium systems
- dynamics of disordered elastic systems

EDUCATION

November 3, 2004	Doctoral degree of natural sciences, Dr. rer. nat. (Ph.D.)
July 2001 – July 2004	PhD. studies in theoretical condensed matter physics at the University of Cologne and the Materials Science Division of Argonne National Laboratory (May 2003 – May 2004). Thesis supervisor: Prof. T. Nattermann Title: “Disordered elastic systems: Fluctuations and AC-dynamics” (defense November 2004)
July 2001	Summer School: Boulder School for Condensed Matter and Materials Physics - *Nonequilibrium Statistical Physics*, Colorado, USA
June 22, 2001	Diploma (~M.S.) in physics at the Institute for Theoretical Physics of the Cologne University, Topic of the thesis: "Quasi-Eindimensionale Ladungsdichtewellen bei endlichen Temperaturen"

September 26, 1998	pre-diploma (~B.S.) in Mathematics, minor subject: Physics
September 23, 1998	pre-diploma (~B.S.) in Physics, minor subjects: Mathematics and Information/Computer Science
February, 1996	enrolled at the University of Cologne, Germany fields of study: Physics Mathematics

EMPLOYMENT AND PROFESSIONAL EXPERIENCE

since Aug. 2012	Associate professor at the Department of Physics, Northern Illinois University, joint with Argonne
since Sept. 2011	Staff member Materials Science Division, Argonne National Laboratory
Jan. 2011 – Aug. 2012	visiting associate professor at Northern Illinois University
Sept. 2010 – Sept. 2011	Argonne Scholar Materials Science Division, Argonne National Laboratory
Oct. 2007 – Sept. 2010	Post-doctoral fellow Materials Science Division, Argonne National Laboratory
Sept. 2005 – Sept. 2007	Visiting scholar under DFG research fellowship Materials Science Division Argonne National Laboratory
May 2004 - Aug. 2005	Research Assistant / Post doc from Nov. 2004 Institute for Theoretical Physics, University of Cologne
May 2003 – May 2004	Exchange Student under DAAD (Deutscher Akademischer Austauschdienst) fellowship Materials Science Division, Argonne National Laboratory Collaboration with Valerii Vinokur.
Jan. 2002 – May 2003	Research & Teaching Assistant Institute for Theoretical Physics Presented lectures on Group Theory and Statistical Mechanics
Jul. 2001 – Dec. 2001	Scientific & Teaching Assistant

	Institute for Theoretical Physics Presented lectures on Quantum Mechanics
Aug. 2001 - Sept. 2001	Computer Engineer Digi4media LLC ("Gesellschaft für effiziente Übertragungstechnologien"), Dortmund Developed and implemented digital-analog encryption software „DuoScript" and analyzed the HIT software for transmission of digital information, embedded in analog data streams (patent protected)
Mar. 15, 2000 – Jun. 30, 2001	Teaching Assistant Institute for Theoretical Physics, Lectured on "Statistical Physics" and "The Cornerstones of Modern Physics" (see www.thp.uni-koeln.de/natter/physwelt)
Summer 1998	Apprentice / practical training Institute for Information Science Developed a Client-Server application (JAVA and C++)
1998 - 2003	Freelance consultant West-German Broadcast Company (WDR) Carried out web support and development of various radio shows
Jul. 1996 – Jun. 2001	Student assistant ExperTeam inc. Developed and supported customer database, and assisted on various consulting projects including computer system administration
1992 - 1994	Student apprentice ExperTeam LLC, Cologne Developed, integrated, and supervised the employee database

AWARDS & HONORS

Sept. 2010 – Oct. 2011	Argonne Scholar
2005 – 2007	German Research foundation (DFG) Fellowship

2003/2004	German Academic Exchange Service (DAAD) Student Fellowship
2002-2005	Member of the Collaborative Research Center SFB 608 *("Complex Transition Metal Compounds with Spin and Charge Degrees of Freedom and Disorder")* at Cologne University

RESEARCH GRANTS

- Renewal of DOE grant "Quantum Mesoscopic Materials" 2017, co-PI, $757K/year for 3 years
- DOE grant "Dynamics of Active Self-Assembled Materials" 2017, co-PI, $1,126K/year for 3 years
- Visiting scientist support for Prof. Gordey Lesovik, 2017, $24K.
- Visiting scientist support for Prof. Gordey Lesovik, 2015, $20K.
- Great Journeys grant, 2014-2015, $17.5K
- Visiting scientist support for Tatyana Baturina at NIU, 2014, $30K
- Renewal of DOE grant "Quantum Mesoscopic Materials" 2014, co-PI, $757K/year for 3 years
- DOE SciDAC supplement, 2013, $130K/year for 4 years.
- Visiting scientist support for Tatyana Baturina at NIU, 2013, $30K
- Joint INSET student support with Michel van Veenendal, 2013, $13K
- DOE SciDAC Partnership grant "Optimizing Superconductor Transport Properties through Large-Scale Simulation" 2012, Lead-PI, $765K/year for 5 years
- MSD equipment Call 2012: extension of the GPU cluster, $84K
- Renewal of DOE grant "Quantum Mesoscopic Materials" 2011, co-PI, $780K/year for 3 years
- DOE Equipment Call 2010: 120TeraFlop GPU cluster award, $250K.
- Argonne Competitive LDRD (Laboratory Director's Research and Development) project on the Physics of Superinsulation: $250K/year; Sept. 2008 – Sept. 2011
- Argonne competitive LDRD project on the Properties of Thin Superconducting Films: $180K/year; Sept. 2009 – Sept. 2011.
- Participant in the successful application for the Collaborative Research Center (SFB) 608 by the German Research Foundation at the Institutes for Physics at Cologne University

PROFESSIONAL ACTIVITIES & SERVICE

Editor of *"Theory of Quantum Transport in Metallic and Hybrid Nanostrutuces"*, NATO Science Series II, Volume 230, Springer 2006

Referee for Journals: Physical Review Letters, Physical Review B, Journal of Physics B, and Central European Journal of Physics

Member of the Organizing Committee for the following Conferences:

- MTI and ITS Fall Workshop 2013: Coherent Hybrid Structures on the Mesoscale, Oct. 2013, Evanston, IL (Principle organizer)
- MTI Non-Conventional Insulators workshop, Nov. 2012, ANL (Principle organizer)
- Advanced Research Workshop NanoPeter 2012, June 2012, St. Petersburg, Russia
- MTI Superconductor-Insulator Transition Workshop, Nov. 2010, ANL
- International Argonne Fall Workshop on Nanophysics III (2003), V (2005), and VI (2006), Argonne National Laboratory, Illinois USA
- International Fall Workshop on Nanophysics VII (2007), Hsinshu, Taiwan
- Advanced Research Workshop NanoPeter 2004, 2005, 2006, 2008: Fundamentals of electronic nanosystems, St. Petersburg, Russia

Committee memberships at NIU

- Search Committee Computer Science, May 2017 - present
- Graduate Exam Committee, Committee Chair, March 2016 - present
- Graduate Exam Committee, September 2012 - February 2016
- Graduate Recruiting Committee, January 2013 - present
- QM Ph.D. candidacy exam coordinator, January 2013 - present
- Executive Committee, Department of Physics, August 2014 - August 2015; August 2017 - present
- Merit Evaluation Committee, 2014, 2018, 2019 (chair)
- Committee on the Economic Status of the Profession, January 2016 - Present
- Member of the ITSC (IT Steering Committee), June, 2014 - Present
- Faculty Senate, Senator of the Physics Department, August , 2015 - Present

Participated in the Review of the research project SFB 608 at Cologne University.

Member of the IT oversight committee of the Materials Science Division, ANL

Author of several websites, including:

- http://mti.msd.anl.gov/homepages/glatz
- http://mti.msd.anl.gov/ & related conference and home web pages
- http://www.thp.uni-koeln.de/natter/
- West German Broadcast Company: Musikpassagen (archived)

Author and Developer of the TexPoint software: http://texpoint.necula.org/

TEACHING AND SUPERVISION

- graduate course “Statistical Physics I” at NIU, Spring 2018

- graduate course “Statistical Physics I” at NIU, Spring 2017
- graduate course “Statistical Physics I” at NIU, Spring 2016
- graduate course “Computational Methods in Condensed Matter Physics” at NIU, Spring 2016
- graduate course “Statistical Physics I” at NIU, Spring 2015
- since July 2014, co-supervision of Hanqi Guo, postdoc at ANL
- since Sept. 2013 advisor and supervision of Gregory Kimmel, Ph.D. student at Northwestern University – defended thesis in December 2016
- since Nov. 2013 advisor and supervision of Ivan Viti, Ph.D. student at NIU – defended thesis in October 2016
- graduate course “Statistical Physics I” at NIU, Spring 2014
- graduate course “Computational Methods in Condensed Matter Physics” at NIU, Spring 2014
- graduate course “Statistical Physics I” at NIU, Spring 2013
- since Oct. 2012 supervision of Ivan Sadovskyy, postdoc at ANL
- Nov. 2011-May 2015 advisor and supervision of Michael Miszczak, Ph.D. student at NIU, defended January 2015
- co-supervised three Ph.D. students at Cologne University and at Argonne, two diploma, and several undergraduate students
- teaching assistance for graduate courses in Quantum Mechanics, Statistical Physics, Group Theory, and Mechanics at Cologne University; and several lectures for a general audience on the “The Cornerstones of Modern Physics”

MEMBERSHIPS

- American Physical Society (APS)
- German Physical Society (DPG)

INVITED TALKS

Simulations of geometrical vortex lattice pinning and melting in thin superconducting strips
13th International Workshop on Magnetism and Superconductivity at the Nanoscale
Coma-Ruga, Spain. July 2017

Designing the Future Superconducting Power Grid on Supercomputers
Colloquium at University of Rome – Tor Vergata
Rome, Italy. June 2017

Detailed Simulation of Vortex Crossing
Superstripes 2017
Naples (Ischia), Italy. June 2017

Optimization of Superconductors through large-scale simulations
International Vortex Workshop 2017
International Institute of Physics, Natal, Bazil. May 2017

Large-Scale Simulations of Critical Currents
Center for Emergent Superconductivity (CES) - 2016 Fall Workshop
Stony Brook University, New York. November 2016

Detailed Simulation of Vortex Crossing
12th International Workshop on Magnetism and Superconductivity at the Nanoscale
Coma-Ruga, Spain. July 2016

Reentrance of superconductivity in parallel fields
Superstripes 2016
Naples (Ischia), Italy. June 2016

Critical Current by Design Through Large-scale Simulations
ICSM 2016 - The 5th International Conference of Superconductivity and Magnetism
Fethiye, Turkey. April 2016

Optimizing Superconductor Transport Properties through Large-Scale Simulation
Scientific Discovery through Advanced Computing meeting 2015
Bethesta, Maryland. July 2015

Towards Critical Current by Design: Splayed Defects in Superconducting tapes
11th International Workshop on Nanomagnetism and Superconductivity at the Nanoscale
Coma-Ruga, Spain. July 2015

Towards Critical Current by Design
Superstripes 2015
Ischia (Naples), Italy. June 2015

Towards Critical Current by Design
International Vortex Workshop 2015
El Escorial, Spain. May 2015

Reentrance of superconductivity in parallel fields
Multi-Condensate Superconductivity and Superfluidity in Solids and Ultracold Gases
Camerino, Italy. June 2014

Reentrance of superconductivity in parallel fields
10th International Workshop on Nanomagnetism and Superconductivity at the Nanoscale
Coma Ruga, Spain. July 2014

Optimizing Superconductor Transport Properties through Large-Scale Simulation

Scientific Discovery through Advanced Computing meeting 2014
Washington DC. July/August 2014

Large-Scale Time-dependent Ginzburg-Landau simulations on GPUs
3rd International Conference on High Performance Computing (HPC-UA 2013)
Kiev, Ukraine. October 2013

Computational studies of vortex dynamics and pinning effects in high-Tc superconductors
SciDAC-III meeting 2013
Washington DC, USA. July 2013

Vortex dynamics simulations in geometrical confined superconductors
9th International Workshop on Nanomagnetism and Superconductivity at the Nanoscale
Coma Ruga, Spain. July 2013

Pseudogap above the line $H_{c2}(T)$ as the result of fluctuation suppression of quasiparticle tunneling
8th International Workshop on Magnetism and Superconductivity at the Nanoscale
Coma Ruga, Spain. July 2012

Fluctuoscopy of disordered two-dimensional superconductors
8th Advanced Research Workshop NanoPeter 2012
St. Petersburg, Russia. June 2012

Superconducting Textures in Two Dimensions
III. International Conference on Superconductivity and Magnetism
Istanbul, Turkey. April 2012

Superconducting islands in two dimensions
Invited Lecture
Northern Illinois University. November 2011

Thermoelectric and Non-equilibrium Phenomena in Mesoscopic Meta-materials
Physics Colloquium
Northern Illinois University. October 2011

Fluctuoscopy of Two-Dimensional Disordered Superconductors
7th International Workshop on Magnetism and Superconductivity at the Nanoscale
Coma Ruga, Spain. July 2011

Theory of Thermoelectricity for Multi-Phasic Meta-Materials
Seminar at the "Centro per la Sensoristica"
University of Rome, Tor Vergata, Italy. June 2011

Self-organized regular superconducting patterns in thin films & Session Chair

Superconductor-Insulator Transition Workshop
Argonne National Laboratory. November 2010

Superconducting nanotextures in thin superconducting films
MRSEC workshop: Transport in nanoengineered materials
University of Chicago. September 2010

Session Chair at
Out of Equilibrium Quantum Systems
KITP, UC Santa Barbara. August 2010

Quantum Fluctuations and Dynamic Clustering of Fluctuating Cooper Pairs
6th International Workshop on Nanomagnetism and Superconductivity
Coma-Ruga, Spain. July 2010

Building an 8 Tera-Flop Desktop Computer
Argonne Engineering Professionals Seminar
Argonne. June 2010

Emergence of superconducting textures in two dimensions
Physics Colloquium
California State University, Northridge. October 2009

Interplay of elasticity and superconductivity in thin films: Regular electronic textures
12th International Workshop on Vortex Matter in Superconductors, Lake Yamanaka, Japan. September 2009

Emerging regular superconducting patterns in thin films
5th International Workshop on Nanomagnetism and Superconductivity
Coma-Ruga, Spain. July 2009

Glassy behavior of disordered Coulomb systems
Physics Colloquium
California State University, Northridge. October 2008

Statistics of Deep Energy States in Coulomb Glasses
MTI International Argonne Fall Workshop on Nanophysics VII
Hsinchu, Taiwan. December 2007

AC conductivity of disordered Luttinger Liquids at finite temperatures
International Theory Workshop on Nanoscale Superconductivity and Magnetism
Argonne National Laboratory. November 2006

Non-adiabatic AC-Dynamics of Disordered Elastic Systems
Condensed Matter Seminar

MIT, Boston, Massachusetts. November 2005

One-dimensional disordered systems: Fluctuations, Quantum-Phase-Transitions, and Transport
Condensed Matter Seminar
Texas A&M University, College Station, Texas. April 2005

Disordered elastic systems: AC-dynamics
Seminar
Molecular Biology Department, Princeton University, Princeton. April 2005

Influence of Thermal Fluctuations and Quantum Critical Behavior in one-dimensional Systems"
Seminar on Mesoscopic Solid State Physics, Universität Freiburg, Freiburg. November 2004

Thermal Fluctuations in One-Dimensional Disordered Quantum Systems
Advanced Research Workshop "Fundamentals of electronic nanosystems" in St. Petersburg, Russia. June 2004

AC-Driving and Displacement Profile of Domain Walls in Random Media
Condensed Matter Seminar at Texas A&M University. February 2004

Influence of thermal fluctuations on quantum phase transitions in one-dimensional CDWs"
International Theory Workshop on Nanoscale Superconductivity and Magnetism at Argonne National Laboratory. November 2003

Quantum Phase Slips and Thermal Fluctuations in One-dimensional Disordered Density Waves
International Workshop on electronic crystals ECRYS, St. Fleur, France. *September 2002*

MAIN RESEARCH METHODS

Analytical Methods:

- Perturbation Theory, including Diagrammatic Techniques
- Renormalization Group Methods
- Scaling Theory
- Mean Field Theory
- Keldysh Technique for non-equilibrium systems

Numerical Methods:

- Monte Carlo simulations
- Density-matrix renormalization group, Density-functional theory
- Molecular dynamics simulations

- (Quantum) Dynamic Equations
- Ginzburg Landau Equations
- Development of new, highly optimized algorithms for classes of physical problems
- Basic "tools" of Numerical Mathematics and Information Science: integration, differential equations (including PDEs), solving equation systems, eigensystems, data modeling, FFT, network and graph theory, cryptography
- Technical "tools": Parallelization (e.g. OpenMP, MPI) for large scale computation, graphical interfaces and real-time visualization including 3D rendering, deployment of various high performance libraries
- Several applications for massive parallel scientific computing on graphics processing units (CUDA, OpenCL) including Ginzburg-Landau, Fluid- and Molecular dynamic simulations.

SELECTED RESEARCH ACTIVITIES

Main research focus:

Optimizing superconductor transport properties through large-scale simulation, Lead PI

This is a SciDAC partnership project funded by the Department of Energy titled "Optimizing superconductor transport properties through large-scale simulation" (OSCon) which was established in September 2012. The main objective of this project is to develop and apply novel methods for optimizing superconductors for energy applications using large-scale computational algorithms and tools. The resulting numerical tools paved the way for a systematic method to design superconductors with high critical currents. In the past, the quest for optimal superconductors with respect to largest critical current was only conducted via the Edisonian process of laborious experimental trial and error. The overall project is carried out in collaboration with SciDAC Institutes using large-scale computation and leveraging DOE's leadership-class computing facilities. [see http://oscon-scidac.org/ for more information]. Within the first 4 years, the results of this project were presented on many international conferences and published in more than 30 publications, and OSCon is recognized as the world leading team in transport simulations of superconductors.

Massive parallel simulation of Ginzburg-Landau and hydrodynamic equations on GPUs

Recent developments in computational architectures made it possible to solve problems "on a desktop", which previously could only be managed on large computing clusters: modern graphics processing units (GPUs) can replace several hundred traditional CPU cores by only one chips. A major advantage is the almost non-existence of inter-process communication latency times and a relatively easy to use development framework (e.g. CUDA). Using this new opportunities, which only emerged in the last 2-3 years, I solved so far two different problems, which are perfectly adaptable to this architecture: (i) The study of self-assembled magnetic micro-particles on a fluid interface [29], which form snake-like structures in a magnetic field, and (ii) the crossover from BCS to BEC for trapped ultra-cold atoms in a Ginzburg-Landau framework, showing shockwaves and radial supercurrents when cooled by evaporation [see also 36, 47, 50] (iii) GPU based codes are a major component of OSCon (see above).

Superconducting fluctuation effects and Fluctuoscopy

In a series of papers I studied the effect of superconducting fluctuations (SF) on transport properties of superconductors beyond the superconducting region. In [33, 35] the effect of SF on the conductivity for arbitrary temperatures and magnetic fields was studied. With this a new "tool" – fluctuation spectroscopy, or short: *Fluctuoscopy* – was established to determine microscopic materials parameters, like the superconducting transition temperature, critical field or pair-breaking parameter, quantitatively based on the underlying microscopic BCS theory. In my work [38], this was extensively demonstrated at the example of TiN films. In the past, the critical temperature was determined by phenomenological criteria. I also studied the effect on tunnel currents in, e.g., STM measurements [46] and their effect on the nuclear magnetic resonance spin relaxation rates [56] – which can be used for Fluctuoscopy.
All results are reviewed in the upcoming review in Review of Modern Physics (see [70]).

Artificial granular nanosolids

Nanosolids are artificially designed arrays of nanocrystals composed of tiny crystals ranging in size from 2 to 30 nanometers. Due to the electron confinement effect, nanocrystals can be viewed as quantum dots and the behavior of their physical properties lie in between that of molecules and bulk materials. A unique opportunity exists to modify the bulk material properties by altering the nanocrystal composition and size. Controlling these parameters during synthesis allows tailoring the transport, optical, and magnetic properties of a nanosolid for specific applications ranging from the synthesis of a new generation of fluorophores to optical switching, optical transistors, optical computing or telecommunications packet switching, and solar batteries.
In one of the first explorations, I studied the transport properties of semiconducting nanocrystal arrays [16] which are especially relevant for novel technologies, such as those related to future generations of detectors and solar cells.
In a series of two papers [19, 20], I investigated the transport properties of nano-granular magnetic systems. We focused on the Giant Magnetoresistance of arrays of ferromagnetically coupled nanoscale ferro-magnetic particles ("superferromagnets") taking into account the non-adiabatic motion of domain walls. We calculated the complex susceptibilities and found excellent agreement with experimental measurements.
Later, I studied yet another important aspect of granular nanosolid metals, their thermoelectric properties (references [22-24]), especially in regard to the thermoelectric and Seebeck coefficients. We found that the thermoelectric figure of merit can be significantly enhanced in weakly coupled arrays – which is even more pronounced in semiconducting arrays (Ref. [25]).
The understanding of thermoelectric properties of granular nano-materials is especially important since they promise to have large figures of merit, which can become close to or even exceed the values for traditional heat engines. To make further progress I developed a Monte-Carlo based numerical approach to study mixed or multi-phasic granular materials which can potentially combine the benefits of metallic grains and semiconducting grains. A related software implementation was realized as part of Ivan Viti's dissertation and will serve for the application to future grants.

Another important area in the research of artificial nanosolids is their ferroelectric properties, which I studied in Refs. [42,49], and non-equilibrium heating effects (which are also important for thermoelectrics), studied in [32,37,40,41].

1/f noise in Coulomb glasses

The nature of 1/f noise is the subject of extensive experimental and theoretical work due to its fundamental and applied importance. However, this phenomenon is far from being fully understood. In particular, the principal questions - what is the microscopic mechanism of 1/f-noise, how universal is this phenomenon, and what are the ways of optimizing the device with respect to the 1/f-noise – remain unanswered. These questions are specifically important for the case of the so-called hopping insulators – materials in which electron transport occurs via tunneling or thermally activated hops between the localized states created by a proper doping of intrinsic disorder.

In earlier works I considered the statistics of the energy states in Coulomb glasses [18,21]. Doped semiconductors in the insulating state are exemplary systems endowed with strong long-range Coulomb interactions and strong disorder. It was hypothesized that the combined influence of both creates a glassy phase, resulting in the term *electron- or Coulomb glass*. One of the main characteristics of the glassy state is the existence of an infinite number of low-lying states (valleys in the rugged free energy landscape) separated by barriers growing infinitely in the thermodynamic limit.

I studied the statistics of local energy minima in the configuration space and the energy relaxation due to activated hopping in a system of interacting electrons in a random environment and found that the distribution of the local minima is exponential, which is in agreement with extreme value statistics considerations. The relaxation of the system energy shows logarithmic time dependence in agreement with the *ultrametric* structure of the system. This seed work opened the path to a deeper understanding of the origin of 1/f noise in these systems. Many aspects of these studies and their numerical codes are now used to study non-equilibrium phenomena in nano-granular materials (see above), especially for their thermoelectric properties

Dynamics of random elastic manifolds

I am especially interested in the dynamics of these systems, i.e., when external forces are applied to the system, e.g. by electric or magnetic fields. This can explain, e.g., the motion of domain walls in magnetic systems or of vortices in type-II superconductors, including pinning phenomena, the depinning transition, or thermal creep.

Main accomplishments:

- While the adiabatic situation - i.e. when changes of the external forces are made infinitely slow - is well known, very little results exist for the non-adiabatic (and in many situations the more realistic) case. In a collaboration with Prof. Nattermann (Cologne University) and Prof. Pokrovsky (Texas A&M University), we studied the effect of AC driven systems [4]. We developed an analytical expression to explain the occurring double hysteresis in the magnetization of magnetic systems, in other words, the velocity of flux lines, and confirmed the results by numerical solution of the equation of motion.

- In following works with experimentalists from the group of Prof. Kleemann at the University of Duisburg, our model was used to explain the experimental data for the complex susceptibility of superferromagnetic materials in an AC magnetic field [10,11]
- I also studied the influence of a strong surface potential on the critical depinning of an elastic system driven in a random medium. If the surface potential prevents depinning completely, the elastic system shows a parabolic displacement profile. We studied the hysteresis of the curvature and the influence of thermal fluctuations [9].

Current research includes a detailed analysis of the depinning transition at zero temperature, e.g. the critical slowing down, and the avalanche motion of the elastic system (in particular vortices) when a weak AC or DC field is applied, and the analysis of viscosity in vortex systems depending on the kind of pinning centers.

Strongly correlated electrons in low dimensions

In one-dimensional systems, the interplay of interaction and disorder gives rise to a variety of interesting physical phenomena. In and below two dimensions, disorder leads to localization of all electronic states. Interactions lead to a breakdown of the Fermi liquid concept in one dimension and to the emergence of a Luttinger liquid which is characterized by collective excitations. In 1d electron systems, these strong perturbations compete with each other.

Main accomplishments

- A full finite temperature RG approach was applied to the disordered Luttinger Liquid for the first time, revealing the quantum phase crossover diagram at finite temperature [3,8,15].
- A new mechanism for the description of quantum phase slips was proposed and studied [3].
- Using the results from the RG, a systematic approach to calculate the frequency and temperature dependent conductivity was developed [17].
- The 1/f noise spectrum of driven charge density waves was analyzed using a wavelet transformation method [7].
- A first step towards the understanding of the origin of 1/f noise in interacting Coulomb glasses was made [18].

LIST OF (REFEREED) PUBLICATIONS

[75] I.A. Sadovskyy, A.E. Koshelev, W.-K. Kwok, and A. Glatz
Targeted Evolution of Pinning Landscapes for Large Critical Currents
submitted to Science (2018)

[74] Gregory Kimmel and Andreas Glatz
Upper limit for critical current in inhomogeneous superconductors
to be submitted to PRB (2018)

[73] R. Willa, A. E. Koshelev, I. A. Sadovskyy, C. L. Phillips, and A. Glatz
Strong pinning regimes by spherical inclusions in anisotropic type-II superconductors
Supercond. Sci. Technol. **31,** 014001 (2017)

[72] Gregory Kimmel and Andreas Glatz
Extensions and analysis of worst-case parameter in weighted Jacobi's method
accepted at Numerical Algorithms (2017)

[71] Gregory Kimmel, Ivan A. Sadovskyy, Andreas Glatz
In silico optimization of critical currents in superconductors
Phys. Rev. E **96**, 013318 (2017)

[70] A. Varlamov, A. Galda, and A. Glatz
Fluctuation Spectroscopy: from Rayleigh-Jeans Waves to Abrikosov Vortex Clusters
accepted at Reviews of Modern Physics (2017)

[69] H. Guo, T. Peterka, and A. Glatz
In Situ Magnetic Flux Vortex Visualization in Time-Dependent Ginzburg-Landau Superconductor Simulations
IEEE PacificVis 2017, 71 (2017)

[68] Sadovskyy, I., Wang, Y., Xiao, Z.-L., Kwok, W.-K., Glatz, A.
Effect of hexagonal patterned arrays and defect geometry on the critical current of superconducting films
Phys. Rev. B **95**, 075303 (2017)

[67] Anderson, B. M., Clark, L. W., Crawford, J., Glatz, A., Aronson, I. S., Scherpelz, P., Feng, L., Chin, C., Levin, K.
Direct Lattice Shaking of Bose Condensates: Finite Momentum Superfluids
Phys. Rev. Lett. **118**, 220401 (2017)

[66] Gregory Kimmel, Andreas Glatz, and Igor S. Aranson
Phase Slips in Superconducting Weak Links
Phys. Rev. B **95**, 014518 (2017)

[65] G.P. Papari, A. Glatz, F. Carillo, D. Stornaiuolo, D. Massarotti, V. Rouco, L. Longobardi, F. Beltram, V.M. Vinokur, and F. Tafuri
Geometrical vortex lattice pinning and melting in YBaCuO submicron bridges
Nature Scientific Reports **6**, 38677 (2016)

[64] Kwok, Wai-Kwong; Welp, Ulrich; Glatz, Andreas; Koshelev, Alexei E.; Kihlstrom, Karen J.; Crab- tree, George W.
Vortices in High-Performance High-Temperature Superconductors
Reports on Progress in Physics **79**, 116501 (2016)

[63] A. Glatz, V. K. Vlasko-Vlasov, .W. K. Kwok, G. W. Crabtree
Vortex cutting in superconductors
Phys. Rev. B **94**, 064505 (2016)

[62] Carolyn L. Phillips, Hanqi Guo, Tom Peterka, Dmitry Karpeyev, and Andreas Glatz
Tracking vortices in superconductors: Extracting singularities from a discretized complex scalar field evolving in time
Phys. Rev. E **93**, 023305 (2016)

[61] L. Fang, J. Im, W. DeGottardi, Y. Jia, A. Glatz, K. Matveev, W.-K. Kwok, G. W. Crabtree, and M. G. Kanatzidis
Large Spin-orbit Coupling and Helical Spin Textures in 2D Heterostructure [Pb2BiS3][AuTe2]
Nature Scientific Reports **6**, 35313 (2016).

[60] A. E. Koshelev, I. A. Sadovskyy, C. L. Phillips, and A. Glatz
Optimization of vortex pinning by nanoparticles using simulations of time-dependent Ginzburg-Landau model
Phys. Rev. B **93**, 060508(R) (2016).

[59] I. A. Sadovskyy, A. E. Koshelev, A. Glatz, V. Ortalan, M. W. Rupich, M. Leroux,
Simulation of the Vortex Dynamics in a Real Pinning Landscape of $YBa_2Cu_3O_{7-\delta}$ Coated Conductors.
Phys. Rev. Applied **5**, 014011 (2016).

[58] Ivan A. Sadovskyy, Ying Jia, Maxime Leroux, Jihwan Kwon, Hefei Hu, Lei Fang, Carlos Chaparro, Shaofei Zhu, Ulrich Welp, Jianmin Zuo, Venkat Selvamanickam, George W. Crabtree, Alexei E. Koshelev, Andreas Glatz, and Wai-Kwong Kwok
Towards Superconducting Critical Current by Design
Advanced Materials **28**, 4593 (2016)

[57] Y. L. Wang, A. Glatz, G. Kimmel, I. S. Aranson, L. R. Thoutam, Z. L. Xiao, G. R. Berdiyorov, F. M. Peeters, G. W. Crabtree & W. K. Kwok
Parallel magnetic field suppresses dissipation in superconducting nanostripes
PNAS **114**, E10274 (2017)

[56] A. Glatz, A. Galda, and A. A. Varlamov
Effect of Fluctuations on the NMR Relaxation Beyond the Abrikosov Vortex State
Phys. Rev. B **92**, 054513 (2015)

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IT SKILLS (SHORT SUMMARY)

- computer simulations/numerics, including e.g. Monte Carlo and DMRG methods, using also external scientific libraries like LinPack, NAG, NR, and parallelization libraries
- network administration & support of Windows and Mac OS X networks (file-, print-, backup-, web-, mail-, and domain services; physical setup of networks)
- network programming (sockets and high-level protocols)
- application development (Linux/Unix, Mac, and Windows), including all kinds of software, GUI and console applications
- sequential, procedural, object oriented, generic, and functional programming
- OpenMP and MPI parallel programming
- Intel XEON Phi OpenMP and offload programming
- GPU programming: OpenCL, Nvidia CUDA

- programming languages/scripts: AppleScript, Assembler (x86, x64, 68K architectures), Basic, Comal, C/C++/C#/Objective C, Fortran, Flash ActionScript, Java/Javascript, Logo, HyperTalk, Pascal/Delphi, Perl, Rexx, VB/VBA, Python
- functional languages: FileMaker Script, Maple, Mathematica, Octave, PovRay, SQL
- markup languages: HTML, XML, LaTex, Postscript, RTF, MathML
- web development and design (html, xml, php, java, javascript, perl, cgi, SQL) and web server administration (apache, omniHTTP)
- database development (Access, Dbase, FileMaker)
- system administration and support for Windows (all versions), Windows Server, Mac OS X, Mac OS X Server, Linux/Unix, and all common applications

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