Working Group "Young DPG"
Arbeitsgruppe junge DPG (AGjDPG)

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Die junge DPG lädt alle Interessierten herzlich zum ihrem Programm auf der Jahrestagung 2015 ein. Wir haben neben den etablierten Formaten, wie dem Promovierendensymposium, der Zusammenarbeit mit dem Fachverband SOE und dem EinsteinSlam ein paar neue Veranstaltungen ausprobiert, die am Mittwoch und Donnerstag stattfinden.

Aktuelle Informationen zum Programm der jDPG gibt es online unter www.jdpg.de

Overview of Invited Talks and Sessions

(Lecture Rooms: HFT-FT 131 and Urania)

Invited Talks

AGjDPG 6.1	Wed	15:00–16:00	HFT-FT 131	**Data Visualisation: Journey to the 2nd Dimension** — •Martin Zaltz Austwick
AGjDPG 7.1	Thu	9:30–10:30	HFT-FT 131	**Über das Schreiben von wissenschaftlichen Arbeiten** — •Ingolf Volker Hertel

Invited Talks of the PhD symposium of the Magnetism Division and the AGjDPG 2015

AGjDPG 3.1	Tue	9:30–10:15	EB 301	**Experimental Studies of Quantum Phase Transitions** — •Andrew Mackenzie
AGjDPG 3.2	Tue	10:15–10:45	EB 301	**Metallic Quantum Ferromagnets** — •Manuel Brando
AGjDPG 3.4	Tue	11:30–12:15	EB 301	**Theoretical Concepts of Quantum Phase Transitions** — •Matthias Vojta
AGjDPG 3.5	Tue	12:15–12:45	EB 301	**Quantum criticality and beyond** — •Andrew Schofield
AGjDPG 3.7	Tue	14:00–14:30	EB 301	**Quantum Criticality in Quantum Magnets** — •Christian Rüegg
AGjDPG 3.9	Tue	14:45–15:15	EB 301	**Beyond quantum phase transitions** — •Wilhelm Zwerger

Invited talks of the joint symposium SYPS

See SYPS for the full program of the symposium.

SYPS 1.1	Wed	9:30–10:00	H 0105	**Anticipating and avoiding tipping points** — •Timothy M. Lenton
SYPS 1.2	Wed	10:00–10:30	H 0105	**Climate investment under uncertainty: the two degree target and the desire for dynamic consistency** — •Hermann Held, Delf Neubersch
SYPS 1.3	Wed	10:30–11:00	H 0105	**What are the resources required to fulfil human needs?** — •Julia Steinberger
SYPS 1.4	Wed	11:15–11:45	H 0105	**Design of Sustainable Supply Chains for Sustainable Cities** — •Anna Nagurney
SYPS 1.5	Wed	11:45–12:15	H 0105	**Ecological econophysics for degrowth** — •Salvador Pueyo

Sessions

AGjDPG 1.1–1.3	Sun	16:00–18:30	H 0104	**Tutorial: From spin models to macroeconomics (SOE, DY, jDPG)**
AGjDPG 2	Mon	20:00–21:00	Urania	**EinsteinSlam in der Urania**
AGjDPG 3.1–3.16	Tue	9:30–16:30	EB 301	**PhD symposium of the Magnetism Division and the AGjDPG 2015: Quantum Phase Transitions: Emergent phenomena beyond elementary excitations**
AGjDPG 4.1–4.3	Wed	9:30–11:15	TA 251	**Digitale Agenda in Theorie und Praxis: Was geschieht in der Wissenschaft? (mit AGjDPG)**
AGjDPG 5.1–5.5	Wed	9:30–12:15	H 0105	**Physics of Sustainability and Human-Nature Interactions**
AGjDPG 6.1–6.1	Wed	15:00–16:00	HFT-FT 131	**Data Visualization**
AGjDPG 7.1–7.1	Thu	9:30–10:30	HFT-FT 131	**Scientific Writing**

AGjDPG 1: Tutorial: From spin models to macroeconomics (SOE, DY, jDPG)

Formulated as a minimal model of ferromagnets, the Lenz-Ising model received a recent renaissance serving as paradigmatic basis for the formulation and analysis of models of social and economic behaviour. Prominent examples are microscopic market and price formation models incorporating herding behaviour of the economic agents and leading to nonlinear and nonequilibrium macroeconomic dynamics. The Sznajd-Weron opinion formation model introduced spin models with outflow kinetics into quantitative social modeling. Finally, the macroscopic (replicator) equations of evolutionary game theory again can be based on microscopic (Glauber-like) reaction kinetics for discretized behavioral states, whereby the payoffs from the neighborhood resemble a local meanfield. This series of tutorial lectures shows that methods adapted from statistical phyics can serve as concepts in quantitative social and economic theories and are worth the effort of bridging the disciplines, which includes properly connecting to economic frameworks. (Session compiled by Jens Christian Claussen.)

Time: Sunday 16:00–18:30 Location: H 0104

Tutorial AGjDPG 1.1 Sun 16:00 H 0104

Economics in a nutshell, for physicists — •Sylvie Geisendorf — ESCP Europe Berlin

The talk explains why and how the economic mainstream, the theory of neoclassical economics, is based on the idea of Newtonian physics. It also discusses why a real Newtonism would probably have been a good idea and where economists deviate from it.

Although modern economists rarely refer to physics, economic theory is based on Newtons idea of universal gravity. Following Newtons discovery, physics became an exact science with rigorous mathematical descriptions. In physics, Newton marked the beginning of the era of rational mechanics. Society was fascinated by Newtons insights and economists based their theory on classical mechanics with the explicit aim to make economics a rational science as well. But instead of adopting Newtons laws of motion they employed the simplified principle of general maximization. Whereas the laws of motion name the forces acting in a system, optimization calculus only deduces the final outcome. Even in physics, the realization of global minima or maxima is only possible under specific conditions. In economics, where actions of bounded rational agents have to be considered, these conditions are even rarer. The talk argues that a real Newtonian approach could have moderated the current lack of contact with reality, economic theory displays, and could have facilitated the necessary transition to an evolutionary theory of the economy.

Tutorial AGjDPG 1.2 Sun 16:50 H 0104

Connecting microscopic behavioral economics to macroscopic financial market models — •Sebastian M. Krause — Rudjer Boskovic Institute, Zagreb, Croatia

Time series of prices show the stylized facts of broadly distributed price jumps which occur clustered. This has serious implications for the accumulation of risk. Macroscopic price evolution models for estimating risk are commonly used. They extend the random walk by including auxiliary volatility variables to model time dependent volatility. On the other hand, agent based models that include behavioral insights are used to enlighten the mechanisms behind stylized facts. This could help to predict crashes and to improve market regulation.

After briefly illustrating this background, I discuss a way of interconnecting these two strands of research. Using an agent based model with herding, I exemplify a general recipe for finding macroscopic models numerically: A macroscopic variable which might control volatility is identified; The stochastic process ruling this volatility variable is measured, using the numeric evolution of the microscopic model. This procedure is suitable for models with puzzling emergent behavior, as well as for complicated models with many parameters. The resulting macroscopic price evolution model can be much simpler, allowing for proceeding investigations. Therefore, the field of agent based modeling profits from a macroscopic description. Another advantage is the microfoundation of macroscopic financial market models which are so far pure phenomenological. The auxiliary volatility variable can inherit a clear behavioral meaning from the microscopic model.

Tutorial AGjDPG 1.3 Sun 17:40 H 0104

You are a young and aspiring physicist. Is working at the interface with economics a good idea? — •Tobias Galla — Theoretical Physics, School of Physics and Astronomy, The University of Manchester, Manchester M13 9PL, UK

The terms econophysics and sociophysics describe research in which physicists apply their ideas and methods to problems in economics and the social sciences. What do you have to know about the field to find your own answer to the question in the title? Well, one way is to talk to as many 'older' physicists as possible who have worked in this area, and then to form your own opinion. In this tutorial I will give you my personal assessment of what physicists can contribute to the field of economics, and comment on why they cannot contribute as easily as it may seem. We will discuss the main achievements of physicists, for example the detection of non-Gaussian features and long-range correlations in financial data, theories of market impact, non-equilibrium ideas and bottom-up models of game theory, decision making and market microstructure. At the same time you will hear about the things physicists have not achieved (despite occasional claims to the contrary). I will then present some of our own work on chaotic dynamics in the learning of complicated games and discuss the potential consequences this has for agent-based market models, and the limitations of our work. In the final part of the tutorial I will comment on the potential hurdles young physicists moving into this area might want to be aware of, and I will highlight the potentials and benefits of working in this field.

AGjDPG 2: EinsteinSlam in der Urania

Alle Teilnehmer der Tagung sind herzlich eingeladen, sich am Montagabend in der Urania den EinsteinSlam anzuschauen.

Der Slam beginnt um 20:00 Uhr, weitere Informationen gibt es online auf www.jdpg.de.

Time: Monday 20:00–21:00 Location: Urania

EinsteinSlam

AGjDPG 3: PhD symposium of the Magnetism Division and the AGjDPG 2015: Quantum Phase Transitions: Emergent phenomena beyond elementary excitations

Organizers: G. Benka, P. Geselbracht, F. Rucker, S. Säubert, and C. Schnarr (TU München)

Traditionally, physics has focused on understanding the stable phases of matter like superconductivity or magnetism. Particle like states, dominating the low-energy physics of such systems, so-called elementary excitations, have been studied extensively in the past century and play an important role in our understanding of solid state physics. Modern material science and new experimental techniques, however, led to the discovery of completely different types of states, in which all electronic properties are dominated by a continuum of fluctuations. Such states arise in the vicinity of phase transitions, which are accessed by the variation of a non-thermal control parameter at zero temperature, so-called quantum phase transitions. Even though quantum phase transitions are strictly defined to be at zero temperature, the quantum critical continuum which surrounds continuous quantum phase transitions can influence electronic systems over a wide range of the phase diagram. This leads to the emergence of unique properties, new phenomena as unconventional superconductivity and the breakdown of the concept of elementary excitations. While the research on quantum phase transitions has started in a small community with the investigation of materials with strong electronic correlations, the interest in this field of research has grown fundamentally in the past years. This is attributed to the discovery of materials, which are much easier to access experimentally, as well as to the fact that the theoretical concepts are relevant to a broad range of physics. This makes quantum phase transitions one of the most vivid research topics in physics over the past decade. This symposium brings together the most recognized international speakers of this field to give a tutorial introduction to conventional and unconventional quantum criticality as well as to highlight recent experimental and theoretical advances. The interplay between tutorials and up to date research talks addresses a very broad audience and will stimulate an interdisciplinary exchange of knowledge which makes this field of research attractive for a larger community. Quantum phase transitions represent a very important area of research for a broad community of PhD students with rather different background. Keeping up to date with such an active field of research, however, is very demanding and time consuming for PhD students, as appropriate further training possibilities are only rarely offered and often focus on extremely specialised topics. This symposium will offer such an opportunity for PhD students working on quantum phase transitions, as well as for students and physicists working in other areas.

Time: Tuesday 9:30–16:30 Location: EB 301

Invited Talk AGjDPG 3.1 Tue 9:30 EB 301
Experimental Studies of Quantum Phase Transitions — •Andrew Mackenzie — Max-Planck-Institute for Chemical Physics of Solids, Dresden, Germany

In my lecture I will review what is known about quantum criticality produced by tuning systems close to magnetic instabilities. I will discuss the key physics behind quantum criticality, and then describe some model experimental systems. I will concentrate on the importance of thermodynamic measurements in classifying both quantum criticality and the novel phases that form in its vicinity.

Invited Talk AGjDPG 3.2 Tue 10:15 EB 301
Metallic Quantum Ferromagnets — •Manuel Brando — Max Planck Institute for Chemical Physics of Solids, Noethnitzer Str. 40, 01187 Dresden, Germany

In my talk I will review studies on quantum criticality with focus on metallic ferromagnets. The existence of a ferromagnetic quantum critical point has been a matter of discussion as long as 40 years ago, but had been dismissed in the past 15. During the last years several ferromagnetic metals have been tuned across the ferromagnetic quantum phase transition. Here, astonishing discoveries were made that are extending our understanding of ferromagnetic quantum criticality.

AGjDPG 3.3 Tue 10:45 EB 301
Neutron-Depolarisation Imaging of the Ferromagnetic Quantum Phase Transition in ZrZn2 — •Philipp Schmakat[1,2], Marco Halder[1], Georg Brandl[1,2], Michael Schulz[2], Stephen Hayden[3], Robert Georgii[2], Peter Böni[1], and Christian Pfleiderer[1] — [1]Physik Department E21, Technische Universität München, Germany — [2]Forschungs-Neutronenquelle Heinz Maier-Leibnitz, D-85748 Garching, Germany — [3]H. H. Wills Physics Laboratory, University of Bristol, Bristol BS8 1TL, United Kingdom

When a polarised neutron beam traverses a ferromagnetic material, the orientation and strength of the polarisation changes sensitively as a function of the ferromagnetic moment and the size of the ferromagnetic domains. We have developed an experimental set up that allows to perform neutron depolarisation imaging as a function of magnetic field. In a study of the ferromagnetic quantum phase transition in the weak itinerant ferromagnet ZrZn2 under pressure we find, that a peculiar field dependence of the neutron depolarisation survives on the paramagnetic side of the temperature versus pressure phase diagram. This provides putative evidence for the emergence of complex magnetic textures.

30 min. Coffee Break

Invited Talk AGjDPG 3.4 Tue 11:30 EB 301
Theoretical Concepts of Quantum Phase Transitions — •Matthias Vojta — Technische Universität Dresden, Germany

This tutorial will cover theoretical concepts and ideas for the description of quantum phase transitions. Starting from order parameters and order-parameter field theories, it will discuss critical exponents and scale invariance, the fascinating interplay of classical and quantum mechanical fluctuations at finite temperatures, and the quantum-to-classical correspondence. Further topics will include interaction-driven metal-insulator transitions, topological phase transitions, and the role of quenched disorder. Throughout the talk, microscopic models will be used for illustration.

Invited Talk AGjDPG 3.5 Tue 12:15 EB 301
Quantum criticality and beyond — •Andrew Schofield — School of Physics and Astronomy, University of Birmingham, Edgbaston, Birmingham, B15 2TT United Kingdom.

The exploration of quantum critical points has provided an extraordinarliy fruitful direction for experimentalists and theorists alike to investigate new ordering principles for correlated matter. Beyond the basic concepts, the field has a number of outstanding questions which motivate current research - from the interplay between critical fluctuations and other forms of order, to the theoretical framework which

governs quantum critical behaviour in physical systems. My talk will explore these questions and their context.

AGjDPG 3.6 Tue 12:45 EB 301

Universal Postquench Prethermalization at a Quantum Critical Point — •Pia Gagel[1], Peter Orth[1], and Jörg Schmalian[1,2] — [1]Institute for Theory of Condensed Matter, Karlsruhe Institute of Technology (KIT), 76131 Karlsruhe, Germany — [2]Institute for Solid State Physics, Karlsruhe Institute of Technology (KIT), 76021 Karlsruhe, Germany

We consider an open system near a quantum critical point that is suddenly moved towards the critical point. The bath-dominated diffusive nonequilibrium dynamics after the quench is shown to follow scaling behavior, governed by a critical exponent that emerges in addition to the known equilibrium critical exponents. We determine this exponent and show that it describes universal prethermalized coarsening dynamics of the order parameter in an intermediate time regime. Implications of this quantum critical prethermalization are: (i) a power law rise of order and correlations after an initial collapse of the equilibrium state and (ii) a crossover to thermalization that occurs arbitrarily late for sufficiently shallow quenches.

Lunch Break

Invited Talk AGjDPG 3.7 Tue 14:00 EB 301

Quantum Criticality in Quantum Magnets — •Christian Rüegg — Paul Scherrer Institute, Laboratory for Neutron Scattering and Imaging, Switzerland — University of Geneva, Department of Quantum Matter Physics, Switzerland

Quantum magnets are exceptional solid-state model systems for high-precision studies of quantum criticality [1]. Recent results from such studies include complex phases like spin Luttinger-liquids and excitations realized in low-dimensional and frustrated systems [2-4], the exciting physics of impurities and quenched disorder [5], and fractionalization and the emergence of novel excitations near quantum critical points [2,6]. Studies of model oxides and halides by neutron scattering and complementary experimental techniques will be presented. These experimental results will be discussed in the context of recent developments of powerful computational methods enabling fully quantitative analysis and of related work on other model systems like gases of ultracold atoms.

[1] T. Giamarchi et al., Nature Physics 4, 198 (2008). [2] B. Thielemann et al., Phys. Rev. Lett. 102, 107204 (2009). [3] Y. Kohama et al., Phys. Rev. Lett. 109, 167204 (2012). [4] F. Casola et al., Phys. Rev. Lett. 110, 187201 (2013). [5] S. Ward et al., J. Phys.: Condens. Matter 25, 014004 (2013). [6] P. Merchant et al., Nature Physics 10, 373 (2014).

AGjDPG 3.8 Tue 14:30 EB 301

Spin Hall effect in two-dimensional systems — •Annika Johansson[1], Christian Herschbach[1,2], Dmitry Fedorov[2,1], and Ingrid Mertig[1,2] — [1]Martin Luther University Halle-Wittenberg, Halle, Germany — [2]Max Planck Institute of Microstructure Physics, Halle, Germany

A relativistic phase shift model (RPSM), derived as a generalization of the resonant scattering model [1-4], was introduced recently [5] to describe the skew-scattering mechanism of the spin Hall effect (SHE) caused by impurities in bulk crystals. The RPSM was found to be an appropriate model to obtain a simple qualitative description of the SHE for dilute bulk alloys based on host crystals with free-electron like Fermi surfaces and weak spin-orbit coupling [6].

Here, we present its analogue for two-dimensional (2D) systems. The proposed 2D-RPSM provides good qualitative agreement with *ab initio* results obtained for dilute alloys based on one-monolayer noble metal films. However, the colossal SHE caused by Bi impurities [7] is not reproduced due to a strong influence of vertex corrections for these systems not properly taken into account by the model. The relation of the 2D-RPSM to the 2D resonant scattering model [8] is also discussed.

[1] A. Fert *et al.*, J. Magn. Magn. Mater. **24**, 231 (1981); [2] G.Y. Guo *et al.*, PRL **102**, 036401 (2009); [3] A. Fert and P.M. Levy, PRL **106**, 157208 (2011); [4] P.M. Levy *et al.*, PRB **88**, 214432 (2013); [5] D.V. Fedorov *et al.*, PRB **88**, 085116 (2013); [6] A. Johansson *et al.*, J. Phys.: Condens. Matter **26**, 274207 (2014); [7] C. Herschbach *et al.*, PRB **90**, 180406(R) (2014); [8] B. Gu *et al.*, arXiv:1402.3012.

Invited Talk AGjDPG 3.9 Tue 14:45 EB 301

Beyond quantum phase transitions — •Wilhelm Zwerger — TU Muenchen

The talk will discuss quantum phase transitions in the context of ultra cold gases in optical lattices. Moreover, it will address the issue of quantum phase transitions which show up only in dynamical properties, the so called many-body localization.

AGjDPG 3.10 Tue 15:15 EB 301

Topological superconductivity and unconventional pairing in oxide interfaces — •Mathias Scheurer[1] and Jörg Schmalian[1,2] — [1]Institut für Theorie der kondensierten Materie (Karlsruher Institut für Technologie), Karlsruhe, Deutschland — [2]Institut für Festkörperphysik (Karlsruher Institut für Technologie), Karlsruhe, Deutschland

To pinpoint the microscopic mechanism for superconductivity has proven to be one of the most outstanding challenges in the physics of correlated quantum matter. Thus far, the most direct evidence for an electronic pairing mechanism is the observation of a new symmetry of the order parameter, as done in the cuprate high-temperature superconductors. Alternatively, global, topological invariants allow for a sharp discrimination between states of matter that cannot be transformed into each other adiabatically. In this talk we present an unconventional pairing state for the electron fluid in two-dimensional oxide interfaces and establish a direct link to the emergence of nontrivial topological invariants. Topological signatures, in particular Majorana edge states, can then be used to detect the microscopic origin of superconductivity. In addition, we show that the density wave states that compete with superconductivity have very rich spatial textures (magnetic vortices, Skyrmions) and sensitively depend on the nature of the pairing interaction.

AGjDPG 3.11 Tue 15:30 EB 301

Quantum criticality in frustrated $CePd_{1-x}Ni_xAl$ — •Akito Sakai[1], Stefan Lucas[2], Veronika Fritsch[1,3], Philipp Gegenwart[1], Oliver Stockert[2], and Hilbert v. Löhneysen[3] — [1]Universität Augsburg, Institut für Physik, Elektronische Korrelationen und Magnetismus, Germany — [2]Max-Planck-Institut für chemische Physik fester Stoffe, Dresden, Germany — [3]Karlsruher Institut für Technologie, Physikalisches Institut, Germany

Various interesting behaviors such as non-Fermi liquid and unconventional superconductivity have been observed in the vicinity of quantum critical points (QCPs), which are induced by the competition between Kondo effect and RKKY interaction. Another route to achieve the QCP is geometric frustration. CePdAl is one of the candidates of such quantum critical frustrated systems [1, 2]. In addition to the heavy fermion behaviors, a partial antiferromagnetic ordering is revealed below $T_N = 2.7$ K, where one third of the Ce moments in the distorted kagomé lattice are still paramagnetic [1]. In this presentation, we discuss the possible QCP in $CePd_{1-x}Ni_xAl$ revealed by the specific heat measurement in the dilution refrigerator.

[1] A. Dönni *et al.*, J. Phys.: Condens. Matter **8**, 11213 (1996).
[2] V. Fritsch *et al.*, Phys. Rev. B **89**, 054416 (2014).

AGjDPG 3.12 Tue 15:45 EB 301

Resonant inelastic x-ray scattering of magnetic excitations in the novel $5d^4$ iridate Ba_2YIrO_6 — •Maximilian Kusch[1,2], T. Dey[1], A. Maljuk[1], S. Wurmehl[1], B. Büchner[1,2], V. M. Katakuri[3], B. H. Kim[3], D. V. Efremov[3], J. van den Brink[3], M. Moretti[4], M. Krisch[4], and J. Geck[1] — [1]Institute for Solid State and Materials Research, IFW Dresden, Helmholtzstrasse 20, 01069 Dresden, Germany — [2]Institut für Festkörperphysik, Technische Universität D-01062 Dresden, Germany — [3]Institute for Theoretical Solid State State Physics, IFW Dresden, Germany — [4]ESRF, B.P.220, 38043 Grenoble, France

In contrast to the much studied $5d^5$ iridates with a spin-orbit coupled J=1/2 ground state, Ba_2YIrO_6 is a realization of a Ir-$5d^4$ system. For this case, a ground state J=0 is expected, i.e, Ba_2YIrO_6 should be non-magnetic. Surprisingly, our measurements of the magnetic susceptibility reveal sizable magnetic moments whose microscopic origin is still unclear. Theoretical studies indicate the important role of low-lying magnetic excitations, thereby providing a possible explanation for the unexpected magnetic susceptibility [Khaliullin Phys. Rev. Lett. 111 (2013)]. In addition, our theoretical models predict a considerable dispersion of the J=1 and J=2 excitations in Ba_2YIrO_6. To elucidate the unconventional magnetism of Ba_2YIrO_6 and to determine the dispersions of the J=1 and J=2 excitations experimentally, we performed RIXS studies of this novel $5d^4$ compound. Here we present the results,

focusing on the magnetic dispersions in a large region of q-space in comparison to our model calculations.

Posters

AGjDPG 3.13 Tue 16:15 EB 301

Fermi surface on the border of Mott transition in NiS_2 — •Hui Chang[1], Sven Friedemann[1,2], Monika Gamza[3], William Coniglio[4], David Graf[4], Stan Tozer[4], and Malte Grosche[1] — [1]Cavendish Laboratory, University of Cambridge, UK — [2]HH Wills Laboratory, University of Bristol, UK — [3]Department of Physics, Royal Holloway, University of London, Egham, UK — [4]National High Magnetic Field Laboratory, Tallahassee, Florida 32310, USA

The transition from a metallic to a correlated, or Mott, insulating state is a long-standing theme of fundamental interest in condensed matter research. Using quantum oscillation measurements in high magnetic fields to probe the electronic Fermi surface and effective carrier mass on the metallic side of the transition could provide much needed microscopic information. In the cuprates, such studies in samples doped into the metallic state have identified the Fermi surface structure in underdoped and overdoped regimes. Because the quantum oscillation signal is strongly suppressed in the presence of disorder, pressure rather than doping should ideally be used to reach the metallic state. We present the first observation of quantum oscillations from a pressure-metallised 3D Mott insulator. NiS_2 can be tuned through the Mott transition at a modest pressure of 30kbar. Quantum oscillations near the Mott transition are observed with the tunnel diode oscillator technique in magnetic fields up to 31T. The main observed oscillation frequency is consistent with the Fermi surface obtained within density functional theory, whereas the effective mass is significantly enhanced over the band mass.

AGjDPG 3.14 Tue 16:15 EB 301

Transport properties across the quantum phase transitions in $Mn_{1-x}Fe_xSi$ — •Fabian Jerzembeck[1], Marlies Gangl[1], Anna Kusmartseva[1,2], Andreas Bauer[1], and Christian Pfleiderer[1] — [1]Physik Department, Technische Universität München, D-85747 Garching, Germany — [2]Department of Physics, Loughborough University, UK-LE11 3TU Leicestershire, United Kingdom

Recent theory identify the thermal and electrical transport properties as a sensitive probe of the validity of the Fermi liquid description of the metallic state [1]. A prime example for a well understood, weakly spin-polarized Fermi liquid ground state has long been established in the weak itinerant helimagnet MnSi. We report a detailed study of the evolution of the thermal and electrical transport properties across the quantum phase transitions in $Mn_{1-x}Fe_xSi$ [2] down to temperatures of $\sim$2 K under magnetic fields up to 14 T. These data are complemented by additional selected measurements in $Mn_{1-x}Co_xSi$. As our main objective we consider the validity of the Wiedemann-Franz law across the quantum phase transitions in $Mn_{1-x}Fe_xSi$.

[1] R. Mahajan, M. Berkeshli, S. A. Hartnoll, Phys. Rev. B **88**, 125107 (2013). [2] A. Bauer *et al.*, Phys. Rev. B **82**, 064404 (2010).

AGjDPG 3.15 Tue 16:15 EB 301

Identification of a Brazovskii quantum phase transition in the Chiral Magnet MnSi — •Jonas Kindervater[1], Stefan Ernst[1], Andreas Bauer[1], Wolfgang Häussler[1,2], Nicolas Martin[1,2,3], Peter Böni[1], Markus Garst[4], and Christian Pfleiderer[1] — [1]Physik-Department, Technische Universität München, Germany — [2]Heinz Maier-Leibnitz Zentrum, Technische Universität München, Germany — [3]CEA Saclay, DSM/IRAMIS/Laboratoire Leon Brillouin, France — [4]Institute for Theoretical Physics, Universität zu Köln, Germany

In the chiral magnet MnSi the transition into the ordered phase is driven to first-order due to strongly interacting fluctuations, which can be explained within the framework of the Brazovskii scenario [1]. We report a small angle neutron scattering and high resolution neutron spin echo spectroscopy study on the quantum phase transition in $Mn_{1-x}Fe_xSi$. Upon suppressing the helimagnetic order by iron doping a putative quantum phase transitions is observed [2]. According to theory [3], a possible Brazovskii quantum phase transition might thereby be realized either as a first- or second-order transition or, alternatively, as a tricritical point. Our study gives insight in the precise nature of the strongly interacting chiral fluctuations and the nature of the quantum phase transitions realized in $Mn_{1-x}Fe_xSi$.

[1] M. Janoschek *et al.*, PRB **87**, 134407 (2013); [2] A. Bauer *et al.*, PRB **82**, 064404 (2010); [3] J. Schmalian and M. Turlakov, PRL **93**, 036405 (2004)

AGjDPG 3.16 Tue 16:15 EB 301

Tuning $ZrFe_4Si_2$ by Ge substitution: confirming the proximity to a magnetic quantum critical point — •Katharina Weber[1,2], Nandang Mufti[1], Til Goltz[2], Theo Woike[3], Hans-Henning Klauss[2], Christoph Bergmann[1], Helge Rosner[1], and Christoph Geibel[1] — [1]Max Planck Institute for Chemical Physics of Solids, Dresden, Germany — [2]Institute of Solid State Physics, TU Dresden, Germany — [3]Institute for Structural Physics, TU Dresden, Germany

Magnetic systems with reduced dimensionality or frustration are attracting strong interest because these features lead to an increase of quantum fluctuations which often results in unusual, very interesting properties. Our previous studies evidence the AFe_4X_2 family (A = Y, Lu, Zr and X = Ge, Si) to cover the whole regime from frustrated antiferromagnetic (AFM) order up to the quantum critical point (QCP) separating the frustrated AFM ground state from the paramagnetic ground state. $ZrFe_4Si_2$ showed evidence for an unusual type of weak magnetic order and was therefore suspected to be near the QCP. In order to get a deeper insight into its ground state, we performed a detailed study of Ge substituted $ZrFe_4Si_2$, where Ge is suspected to stabilize the magnetic state because of a negative chemical pressure effect. We synthesized polycrystalline samples of $ZrFe_4(Si_{1-x}Ge_x)_2$ with $x = 2\,\%$ to $50\,\%$ and investigated their magnetic, thermodynamic, structural and transport properties. As expected with increasing Ge content the magnetic state is stabilized towards a well defined AFM order at high Ge content. This confirms the near-by QCP in $ZrFe_4Si_2$.

AGjDPG 4: Digitale Agenda in Theorie und Praxis: Was geschieht in der Wissenschaft? (mit AGjDPG)

Time: Wednesday 9:30–11:15 Location: TA 251

Invited Talk AGjDPG 4.1 Wed 9:30 TA 251

Der Umgang mit Forschungsdaten in einer digital geprägten Informationsinfrastruktur — •Peter Schirmbacher — Humboldt-Universität zu Berlin, Institut für Bibliotheks- und Informationswissenschaft

Der Vortrag verfolgt das Ziel, zunächst den Wandel der Gestaltung von Informationsinfrastrukturen in einer Wissenschaftswelt darzustellen, die immer mehr durch die Digitalisierung und die Vernetzung geprägt ist. Ein Teil dieser Veränderungen lässt sich am Umgang mit Forschungsdaten sehr gut dokumentieren. Es geht darum das allgemeine Verständnis zum Umgang mit Forschungsdaten zu wecken, Beispiele zu bringen und auf die vielen bisher nicht gelösten Probleme hinzuweisen. Diese wären z. B. die Wahrung der Qualität von Forschungsdaten und der sie beschreibenden Metadaten, das Forschungsdatenmanagement, der Aufbau von Forschungsdaten-Repositories, die Gestaltung von Informationsinfrastrukturen. Der Umgang mit Forschungsdaten hat drei Dimensionen: Eine wissenschaftspolitische Dimension, eine organisatorische Dimension und eine technische Dimension. Natürlich können diese Themen teilweise nur angerissen werden, wobei jedoch der Versuch unternommen wird, den gegenwärtigen Stand zu beschreiben und sich andeutende Entwicklungslinien aufzuzeigen. Die einzelnen Themenkomplexe werden auf der Grundlage der Ergebnisse einer umfangreichen Befragung der Wissenschaftlerinnen und Wissenschaftler der Humboldt-Universität dargestellt werden.

AGjDPG 4.2 Wed 10:15 TA 251

Forschungsförderung und Digitale Agenden. Ein Einblick in DFG-Strategien zur Ausgestaltung einer funktionalen Informationsinfrastruktur — •Johannes Fournier — Deutsche Forschungsgemeinschaft (DFG) - Wissenschaftliche Literaturversorgungs- und Informationssysteme - 53170 Bonn

Seit einigen Jahren unterliegen Forschung und Wissenschaftskommuni-

kation intensiven, durch die fortschreitende Digitalisierung bedingten Wandlungsprozessen, die nun verstärkt die Aufmerksamkeit auch der Politik finden. Dies zeigt sich z.B. an der Digitalen Agenda der Bundesregierung, der Diskussion um die Einführung einer allgemeinen Wissenschaftsschranke in das Urheberrechtsgesetz oder den Debatten um die Verankerung des Open Access in Hochschulgesetzen. Mindestens ebenso wichtig wie wissenschaftsfreundliche politische Rahmenbedingungen sind jedoch Informationsinfrastrukturen, die ein den Bedürfnissen der unterschiedlichen Communities entsprechendes wissenschaftliches Arbeiten optimal unterstützen oder gar erst ermöglichen.

Mit den von der Gruppe „Wissenschaftliche Literaturversorgungs- und Informationssysteme“ betreuten Förderprogrammen bietet die DFG Wissenschaftlern und Wissenschaftlerinnen unterschiedliche Möglichkeiten, in Kooperation mit einschlägigen Einrichtungen für sie relevante Informationsinfrastrukturen zu entwickeln und zu erproben. Dabei wird das strategische Ziel verfolgt, in einem abgestimmten System einen für Nutzerinnen und Nutzer freien und umfassenden Zugang zu nachnutzbaren wissenschaftlichen Informationen zu schaffen und damit die Qualität der Forschung zu verbessern. Vor dem Hintergrund aktueller politischer Diskussionen wird im Vortrag aufgezeigt, mit welchen strategischen Schwerpunkten die DFG dem gegenwärtigen Transformationsprozess gerecht wird und gezielt dazu beträgt, Informationsinfrastrukturen zukunftsfähig zu machen. Schwerpunkte des Vortrags werden DFG-Aktivitäten zur offenen Bereitstellung von Forschungsergebnissen und ihrer potenziellen Nachnutzbarkeit sein.

AGjDPG 4.3 Wed 10:45 TA 251

Content Mining des TIB|AV-Portals: Automatische Analyse und Verschlagwortung von AV-Medien — •Sven Strobel — Technische Informationsbibliothek (TIB), Welfengarten 1B, 30167 Hannover

Das TIB|AV-Portal wurde vom Kompetenzzentrum für nicht-textuelle Materialien an der Technischen Informationsbibliothek gemeinsam mit dem Hasso-Plattner-Institut für Softwaresystemtechnik von 2011 bis 2014 entwickelt. Der Schwerpunkt seines Sammlungsprofils liegt auf AV-Medien aus Technik und Naturwissenschaft. Der Vortrag beleuchtet die automatische Videoanalyse des TIB|AV-Portals unter besonderer Berücksichtigung der automatischen Verschlagwortung.

Die Prozesskette der automatischen Videoanalyse besteht aus dem Ingest der AV-Medien und manuell-intellektuellen Metadaten, der Szenenerkennung, der Audio- und Texterkennung (Speech to Text, OCR-Analyse), Bilderkennung sowie automatischen Verschlagwortung (Named Entity Recognition). Darüber hinaus bekommen die Videos einen Digital Object Identifier (DOI) vergeben; den einzelnen Videosegmenten wird ein Media Fragment Identifier (MFI) zugewiesen. Mit Hilfe von DOI und MFI können die Videos bzw. Videosegmente eindeutig und permanent dereferenziert und zitiert werden.

Die automatische Verschlagwortung der AV-Medien verläuft segmentbasiert, so dass eine zielgenaue Suche innerhalb der Videos möglich ist. Für die Verschlagwortung werden Fachabzüge der Gemeinsamen Normdatei (GND) herangezogen. Das bedeutet: Die Videos werden je nach Fachzugehörigkeit mit einem entsprechenden GND-Fachabzug aus Technik, Physik, Mathematik etc. indexiert. Die Sachbegriffe der GND stehen in semantischer Beziehung zueinander (Synonyme, Unterbegriffe, englische Übersetzungen etc.), was bei der Suche genutzt wird, um die Ergebnismenge zu erweitern. Der Vortrag schließt mit einer Zusammenfassung des Mehrwerts des TIB|AV-Portals, der sich im Wesentlichen durch die automatische Videoanalyse ergibt.

AGjDPG 5: Physics of Sustainability and Human-Nature Interactions

Time: Wednesday 9:30–12:15 Location: H 0105

Invited Talk AGjDPG 5.1 Wed 9:30 H 0105

Anticipating and avoiding tipping points — •Timothy M. Lenton — University of Exeter, Exeter, UK

A 'tipping point' occurs when a small change in forcing triggers a strongly non-linear response in the internal dynamics of a system, qualitatively changing its future state. Large-scale 'tipping elements' have been identified in the Earth's climate system that may pass a tipping point under human-induced global change this century. At the smaller scale of ecosystems, some tipping points have already been observed, and more are anticipated in future. Our capacity to forecast such abrupt, non-linear changes has historically been poor. However, much excitement has recently been generated by the theory that some approaching tipping points carry generic early warning signals. I will critically examine the prospects for gaining early warning of approaching tipping points. Promising methods are based on detecting 'critical slowing down' in the rate a system recovers from small perturbations, and on accompanying changes in the statistical distribution of its behaviour. I will show examples of early warning signals in paleo-data approaching past abrupt climate changes, and in models being gradually forced past tipping points. I will also consider the conditions under which the methods fail. Finally, I will discuss how we might respond to early warning to try and avoid tipping points, especially in the climate system.

Invited Talk AGjDPG 5.2 Wed 10:00 H 0105

Climate investment under uncertainty: the two degree target and the desire for dynamic consistency — •Hermann Held and Delf Neubersch — Center of Earth System Research and Sustainability, University of Hamburg, Grindelberg 5, 20144 Hamburg

During the climate Conferences of the Parties 2009-2011 the global community developed a formal consensus to limit the anthropogenically induced increase of global mean temperature to 2K (“two-degree targe” or “2°-target”). While the latest IPCC (Intergovernmental Panel on Climate Change) report (2014) summarizes cost estimates that can be interpreted as rather low, suggesting some potential political feasibility of the 2°-target, some authors start to question the conceptual validity of the 2°-target: it might be too late to still comply with it, given the slow pace of mitigation policy. Moreover, it is pointed out that a strictly interpreted temperature target does not have a straightforward generalization when uncertainty is internalized in decision-making under anticipated future learning.

Here we present a generalization of the 2°-target that addresses both of these problematic aspects and that respects dynamic consistency under anticipated future learning. Consequences for climate policy are highlighted. We find that previous climate economic analyses of the 2K-target in terms of low cost for transforming the energy system are still valid, when being re-interpreted. Moreover, mitigation costs could be reduced by up to 1/3 if the climate response to greenhouse gas forcing were known with certainty, pointing to the expected economic value of geo-scientific information.

Invited Talk AGjDPG 5.3 Wed 10:30 H 0105

What are the resources required to fulfil human needs? — •Julia Steinberger — Sustainability Research Institute, University of Leeds, UK

All human societies require environmental resources, in the form of energy and materials, to survive and flourish. However, the exact level of resource requirements may be difficult to estimate, since it can depend on many factors. These factors include: local biophysical conditions, such as climate or available crops for food; technological options and efficiencies for delivering key services; but also socio-economic parameters, including consumption levels and inequality in distribution. This talk will present recent advances in the international study of energy requirements for human needs. These results demonstrate that high levels of human wellbeing are attainable at moderate as well as very high energy use, and that the average level of energy use required to achieve high human wellbeing is declining over time. Moreover, it can be shown that energy itself does not play a dominant role in explaining the considerable advances in human wellbeing over the past half century. An agenda for analysing the resource requirements to fulfil universal basic human needs will then be presented. This agenda must take into account socio-economic as well as technological choices, since fulfilling human needs at low levels of resource use most likely requires a re-organisation and re-orientation of many socio-economic activities.

15 min. break

Invited Talk AGjDPG 5.4 Wed 11:15 H 0105

Design of Sustainable Supply Chains for Sustainable Cities — •Anna Nagurney — Isenberg School of Management, University

of Massachusetts Amherst

Supply chains provide the critical infrastructure for the production and distribution of goods and services in our Network Economy and serve as the conduits for the manufacturing, transportation, and consumption of products ranging from food, clothing, automobiles, and high technology products, to even healthcare products. Cities as major population centers serve not only as the principal demand points but also as the locations of many of the distribution and storage facilities, transportation providers, and even manufacturers. The sustainability of supply chains is, hence, a precursor to the sustainability of our cities.

In this presentation, we discuss a plethora of relevant supply chain networks for cities from food to energy ones. We provide the foundations of the methodologies in terms of variational inequality theory and projected dynamical systems theory and describe both an optimization model for sustainable supply chain network design as well as a game theory one with multiple decision-makers and frequencies of the network economic activities.

Invited Talk AGjDPG 5.5 Wed 11:45 H 0105
Ecological econophysics for degrowth — •Salvador Pueyo — Dept. d'Ecologia, Universitat de Barcelona, Barcelona, Catalonia, Spain — Research & Degrowth, Barcelona, Catalonia, Spain

Climate change, resource scarcity and ecosystem degradation suggest that we have already overshot the sustainable level of economic throughput. One of the greatest challenges of our time is to move from a growth-based economy to a socially benign degrowth. The obstacles ahead are not only political and cultural but also technical: How to transform the economic system in depth without undesired emergent properties or loss of its basic functionality? How to shrink the economy without triggering uncontrolled recessions? How to effectively increase equality to compensate for a decreasing average consumption? Several of the involved features are best expressed as frequency distributions (of recession sizes, of individual income or resource consumption), thus demanding the kind of approach used in statistical physics, which links distributions to mechanisms. This econophysical approach should be combined with that of ecological economics, which treats the economy as a subsystem of the biosphere instead of an autonomous system. Researchers in econophysics or complexity economics are in a unique position to move beyond more mundane goals and apply their knowledge to help changing the system in favor of sustainability, equality and democracy while we still have the opportunity.

AGjDPG 6: Data Visualization

Time: Wednesday 15:00–16:00 Location: HFT-FT 131

Invited Talk AGjDPG 6.1 Wed 15:00 HFT-FT 131
Data Visualisation: Journey to the 2nd Dimension — •Martin Zaltz Austwick — CASA, UCL, Gower Street London, W1T 4TJ

Data Visualisation has become a constant fixture in the scientific literature and the media as computer power and accessibility allows more and more creative and technical people use tools to bring data to life through maps, animations, and infographics. In this, the International Year of Light, we'll be taking a tour around visualisation - what it's achieved, where it's failed, and where physicists can contribute and benefit from the field. We'll talk about how visualisation can present live data, give researchers an insight into how to approach analysis, represent model outputs, and communicate their results to wider audiences, engaging people with their work. We'll ask how we reconcile the wider goals of informing people and delighting people, and what tools and techniques are commonly employed to create effective, beautiful and impactful visualisations.

AGjDPG 7: Scientific Writing

Time: Thursday 9:30–10:30 Location: HFT-FT 131

Invited Talk AGjDPG 7.1 Thu 9:30 HFT-FT 131
Über das Schreiben von wissenschaftlichen Arbeiten — •Ingolf Volker Hertel — Max-Born-Institut und HU, Berlin-Adlershof

Viele, die damit beginnen, wissenschaftlicher Texte zu schreiben – sei es eine Bachelor- oder Masterarbeit, eine Dissertation oder eine Publikation in einem internationalen Journal – meinen zu wissen, wie man das macht. Die Praxis zeigt jedoch, dass dies meist ein Trugbild ist, und dass einiges an Erfahrung zu sammenln ist, bevor das Ergebnis solcher Anstrengung wie selbstverständlich auch die Leser in der gewünschten Weise erreicht.

In diesem Vortrag werden eine Reihe von Tipps und Regeln zusammengestellt, die dabei helfen sollen, typische Schwierigkeiten zu uberwinden und Standardfehler zu vermeiden – die oft auch von erfahreneren Wissenschaftlern noch gemacht werden. Diese Anregungen basieren auf vielen Jahren eigener wissenschaftlicher Publikationstätigkeit, aber auch auf den Erfahrungen bei der Betreuung zahlreichen Seminar-, Diplom- und Doktorarbeiten. Idealerweise möge das hier Vorzutragende den Zuhörern helfen, einen eigenen, wirklich professionellen Stil fur die schriftliche Aufarbeitung wissenschaftlicher Themen und Ergebnisse und für ihre Niederschrift zu entwickeln.

Schließlich folgen einige Anregungen dazu, wie man mit einer solchen Arbeit überhaupt beginnen sollte – auch in Hinblick auf das später Aufzuschreibende. Studierende bzw. Doktoranden entdecken oft viel zu spät, was man alles viel früher hätte berücksichtigen sollen.