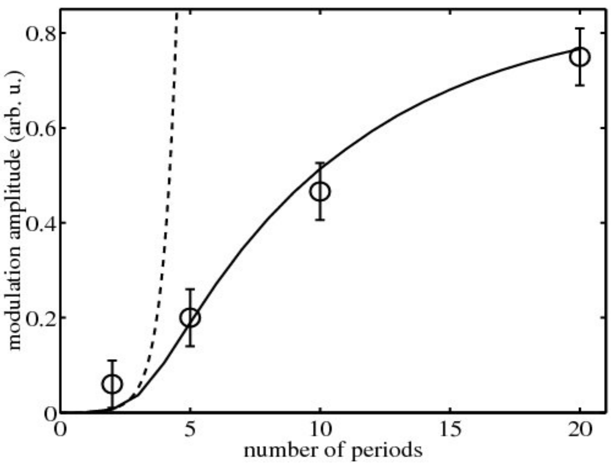

Figure 1. The dependence of the modulation amplitude on the number of superlattice periods. The circles with error bars are the experimental points obtained from the X-ray data, the full line represents the simulations. The dashed line is the evolution of the modulation amplitude calculated in the linearized approach [5].

observed stabilization of the modulation amplitude during the growth.

We have simulated a full nonlinear time evolution equation of the spontaneous lateral modulation and we have obtained the critical wavelength L_{crit} = 300 Å. The particular values of diffusion rate have only weak influence on the resulting interface morphology. We have also found that the nonlinear dependence of the strain energy on the layer thickness (wetting effect) has a crucial influence on the resulting interface morphology. The parameters of this nonlinear dependence were determined from the fit of the experimental data with the simulation and these values were compared with the atomistic calculation [6]. The resulting experimental and theoretical dependence of the modulation amplitude on the number of superlattice periods is plotted in Fig. 1.

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Lectures - Friday, June 23, morning

L9

X-RAY SCATTERING ON SURFACES AND NANOSTRUCTURES

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L10

X-RAY SCATTERING FROM SELF-ORGANIZED SEMICONDUCTOR NANOSTRUCTURES - OUR RESULTS AND HOPES FOR FUTURE

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The determination of shapes, elastic deformations, and local chemical composition of semiconductor nanostructures (quantum wires and dots) by x-ray scattering is a challenging task requiring to use very intense energy-tunable x-ray sources. The shapes of nanostructures can be studied by small-angle X-ray scattering (the GISAXS method), while the elastic strains and local chemical composition can be determined by diffraction (coplanar X-ray diffraction or grazing-incidence diffraction). Recently, new methods appeared making use of the possibility of energy tuning of the synchrotron radiation, namely anomalous x-ray diffraction close to the absorption edge and diffraction anomalous fine structure method (DAFS) measuring the energy dependence of the diffracted intensity just above the absorption edge. These methods can give direct information on the chemical composition of nanostructures. In the talk, the scattering methods used for nanostructures are briefly summarized, illustrated by experimental results obtained at ESRF.

L11

NEUTRON REFLECTIVITY AT THE ILL

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Neutron reflectometry is an experimental technique for examining surfaces and buried interfaces. It gives sensitive information on the atomic composition and magnetic properties of a material as a function of depth with Angstrom resolution, and can probe in-plane structures with length scales of the order of micrometers. Neutrons have a high probability of interaction with light elements such as hydrogen and carbon, with magnetic moments, and the probability varies with isotope rather than with element. Unprecedented and unique information can be obtained by exploiting these properties through techniques such as contrast variation, where isotope substitution can be used to highlight or suppress scattering, and polarization analysis, where vector magnetization density can be probed by measuring the change in direction of a neutron's spin. Neutron reflectometry is thus being used in an increasing number of scientific fields from biology to physics.There are two neutron reflectometers at the ILL that may be used by researchers: D17 is an ILL-owned instrument, and ADAM is run by a German consortium in cooperation with the ILL. Neutron reflectometry will be briefly explained, and various examples from recent experiments will be used to illustrate the capabilities of the techniques. The presentation will end with an open invitation to come and use the instrument.

L12

NEUTRON DIFFRACTION IN SOLID STATE SCIENCES: INSTRUMENTS, DATA ANALYSIS AND NEW MATERIALS

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Neutron diffraction is a well developed technique with many applications in all fields of the solid state sciences. It is perfectly adapted to crystallographic studies in a complementary way to X-ray diffraction. The particular properties of neutrons, compared to X-rays, make them the probe of choice to refine the position and occupation factors of light elements in crystalline materials (i.e. hydrogen in intermetallic compounds), to distinguish adjacent elements in the periodic table, to determine magnetic structures, to study all kind of phase transitions in complex environment, etc.

The Institute Laue-Langevin is currently under a process of upgrading many existing instruments and constructing new ones. The Millennium Program is under strong development and diffraction instruments play an important role in it. In this talk, after reviewing the most important characteristics of neutron diffraction, I will present the current situation at ILL concerning diffraction, particularly the upgrades of the high resolution powder diffractometer D2B, the high resolution mode of D20 and the single crystal diffractometers D10 and D19 as well as the new proposed diffractometer DRACULA. Some words will be devoted to the quasi-Laue diffractometers VIVALDI, ORIENT EXPRESS and the new project CYCLOPS. I will also describe the existing projects concerning the development of software for data analysis related to the high throughput of the new instruments.

As an illustration of the present capabilities of the existing instrument, in comparison with other neutron sources in the world, I will present some neutron powder diffraction examples.

L13

HIGH-ENERGY X-RAY DIFFRACTION

Veijo Honkimäki

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The use of high-energy radiation has increased during the last years with the first high-energy sources on third generation synchrotrons. The high flux and well-collimated beam together with the high penetration depth enable the study of thick samples but nevertheless small gauge volumes. Furthermore, the high-energy diffraction is on forward direction and therefore, the use of flat 2D-detectors is possible. This has opened new possibilities for many applications including the studies of liquids and amorphous materials, powder diffraction, single crystal studies, diffuse scattering and studies of buried interfaces. Some examples of the use of these properties for studying bulky and heavy samples are given, like, the stress-strain analysis and studies of buried interfaces.

Lectures - Friday, June 23, afternoon

L14

NEUTRON LAUE DIFFRACTION - APPLICATIONS IN MAGNETISM AND HARD CONDENSED MATTER

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Neutron Laue diffraction is a complementary technique to powder and single-crystal neutron diffractometry with possible wide use in magnetism and other areas of hard condensed matter physics. The ILL neutron Laue diffraction instrument VIVALDI (Very-Intense, Vertical-Axis Laue Diffractometer) with its vertical geometry allows for low-temperature sample environment necessary in most of magnetic structure studies. The power of this technique and the instrument in determining magnetic structures will be shown on the example of several rare-earth intermetallic compounds, in particular NdPtSn, $PrCo_2Ge_2$ and $HoCoIn_5$.

L15

STUDY OF FERROELECTRICS BY INELASTIC NEUTRON SCATTERING

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Ferrolectrics, and particularly relaxor ferroelectrics, have been intensively studied for their unusual dielectric, electrostrictive and piezoelectric properties [1, 2]. The majority of ferroelectrics has a cubic perovskite structure in the parent high-temperature phase. Howevever, they exhibit a large variety of phenomena.

The optical methods (infrared, Raman spectroscopy...) are able to provide information about the dynamics only from the Brillouin zone centre. Therefore, in order to investigate lattice dynamics of single crystals, one has to employ inelastic neutron or X-ray scattering.

In this contribution, we shall describe typical phenomena that can be studied on (nonmagnetic) monocrystalline materials by inelastic neutron scattering. Advantages and difficulties will be demonstrated on:

- determination of dispersion curves [3, 4], in connection with constant-Energy vs. constant -**Q** scans, and the new FlatCone possibility[5]