SYQL 1 SYQL

Zeit: Freitag 10:15–12:40 Raum: TU HE101

Hauptvortrag SYQL 1.1 Fr 10:15 TU HE101

Single Spin Detection by Magnetic Resonance Force Microscopy — •Daniel Rugar, H. J. Mamin, R. Budakian, and B. W. Chui — IBM Research Division, Almaden Research Center, San Jose, CA 95120 USA

Single-spin detection by magnetic resonance force microscopy (MRFM) is based on the detection of the attonewton magnetic force between a spin and a nearby magnetic tip. Interest in the technique is driven by potential applications to three-dimensional atomic resolution imaging and by fundamental interest in the detection and manipulation of individual quantum objects. This talk describes the basic principles of MRFM and recent results that have demonstrated the ability to detect an individual electron spin buried below the surface of a silicon dioxide sample. Various innovations that led to single spin detection will be described, including ultrasensitive force detection, spin-friendly micromechanical cantilevers and methods to measure and control statistical polarization in small spin ensembles. Future prospects for quantum state readout and for extension to nuclear spin detection will be discussed.

D. Rugar, R. Budakian, H. J. Mamin, and B. W. Chui, Nature **430**, 329 (2004).
Ch. Day, Phys. Today **57** (9), 21 (2004).

Hauptvortrag SYQL 1.2 Fr 11:00 TU HE101

Optical Characterization of Single Two-Level Systems in Disordered Solids — •Lothar Kador and Markus Bauer — University of Bayreuth, Institute of Physics and Bayreuther Institut für Makromolekülforschung (BIMF), 95440 Bayreuth, Germany

The properties of disordered solids at low temperatures are well described by the phenomenological tunneling model [1,2] which postulates the presence of localized low-energy excitations (two-level systems, TLSs). These are attributed to groups of atoms which can change between two nearly degenerate states. In the optical spectra of single dopant molecules [3], interactions with nearby TLSs manifest themselves as spectral jumps and/or splitting of the molecular lines.

Single-molecule spectroscopy was used to characterize single TLSs in the amorphous polymer poly(isobutylene) and the Shpol'skiĭ system *n*-hexadecane. Some of the tunneling systems were found to be affected by temperature changes or electric fields, which allowed us to determine all their physical parameters. The results of most of our experiments are in very good agreement with the quantum-mechanical tunneling model. Only in a few cases, clear deviations were observed, e. g., interactions between two TLSs.

[1] P. W. Anderson, B. I. Halperin, and C. M. Varma, Phil. Mag. **25**, 1 (1972).
[2] W. A. Phillips, J. Low Temp. Phys. **7**, 351 (1972).
[3] Th. Basché, W. E. Moerner, M. Orrit, and U. P. Wild (eds.), *Single-Molecule Optical Detection, Imaging, and Spectroscopy* (VCH, Weinheim, 1996).

Hauptvortrag SYQL 1.3 Fr 11:20 TU HE101

Supraleitende Qubits auf dem Weg zum Quantenrechner — •Evgeni Ilichev — IPHT Jena

We show that adiabatic quantum evolution of flux qubits can be controlled by the impedance measurement technique (IMT). In the framework of this method, qubits of interest are inductively coupled to a high-quality tank circuit. Efficiency of this technique was demonstrated for one- and two-qubit examples experimentally. Comprehensive information about qubits, including classical behavior and Landau-Zener transitions, is obtained from the read-out of the tank properties. We have also proposed the application of the IMT of the three-qubit system for demonstration of the adiabatic quantum algorithm.

Hauptvortrag SYQL 1.4 Fr 11:40 TU HE101

Application of cryogenic detectors in time-of-flight mass spectrometry of large biomolecules — •S. Uchaikin[1,2], P. Christ[3], S. Rutzinger[3], W. Seidel[3] und F. Proebst[3] — [1]IPHT, Albert-Einstein-Str.9, 07745, Jena — [2]D-Wave System Inc., Vancouver, Canada — [3]Max Plank Institut für Physik, Föhringer Ring 6, 80805 München

Microchannel plates (MCP) which are used as detectors in conventional time-of-flight mass spectrometers exhibit a very good performance for small ion masses up to about 20 kDa. Due to their detection mechanism the sensitivity of MCP's decreases drastically for very large and, accordingly, very slow molecules.

Cryogenic calorimeter are extremely sensitive particle detectors. They combine a 100% detection efficiency, which is impact independent of the velocity of the molecule, with energy resolution and a low threshold. Thus, a very high and mass-independent detection sensitivity is expected from their application in time-of-flight mass spectrometry.

We implemented a cryogenic calorimeter with a superconducting phase transition thermometer in a dual reflector time-of-flight mass spectrometer. In a dilution series, using standard sample preparation procedure, we could show that the detection limit of insulin can be decreased by several orders of magnitude, down to below 1 amol total amount on the target.

Hauptvortrag SYQL 1.5 Fr 12:00 TU HE101

Bolometer-Arrays für die Large Bolometer Camera — •Ernst Kreysa — Max-Planck-Institut für Radioastronomie, Bonn

Hauptvortrag SYQL 1.6 Fr 12:20 TU HE101

Magnetische Kalorimeter für Röntgenspektrometer in der Halbleiter-Qualitätskontrolle — •Andreas Fleischmann[1] und Jens Höhne[2] — [1]Uni Heidelberg — [2]VeriCold Technologies