Plenary Talk

Plenary Talk — M. A. G. M. van der Vorst — University of Twente, Enschede, The Netherlands

This talk will discuss the role of science in society and the importance of interdisciplinary collaborations. It will explore how cooperation among scientists from different fields can lead to innovative solutions to complex problems. The presentation will highlight recent examples of successful interdisciplinary projects and will outline strategies for fostering scientific collaboration and innovation.
Special Talk  
Plenary Talks (PV)  
**Invisible Hands, Invaluable Assets** — John Krige — Kranzberg Professor, School of History Technology, and Society at Georgia Institute of Technology, Atlanta GA 30332-0345

The reward system of science, and our culture’s enthusiastic valorization of individual achievement, mean that a high premium is placed on the discoveries of great men and women. The history of science mimicking the prevailing norms of the social system, and often depending on leading scientists for their intellectual cooperation and institutional support, tends to reinforce this view of how knowledge is produced. And understandably so, for the sciences, and physics in particular, have attracted some of the greatest minds of all time whose outstanding contributions to our understanding of nature deserve to be recorded.

Nevertheless, at least in the experimental domain, and with increasing importance after World War II, these individual achievements would not have been possible without the assistance of skilled and highly competent technicians, whose practical knowledge of the material world and how to manipulate it provided an essential platform on which cutting-edge research was made. These technicians and virtuosos in the mechanical arts are the silent and formally unrecognized participants in laboratory life whose contributions, even if appreciated, are seldom celebrated, nor usually traced in the historical record. To give them their voice is not only to recognize their contributions to science but also to reconfigure our understanding of the conditions of the possibility of scientific innovation and successful scientific achievement.

Drawing on a number of case studies in physics and related fields this paper will throw light on the contributions of the otherwise invisible hands whose activities have been overshadowed by the brilliance of the men and women who have made major contributions to the advance of scientific knowledge.

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**Plenary Talk**

**Quantum dot spin manipulation** — Atac Imamoglu — Institute of Quantum Electronics, Quantum Photonics Group, ETH Hönggerberg, HPT G10, CH-8093 Zürich

Spin dynamics in quantum dots are enriched by their solid-state environment. I will describe recent experiments demonstrating efficient all-optical pumping and measurement of a quantum dot spin. Single-spin pumping is achieved using spontaneous spin-flip Raman transition, enabled by the hyperfine-interaction induced mixing of the single electron spin states. Measurement of the time-averaged spin-state on the other hand, is realized by observing the Faraday rotation of an off-resonant laser field.

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**Plenary Talk**

**Magnetic Nanostructures in the Lateral and Perpendicular Direction** — Hartmut Zabel — Institute for Condensed Matter Physics, Ruhr-Universität Bochum, D-44780 Bochum, Germany

Artificial magnetic nanostructures in the lateral and in the perpendicular direction are being intensively studied because of their interesting magnetic properties and their use in spintronic devices. Perpendicularly stacked magnetic heterostructures allow the investigation of collinear and non-collinear interlayer exchange coupling, the exchange bias phenomena between ferro- and antiferromagnetic layers, as well as confinement and scaling effects of spin density wave magnetism. In the lateral direction a multiplicity of different shapes for ferromagnetic nanostructures can be realized such as stripes, dots, rings, squares, etc. The main interest in these nanostructures is the understanding of the domain structure in the ground state, the magnetization reversal in space and time, and the dipole interactions between the elements. In this talk an overview will be presented on investigations of magnetic superlattices and lateral magnetic nanostructures using mainly three experimental tools: vector and Bragg-MOKE, polarized neutrons reflectivity, and resonant soft x-ray magnetic scattering.

This work is supported by SFB 491 and by BMBF 03Z46BC2 and 05KS4PCA

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**Evening Talk**

**Adhesion an Mikro- und Nanostrukturen: Von Geckos, Mipillen und smarten Oberflächen** — Eduard Arzt — Max-Planck-Institut für Metallforschung — Universität Stuttgart


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**Prize Talk**

**Spin Transfer Phenomena in Semiconductor quantum dots and molecules** — Jonathan J. Finley — Walter Schottky Institut, Technical University of Munich, 85748 Garching, Germany — Träger des Walter-Schottky-Preises

I will review investigations of optically pumped spin-memory devices that enable the reversible transfer between photon polarisation and the spin state of a quantum dot. The exploitation of these effects is of considerable technological interest in spintronics, particularly in coupled QD-nanostructures.

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Plenary Talks (PV)

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**PV XV** Fri 8:30 H1

**Active gels: toward a generic approach of cell mechanics**

Jean-François Joanny — Physicochimie Curie (CNRS-UMR168), Institut Curie Section Recherche, 26 rue d’Ulm, 75248 Paris Cedex 05, France

Active systems are systems where energy is constantly injected by a chemical reaction or by an external drive. Examples of active systems are vibrated sand piles, bird flocks or fish colonies. The cell cytoskeleton is also active: the energy is provided by the hydrolysis of ATP molecules which both promotes the polymerization and the depolymerization of the cytoskeletal filaments but also is used as a fuel by the molecular motors that walk along the filaments and create internal stresses. The dynamical properties of the cytoskeleton seem to be dominated by the gel formed by actin filaments interacting with myosin motors. A further property of the cytoskeletal filament is their polarity which imposes a local orientation in the gel.

We have built a general hydrodynamic theory to describe the rheology of polar active gels in the spirit of the hydrodynamic theory of liquid crystals. The theory takes into account the viscoelasticity of the gel, the polymerization and depolymerization, the local polarization, and the active stresses induced in the gel. We briefly present this theory and show some very unusual hydrodynamic behavior of active gels that can flow spontaneously even in the absence of any pressure gradient. We then give some examples of application of active gel hydrodynamics to study the properties of cells: lamellipodium motion, cell instabilities driven by cortical actin.

This work has been done in collaboration with F. Jülicher, K. Kruse, J. Prost and K. Sekimoto.

**PV XVI** Fri 9:15 H1

**Catalysis from first principles**

Jens K. Nørskov — Center for Atomic-scale Materials Design, Department of Physics, Technical University of Denmark

Electronic structure methods based on density functional theory have reached a level of sophistication where they can be used to describe complete catalytic reactions on transition metal surfaces. This gives an unprecedented insight into these processes and it allows us to extract knowledge about the catalyst properties determining its activity. The ammonia synthesis is used to exemplify the approach. It will be shown that we can now predict relative catalytic activities of different materials and discussed how we can use this to develop concepts helping the design of new alloy catalysts. The generality of the approach is illustrated by including a number of other catalytic reactions into a universal property-activity scheme, which identifies the surface properties that determine the catalytic activity for a whole class of reactions.