TECHNISCHE UNIVERSITÄT DRESDEN

Fakultät Mathematik und Naturwissenschaften, Fachrichtung Physik

EINLADUNG

zum

PHYSIKALISCHEN KOLLOQUIUM

Referent: **Prof. Dr. Marty Gregg**

School of Maths and Physics, Queen's University Belfast, Belfast, U. K.

Thema: **Ferroic Domain Walls: A New Playground in 2D Functional Materials**

Zeit und Ort: Dienstag, 08.12.2015, 16:40 Uhr

Physikgebäude, Hörsaal PHY/C213, Zellescher Weg 16/Haeckelstr. 3

Leiter: Prof. Dr. Lukas Eng

Abstract: It is no secret that there has been an explosion of interest in sheet conductors: surface states in topological insulators [1], LaAlO3-SrTiO3 interfaces [2] and graphene layers [3] have been the preoccupation of large research teams across the globe for many years. Ferroic domain walls are much less well-known as sheet conductors; yet they may have even greater potential than those of the well-established systems: after all, domain walls have special properties that other systems do not have in that they are mobile, can be controllably shunted from point to point, and can be spontaneously created, or made to disappear. The potential of "domain wall nanoelectronics" [4], as it now known, is immense, but can only be fully assessed once a great deal of fundamental science is done: good news for interested researchers.
This talk will concentrate on two areas of domain wall research recently performed at Queen's University Belfast: firstly, experiments revealing fundamental insight into domain wall conduction mechanisms will be described. Specifically, the use of scanning probe microscopy to determine Hall voltages at domain walls will be discussed, as will the active carrier types, mobilities and densities implied in rare earth manganites, metal-halide boracites and LiNbO3 (all with transport-active "head-to-head" and "tail-to-tail" walls). Secondly, various ways in which domain wall injection and motion [5] have been controlled, using sample morphology, electric and stress fields, will be described which have culminated in the successful creation of a ferroelectric domain wall diode [6].

[1] H. Zhang et al. Nature Physics 5, 438 (2009)
[2] A. Ohtomo and H. Y. Hwang, Nature 427, 423 (2004)
[3] K. S. Novoselov et al. Science 306, 666 (2004)
[4] G. Catalan et al. Rev. Mod. Phys. 84 119 (2012)
[5] J. R. Whyte et al. Adv Mat. 26, 293 (2014); J. R. Whyte et al. J. Appl. Phys. 116, 066813 (2014)
[6] J. R. Whyte et al. Nat. Comms, 6, 7361 (2015).

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PHYSIKALISCHEN KOLLOQUIUM

Referent: **Prof. Dr. Martin Dressel**
Physikalisches Institut, Universität Stuttgart, Germany

Thema: **Optical Spectroscopy on Superconductors: The Higgs mode in disordered films**

Zeit und Ort: Dienstag, 15.12.2015, 16:40 Uhr

Physikgebäude, Hörsaal PHY/C213, Zellescher Weg 16/Haeckelstr. 3

Leiter: Prof. Dr. Arno Straessner

Abstract: The electrodynamic properties of superconductors are of interest from a fundamental side as well as for applications. Since the seminal work of M. Tinkham on the superconducting energy gap in the late 1950s optical investigations have been established as a powerful method to explore the quasi-particle excitations and their dynamics which yield important information on the density of states, the symmetry of the order parameter, the scattering mechanism, and eventually the glue to super¬conductivity. In addition, the superconducting condensate is probed, i.e. the Cooper pair density and stiffness. Most recently, it became clear that under certain conditions, also collective modes can be studied: these are the phason excitations (Nambu-Goldstone mode) and the amplitude mode (Higgs mode).
The talk will give a general introduction to the optical properties of superconductors, sketch the theory and highlight some important experimental findings, as well as applications, such as superconducting single photon detectors. In particular we will focus on ultrathin superconducting films, such as InO, Nb, NbN, TiN, and TaN, but also Al, which exhibit a superconductor-insulator transition as disorder or granularity increases. We discuss the possibility of collective low-frequency ex¬citations due to the Higgs mechanism, which become long-lived and well defined in the vicinity of a quantum critical point.

References

[1] M. Dressel et al., IEEE Sel. Top. Quant. Electr. 14, 399 (2008); Adv. Condens. Matter Phys. 2013, 104379 (2013).
[2] U. S. Pracht et al., IEEE Trans. THz Sci. Technol. 3, 269 (2013); Phys. Rev. B 86, 184503 (2012).
[3] D. Sherman et al., Phys. Rev. B 89, 035149 (2014); Nature Phys. 11, 188 (2015).
[4] N. Bachar et al., J. Low Temp. Phys. 179, 83 (2014); U Pracht, et al. arXiv:1508.04270.

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Fakultät Mathematik und Naturwissenschaften, Fachrichtung Physik
Philosophische Fakultät, Institut für Philosophie

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GEMEINSAMEN KOLLOQUIUM DER FACHRICHTUNG PHYSIK UND DES INSTITUTS FÜR PHILOSOPHIE

Referent: **Prof. Dr. Michael Esfeld**

Université de Lausanne, Schweiz

Thema: **Was ist Materie? Die Naturphilosophie der klassischen und der Quantenphysik**

Zeit und Ort: Dienstag, 05.01.2016, 16:40 Uhr

Physikgebäude, Hörsaal PHY/C213, Zellescher Weg 16/Haeckelstr. 3

Leiter: Prof. Dr. Michael Kobel

Abstract: Newtons Principia setzen das Paradigma für eine Naturphilosophie, in der Physik und Philosophie zusammen eine Antwort auf die folgenden drei Fragen suchen: (1) Was ist die Materie in Raum und Zeit? (2) Was sind die Gesetze von deren Verhalten? (3) Wie erklären die Konstitution der Materie und die dynamischen Gesetze die beobachtbaren Phänomene? Der Vortrag ist ein Plädoyer dafür, dass Naturphilosophie in diesem Sinne auch heute noch erforderlich ist: für eine Antwort auf diese Fragen braucht es mathematischen Formalismus und experimentelle Daten zusammen mit begrifflicher Analyse der Philosophie. Inhaltlich skizziere ich zunächst Newtons Antwort auf diese Fragen und gehe dann dem nach, was genau sich im Übergang von der klassischen zur Quantenmechanik ändert. Meine These ist, dass die Quantenmechanik genau wie die klassische Mechanik die Verteilung von Materieteilchen im Raum beschreibt, sich die Gesetze aber grundlegend ändern und dieses folgende Auswirkung auf das Materieverständnis hat: der Akzent verschiebt sich von Eigenschaften individueller Teilchen (Masse, Ladung) zu Relationen oder Strukturen (Zustandsverschränkungen) und einer mit diesen einhergehenden spezifischen Nicht-Lokalität.

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Die Hochschullehrer der Fachrichtung Physik

und des Instituts für Philosophie

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PHYSIKALISCHEN KOLLOQUIUM

Referent: **Prof. Ulrich Nierste**
KIT, Institut für Theoretische Teilchenphysik, Karlsruhe

Thema: **Flavour physics: a journey from the Standard Model to new physics**

Zeit und Ort: Dienstag, 12.01.2016, 16:40 Uhr
Physikgebäude, Hörsaal PHY/C213, Zellescher Weg 16/Haeckelstr. 3

Leiter: Prof. Dr. Dominik Stoeckinger

Abstract: The Standard Model of elementary particles permits transitions between quarks of different generations only through the Yukawa interaction, which couples the fermions to the Higgs field. The strengths of these flavour-changing transitions is encoded in the Cabibbo-Kobayashi-Maskawa (CKM) matrix. I give an overview on the basic methodology of flavour physics, illustrating the steps linking the experimental results to the CKM elements and other fundamental parameters. Furthermore, flavour-changing transitions are highly sensitive to new physics. I recall the role of flavour physics for past discoveries of new physics --- jigsaw pieces which today are part of the ``old physics'' of the Standard Model. Then I discuss how current and future precision measurements at the flavour experiments LHCb, Belle II, and NA62 can reveal physics beyond the Standard Model.

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PHYSIKALISCHEN KOLLOQUIUM

Referent: **Prof. Dr. Gerhard Wilde**
Institute of Materials Physics, University of Münster

Thema: **Grain boundaries in severely deformed metals and alloys**

Zeit und Ort: Dienstag, 19.01.2016, 16:40 Uhr
Physikgebäude, Hörsaal PHY/C213, Zellescher Weg 16/Haeckelstr. 3

Leiter: Prof. Dr. Werner Skrotzki

Abstract: Ultrafine-grained materials that were processed by severe deformation show remarkable property combinations that exceed the modifications due to the mere presence of internal interfaces, indicating additional structural changes besides enlarging the total grain boundary area. The present contribution summarizes recent experimental results based on microstructure analyses (SEM-EBSD, TEM including Cs-corrected HRTEM and local strain analyses with atomic-scale spatial resolution by Geometric Phase Analysis) together with detailed grain boundary diffusion analyses on different pure metals and binary alloys using the radiotracer method. Basic issues concerning the existence and evolution of so-called "non-equilibrium" grain boundaries, their property characteristics and their relation with the performance of SPD-processed materials are addressed.

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PHYSIKALISCHES KOLLOQUIUM

Referent: **Prof. Dr. Angel Rubio,**
NanoBio Spectroscopy Group and ETSF Universidad del País Vasco
UPV/EHU, Donostia, Spain

Thema: **A TDDFT formulation for strong light matter interactions : applications to energy conversion**

Zeit und Ort: Dienstag, 26.01.2016, 16:40 Uhr
Physikgebäude, Hörsaal PHY/C213, Zellescher Weg 16/Haeckelstr. 3

Leiter: Prof. Dr. Carsten Timm

Abstract: In this talk we will review the recent advances within density-functional and many-body based schemes to describe spectroscopic properties of complex systems with special emphasis to modelling time and spatially resolved electron spectroscopies We will discuss the theoretical approaches developed in the group for the characterisation of matter out of equilibrium, the control material processes at the electronic level and tailor material properties, and master energy and information on the nanoscale to propose new devices with capabilities. We will focus on examples linked to the efficient conversion of light into electricity or chemical fuels ("artificial photosynthesis") and the design on new nanostructured based optoelectronic devices based on inorganic nanotubes, among others. The goal is to provide a detailed, efficient, and at the same time accurate microscopic approach for the ab-initio description and control of the dynamics of decoherence and dissipation in quantum many-body systems. With the help of quantum optimal control (QOC) theory and the mastery over spectroscopy we could direct the movement of electrons, selectively trigger chemical reactions and processes, and create new materials.

Work done in collaboration with H. Appel, J. Flick, C, Pellegrini, I. Tokatly, and M. Ruggenthaler. We acknowledge financial support from the European Research Council Advanced Grant DYNamo (ERC-2010- AdG-267374), Spanish Grant (FIS2013-46159-C3-1-P), Grupos Consolidados UPV/EHU del Gobierno Vasco (IT578-13) and COST Actions CM1204 (XLIC) and MP1306 (EUSpec)

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PHYSIKALISCHEN KOLLOQUIUM

Referent: **Dr. Alexander Eisfeld**
Max Planck Institute for the Physics of Complex Systems, Dresden

Thema: **Energy transfer and optical properties of light harvesting aggregates**

- Vorstellungsvortrag zur Habilitation -

Zeit und Ort: Dienstag, 02.02.2016, 16:40 Uhr
Physikgebäude, Hörsaal PHY/C213, Zellescher Weg 16/Haeckelstr. 3

Leiter: Prof. Dr. Walter Strunz

Abstract: Assemblies of weakly interacting molecules (so-called molecular aggregates) have become remarkably versatile quantum systems with applications in photography, opto-electronics, solar cells, and photo-biology.
The remarkable properties of these aggregates stem from the strong transition dipole-dipole interaction between the individual molecules which leads to eigenstates with excitation shared coherently by a large number of molecules.
As a consequence, electronic excitation can migrate through the aggregate and new superradiant optical properties emerge.

In this talk I will give an introduction on the relationship between the structure of the aggregate (spatial arrangement, molecular properties, environment) and the resulting optical and transfer properties with a focus on the the important role of coupling to vibrational modes. As examples I will discuss superradiant emission of molecules on dielectric surfaces and energy transfer in biological light harvesting systems.

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