

**PS01.07.11 STUDY OF THE CRITICAL DYNAMICS OF ISOTROPIC HEISENBERG FERROMAGNETS BY NEUTRON SCATTERING.** S. Schorr, F. Mezei, Hahn-Meitner-Institut Berlin, Glienicker Str.100, D-14109 Berlin, Germany.

The critical dynamic behavior in the isotropic Heisenberg ferromagnet EuO can be tested by inelastic neutron scattering. Below the ferromagnetic Curie temperature  $T_c$  we observed magnetic excitations (spin waves) and above this temperature the critical magnetic scattering, which is reduced to the large spin fluctuations near the ferromagnetic phase transition, was measured. We can understand the critical dynamic behavior by taking into account the strong dipolar effects at wavenumbers  $q$  below  $\sim 0.1 \text{ \AA}^{-1}$ . The dipolar interaction, i.e. the action of an internal magnetic field produced by critical fluctuations on the fluctuations themselves, plays a pronounced role, because it covers the dynamic scaling behavior in a certain well understood  $q$ - $T$ -domain. We compared our results to recent mode coupling computational results [1], [2] taking into account both Heisenberg exchange and dipolar forces. Comparing various ferromagnetic materials such as EuO, EuS, Fe and Ni ([3], [4], [5]) there are big apparent differences between in the critical dynamics. We found that this differences can be explained if the dipolar perturbations are properly taken into account. Thus the principle of universality is maintained.

[1] E. Frey, H. Schwabl, *Z. Phys. B* 71 (1988) 355

[2] H. Schinz, H. Schwabl, to be published in *J. Magn. Magn. Mat.*

[3] P. Böni, to be published

[4] F. Mezei, *J. Magn. Magn. Mat.* 45 (1984) 67

[5] P. Böni et al., *Phys. Rev. B* 41 (1991) 575

### Electron Diffraction From Surfaces LEED, RMEED, PED, etc.

**MS01.08.01 COORDINATION ARRANGEMENTS IN SURFACE RECONSTRUCTIONS OF TRANSITION METALS STUDIED BY LOW-ENERGY ELECTRON DIFFRACTION.**

K. A. R. Mitchell, W. Liu, D. T. Vu, Y. M. Wang, K. C. Wong, Department of Chemistry, University of British Columbia, 2036 Main Mall, Vancouver, British Columbia, Canada V6T 1Z1.

The interaction of electronegative elements with well-characterized transition metal single-crystal surfaces can yield a wide variety of structural arrangements which may be studied by diffraction techniques. The most detailed information is from low-energy electron diffraction, particularly in the tensor LEED approach. For example, the types of structure formed with electronegative atoms like O, N, S or P can correspond to: (i) simple chemisorption, where electronegative atoms form chemical bonds to a relaxed, but not dramatically changed, metal surface; (ii) underlayer absorption; (iii) incipient surface compound formation, where a small number of compound-type layers bond to the metal substrate; or (iv) an independent adsorbate-induced surface reconstruction. A review will be made of some representative examples of structures recently determined on low-index surfaces of copper, rhodium, zirconium and palladium, including some discussion of reasons for particular choices of structure. Completely new structures are being uncovered. For example, P on the Rh(111) surface gives a reconstruction which involves a packed arrangement of nearly co-planar Rh pentagons and triangles on the surface. In this extremely stable structure each P atom, which is also essentially co-planar with the topmost metal layer, has an identical environment and bonds to eight neighbouring Rh atoms.

**MS01.08.02 REFLECTION HIGH-ENERGY ELECTRON DIFFRACTION AND SURFACE ATOMIC STRUCTURES.**

Ayahiko Ichimiya, Department of Quantum Engineering, Nagoya University, Nagoya 464-01, Japan

Reflection high-energy electron diffraction (RHEED) is one of the methods in order to determine atomic structures of crystal surfaces. For the determination, intensity rocking curves are analyzed by RHEED dynamical calculations. High energy electrons are scattered dominantly in the forward direction by atoms. Therefore dynamic diffraction mainly occurs in a forward direction. Using this feature, it is possible to a diffraction condition in which electrons are diffracted mainly by lattice planes parallel to the surface, when the incident direction is chosen at a certain azimuthal angle with respect to a crystal zone axis. This diffraction condition is named the one-beam condition, because the main diffraction beam is simply the specular one. At this condition, the rocking curve of the specular reflection intensity is a function of surface normal components of atomic positions, but scarcely depend upon lateral components of them. The rocking curve is also a function of atomic densities of surface parallel layers. Therefore surface normal components of atomic positions and densities of surface layers are determined by dynamical calculation analysis of a one-beam rocking curve with short computation time. We can easily analyze surface structure changes by adsorption, epitaxial growth and phase transition processes by the one-beam method. Using the results at the one-beam condition, lateral components of atomic positions are determined by analysis of rocking curves at many-beam conditions, where the direction of the incident beam is chosen along a low-order crystal zone axis.

**MS01.08.03 PHOTOELECTRON AND AUGER ELECTRON DIFFRACTION OF SURFACES, INTERFACES, AND EPITAXIAL FILMS — A BRIEF OVERVIEW.**

Scott A. Chambers, Environmental Molecular Sciences Laboratory Pacific Northwest National Laboratory Richland, WA 99352 USA

The closely-related techniques of Auger and photoelectron diffraction (AED/PED) have evolved into powerful and widely-utilized techniques for qualitative and quantitative surface and interface structure determination. In contrast to LEED and RHEED, which are sensitive to long-range order, AED and PED are governed by the local structural environment surrounding a particular kind of atom in the near-surface region. The elastic scattering and subsequent interference at the detector of an outgoing Auger or photoelectron from the atom of interest is used as a probe of the short-range structural environment. The two techniques share a number of strengths. These include: (i) atom specificity, (ii) no need of long-range order (although the specimen must be a single crystal), (iii) simple and direct interpretation of the most basic features (i.e. zeroth-order forward scattering peaks at high electron kinetic energies), (iv) relatively simple interpretation of higher-order interference fringes by quantum-mechanical scattering theory, and, (v) direct inversion of diffraction patterns to yield accurate, real-space (but domain-averaged) images of nearest and next-nearest neighbor atoms for certain kinds of systems. In this talk, we present the basics of the methods, and illustrate their respective utilities with a representative selection of applications. Examples will include: (i) chemisorption geometry of atoms and small molecules on surfaces, (ii) surface reconstruction geometry, (iii) foreign atom incorporation in the near-surface region, and (iv) tetragonal distortion in ultrathin epitaxial films associated with lattice mismatch.