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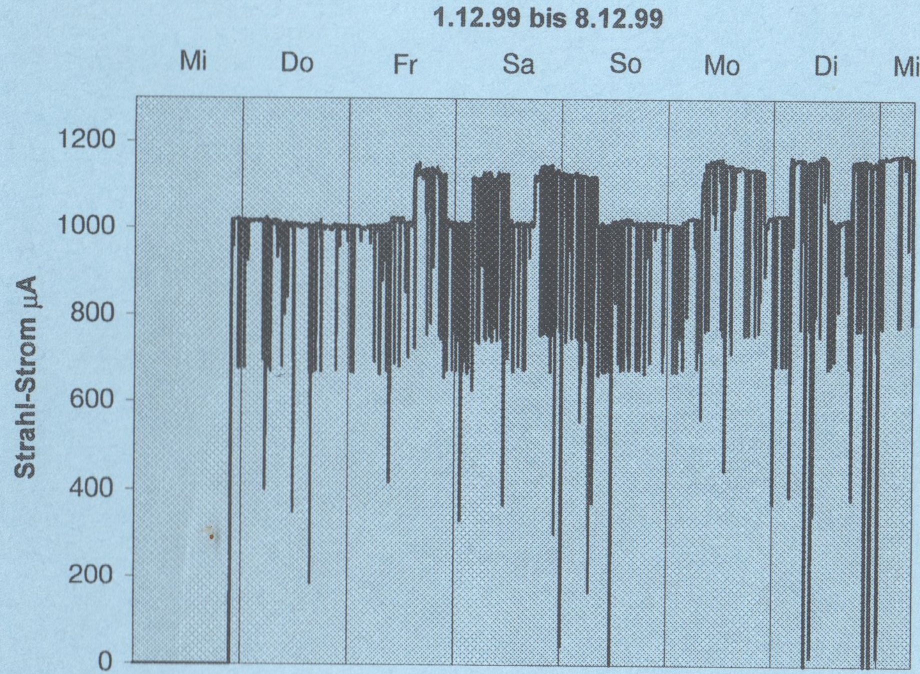
SWISS NEUTRON NEWS



Schweizerische Gesellschaft für Neutronenstreuung
Société Suisse pour la Diffusion des Neutrons

Cover illustration:
The neutron flux at SINQ is improving! The replacement of target E (used for muon production) led to a 25% increase of the neutron flux at SINQ. Further increases of the order of 10% were achieved by running the accelerator at higher proton currents. The figure shows the excellent and stable beam statistics at SINQ during the first week of December 1999 for proton currents at the exit of the accelerator of 1.5 mA and 1.7 mA. Next year, the new lead target will improve the neutron flux by another 60% (see La page du président de la SSDN in this issue).

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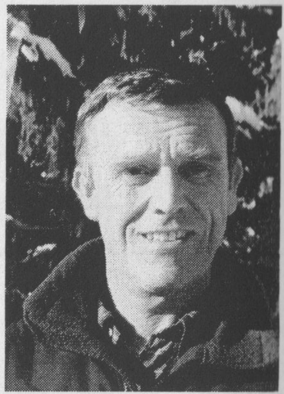
Inhaltsverzeichnis

La page du président de la SSDN

Dear Members,

No doubt, the Swiss home base for neutron scattering SINQ has been improved considerably during the past few months. Its neutron flux – which was a point of major concern – has been enhanced by about 40 %. This has been achieved by increasing the proton current and shortening the target E used for muon spectroscopy. At the same time, the instruments' performance has been improved by a factor of up to four and some are now considered of world class category. Progress has also been made with the sample environment, thanks mainly to new equipment and additional manpower. Finally, the planning for 'second generation' instruments is well under way.



This is particularly true for the thermal neutron 3-axis spectrometer, which has received support from the Scientific Council of SINQ. Altogether, the accelerator's and the SINQ's performance is very reliable and the Swiss neutron "aficionados" feel relieved over their future working conditions as compared to six months ago. For these achievements the SINQ staff and PSI management are to be applauded.

Of course, these positive developments should not obscure the fact that further progress needs to be accomplished. At present, four out of eight 'first generation' instruments do not perform according to specifications and/or are not fully operational. Two need significant improvements on the detector side, and two must be put into users' operation. Others require new electronics and focussing polarizers and/or various mechanical work such as adjustment, shielding and cooled Be filters. The sample environment – in spite of the progress achieved - cannot presently be considered as consolidated. Further improvement, in particular with respect to temperature, pressure and magnetic field (dilution cryostat, closed circle refrigerator, magnet, pressure cell, heater and temperature controllers) is required. There is also an urgent need for additional working space which calls for a rapid extension of the SINQ guide hall. Last but not least, all SINQ users look forward to the installation of the new target (liquid Pb) which is scheduled during year 2000. Only then will the neutron flux at SINQ reach a level that matches the quality of its instruments and makes the latter competitive on an international level. Finally, the danger that the flux increase

achieved will be partly offset by the re-installation of a longer target E must be considered. Evidently, good will from both the muon spectroscopists and the neutron scatterers will be necessary to ensure a peaceful co-existence between these two user communities at PSI.

The situation at the Institute Laue-Langevin (ILL) continues to be very favorable for Swiss users. During the last proposal round, Swiss users have again obtained significantly more beam time than foreseen in the ILL budget (4.5 % versus 3.5 %). The expected 'SINQ impact' on the allocated beam time was hardly noticeable. Swiss scientists continue to participate fully in the scientific life of ILL and play an important role in the Scientific Council and its various subcommittees. As to future developments, ILL Management has recently given its go-ahead for constructing the first five instruments of the ILL Millenium Programme (see contribution in this issue). ILL Management has also recognized the necessity for upgrading the infrastructure, in particular the outdated neutron guides.

Many members of our Society use neutrons both at SINQ and ILL, and some also at other European sources. Therefore, it is important that we keep thinking about long-term prospects for neutron scattering in Europe and how these prospects fit our needs. One of the central questions will be: "To what extent should Switzerland support the planning and construction of new neutron facilities beyond its borders?" I invite all members of our Society to think about this issue to be debated soon.

I wish you all a good start in the next Millennium!

Klaus Yvon

Information from *SINQ* Scientific Coordination Office

The deadline for the *SINQ* - proposals is May 15, 2000. Scheduling periods for short term proposals will be August -December 2000 and for long-term proposals August 2000 - July 2002.
Long-term proposals have to fulfill high standards concerning scientific background, aim, strategy, and coherency. A collection of different measurements alone does not justify a long-term status. Such research should be planned with short-term proposals (one proposal for each instrument).
The Scientific Committee will meet on June 26, 2000. Acceptance of proposals will be decided at that time.
Experimental Reports should be submitted within 6 months after completion of a proposal. Forms can be downloaded from:
http://www1.psi.ch/www_sinq_hn/SINQ/UserInfos.html
The user meeting for the year 2000 will most likely be held in the second week of January 2001 and again jointly with the µSR community.
We received a total of 47 proposals for round I/00; 34 proposals were accepted, 13 were rejected.

A statistic of allocated beam time per country is shown on the table below.

Total requested and allocated beam time per country for round I/00

	requested (days)	requested (%)	allocated (days)	allocated (%)	success rate (%)
LNS	299.0	37.4	143.0	37.7	47.83
PSI	66.5	8.3	36.0	9.5	54.14
Switzerland	112.5	14.1	60.5	16.0	53.77
Poland	5.0	0.6	1.0	0.3	20.00
Germany	5.0	0.6	2.0	0.5	40.00
Japan	19.5	2.4	9.5	2.5	48.72
China	8.0	1.0	5.5	1.5	68.75
France	8.0	1.0	6.0	1.6	75.00
Russia	101.5	12.7	49.5	13.1	48.77
Ukraine	4.0	0.5	1.0	0.3	25.00
U.K.	35.5	4.4	16.5	4.4	46.48
USA	21.0	2.6	14.0	3.7	66.66
Israel	4.0	0.5	4.0	1.1	100.00
Spain	3.5	0.4	2.0	0.5	57.14
Netherlands	21.0	2.6	1.0	0.3	4.76
Austria	26.0	3.3	8.0	2.1	30.77
Hungary	4.0	0.5	4.0	1.1	100.00
Romania	2.0	0.3	2.0	0.5	100.00
Czech. Rep.	10.0	1.3	0	0	0
India	8.0	1.0	6.0	1.6	75.00
Italy	32.0	4.0	7.5	2.0	23.44
TOTAL	799.0	100.00	379.0	100.00	47.43

ILL: THE FIRST FIVE INSTRUMENTS OF THE MILLENNIUM PROGRAMME

Colin J. Carlile, Institut Max von Laue Paul Langevin

Thermal LADI

An instrument for single crystal structure determination, exploiting image-plate technology to improve data rates by a factor of 50. Applicable to subtle magnetic structures and to pharmaceutical chemistry. Duration 18 months. Cost to ILL 3630 KF + 160 KF manpower. Additional manpower input from King's College, London and the EMBL.

The LADI concept involves the use of a wide band of neutron wavelengths incident upon a small single crystal sample from which Laue diffraction patterns are recorded on a high-resolution large-solid-angle image-plate detector. The concept promises to revolutionise single crystal neutron diffraction not only by significantly reducing the size of instruments, but by reducing the time spent in determining structures to levels common at synchrotrons, yet retaining all the advantages of neutrons. The LADI instrument on a cold beam is already operational and is paying dividends in large unit cell studies, for example small proteins such as hen egg white lysozyme, where neutrons have always promised advances but have never previously delivered.

Thermal LADI (or Tea Lady, as its designers have dubbed it) is the extension of this concept to a thermal neutron beam. Here it will be a powerful adjunct to traditional methods offering significantly faster data collection times. Recent very positive prototyping tests indicate not only a factor of 50 improvement in data rates - making the precise study of subtle magnetic phase transitions in a matter of hours, and as a function of temperature, pressure or magnetic field, a reality – but also a step change in quality opening up the exploration of new fields.

The instrument has been designed by a team from Kings College London, the EMBL and ILL, and a design and build tender has been issued, results of which have now been received. This instrument could be manufactured, installed and operational within 18 months from now.

Strain Scanner

An instrument to measure the strain fields in mechanical components resulting from manufacturing processes, ageing effects or stresses applied during service, with the *aim of providing the academic engineering community with data to improve manufacturing processes and to avert catastrophic failure of key components. Duration 36 months; Cost to ILL 2 440 KF + 460 KF manpower. Additional financial & manpower input from a University Consortium.*

The applicability of neutron scattering methods to engineering science is now recognised by members of the academic engineering community as offering information previously unavailable by any method, destructive or non-destructive. In recent years international networks (e.g. VAMAS, TRAINSS and RESTAND) have acted as a catalyst to transfer knowledge to industry about the potency of the method. At ILL the D1A powder diffractometer was "strain adapted" some years ago to offer a limited service to the engineering community but has been less than adequate, both qualitatively and quantitatively, for their needs.

A proposal from a team of academic engineers led by Prof. P. Withers (Manchester University) to secure 50% of the funding required for a purpose-built strain scanner at ILL is currently under consideration by EPSRC. It will lead to the realisation of one of the best instruments in the world, will increase the measuring time at ILL for engineering and materials research to ~ 200 days per year and will significantly extend the range of science and engineering that can be encompassed. Notably this instrument will be the first to be built to ISO 9000 standards and will make measurements to this standard also – an essential aspect if the credibility of the engineering community is to be won.

Specifically, a purpose-built instrument on a continuous source, will allow massive engineering components (up to 500 kg), to be examined. Only a limited range of scattering parameters is required for these studies (unlike the case of structural powder diffraction) meaning that count-rates are very high and strain maps around welds in critical load-bearing equipment, for example aeroplane wings, car chassis or bridge components, can be observed within a complete volume, making it possible to apply tomographic computing techniques to reconstruct 3-dimensional strain fields. In addition, the study of adhesive joints and brazed ceramics will now yield quantitative results, and research into biomimetic coatings for artificial bones, and the kinetics of fatigue could be tackled experimentally.

Fast detector for SANS instruments

A project to develop a fast position-sensitive neutron detector for small angle scattering cameras, which will extend the counting rate from 50 kHz to 2 MHz, thereby taking full advantage of the flux already available on the D22 and D11 instruments. In

particular, kinetic experiments, observing physico-chemical changes in, for example, manufacturing processes such as the extrusion of polymers, could be observed in real times of seconds and minutes, rather than hours. Duration 48 months; Cost to ILL 4 200 KF + 880 KF manpower. Additional financial & manpower input from the TECHNI network.

Current generations of two-dimensional position sensitive detectors for small angle neutron scattering suffer significant losses due to detector dead-time (pulse overload) as one approaches a count rate of 50 kHz (20 μs event separation on average). With scattered neutron intensities incident upon detectors now exceeding 2 MHz (0.5 μs event separation on average), these events cannot be recorded because of the saturation of the current generation of detectors. The potential of the SANS method to enter new scientific areas is therefore presently severely limited.

It is proposed, over a four-year period, to realise a detector for SANS with a maximum count-rate of 2 MHz without compromising other properties of the detector (efficiency, spatial resolution, and gamma sensitivity).

The project will comprise a two-year feasibility and prototyping study (computer simulation, electronic prototypes, 10-wire test detector) followed by a two-year build phase of a fully functioning detector for D22, followed later by the manufacture of a similar detector for D11.

The principle of the detector will be similar to that on D22 at present – a multi-wire gas proportional counter – but will incorporate significant technical advances to obtain the short dead-time required. The stainless steel anode assembly will be replaced by an insulating assembly, the tungsten wires will be replaced by finer nickel-chrome wires and the level of quench gas (CF_4) will be raised. In this way it is estimated that an improvement in dead-time of a factor of 40, and thus of the maximum count-rate before saturation occurs, can be realistically achieved. Special effort will be put into rendering the detector shock-proof since its mechanical sensitivity will also be increased. This is mainly important during manufacture and installation rather than during the operational phase.

D3C – Spherical Neutron Polarimetry

A rebuild programme for the D3B single crystal diffractometer which will significantly increase the luminosity of the instrument by separating the monochromating and polarising functions, and adding spherical polarisation analysis, thereby making the instrument a leader in its field of applicability – precision determination of weak magnetisation distributions avoiding ambiguities present in other techniques. D3C and

T-LADI will form a complementary pair. Duration 60 months; Cost to ILL 4 780 KF + 1 280 KF manpower. Additional financial & manpower input will come from a European network of University groups collaborating on the polarised helium-3 project.

The diffractometer D3B uses the polarised neutron diffraction (PND) technique to determine precise quantitative magnetisation distributions of single crystals that are magnetically ordered in a ferro- or ferri-magnetic phase under an applied magnetic field. The PND technique is a very sensitive method to observe the distribution of unpaired electrons in the whole unit cell. It reveals unambiguously the spin delocalisation, the polarisation sign, the density shape and the effects of magnetic interactions. It can be applied successfully to molecular compounds (3d transition metal complexes and free radicals), heavy fermions, high-T_c superconductors, transition metals and actinide alloys. The versatility of this instrument also permits unusual neutron physics experiments to be carried out, such as the study of the parity-violation in the vicinity of the p-wave neutron resonance of ^{139}La, and so its applicability extends beyond that of neutron scattering.

In order to improve the characteristics and extend the fields of science investigated on the present instrument, a total rebuild is proposed. Taking advantage of the novel ^3He neutron spin filter presently available at the ILL, we can: (i) improve the peak count rates by optimising the monochromator irrespective of the spin selection process and (ii) add polarisation analysis of the scattered beam. By providing the highest polarised flux at short wavelength in combination with a 10 Tesla cryomagnet for optimised flipping ratio measurements and either uniaxial polarisation analysis or a dedicated zero-field neutron spherical polarimeter, Cryopad, for carrying out 3–dimensional polarisation analysis experiments, D3C will be the most powerful and flexible neutron machine in its field. Among the new areas of science which will be enabled, are the determination of exotic magnetic structures and the precision measurements of antiferromagnetic form factors in the large **Q** range.

Feasibility studies have been carried out already to ensure that polarised ^3He at the analyser can withstand stray magnetic fields applied to the sample position and the results have been very encouraging and we have proceeded to the design stage, which is now well advanced.

IN20B – Polarisation Analysis Spectroscopy

A renewal of the IN20 triple axis spectrometer which, by relaxing the collimation of the instrument by the provision of a new beam-tube, focussing Heusler monochromators

(developed at ILL) and analysers, together with a position sensitive detector, will significantly increase the neutron throughput of the instrument. This redesign will allow the application of state-of-the-art spherical polarisation analysis methods to be extended to coherent inelastic scattering studies. Duration 36 months; Cost to ILL 2 870 KF + 480 KF manpower. Collaboration with underlying design studies has been offered by the University of Göttingen.

In recent years the study of magnetic excitations in condensed matter has created much excitement. In particular, in systems of low dimension (when the interactions are limited in space to lines or to planes) very unusual phenomena occur. Seemingly very simple systems, such as a collection of electrons arranged on a line, can show the most complex and exotic behaviour which is often not able to be properly understood. For instance, although electrons are point-like particles, in low-dimensional systems manifestations of their electric charge and their magnetism may be found on widely separated locations in space.

Such magnetic systems are best studied by polarised-neutron scattering with subsequent polarisation analysis. However, the implementation of a polarisation option on any instrument always brings a concomitant large loss in neutron intensity, which makes measuring times typically 30 times longer. Therefore, on an instrument such as IN20, which specialises in polarised neutron work, an increase in efficiency is essential for this work to be tenable. This increase can be achieved as follows. Firstly, by the use of a larger solid angle beam tube. Secondly, by using a large focussing array of polarising monochromators to increase the luminosity of the instrument, and thirdly, by installing the spherical polarimeter CRYOPAD and optional ^3He-polarisers. Further improvements to the secondary spectrometer of IN20 by the use of a multicrystal analyser and a position-sensitive detector, will bring gains up to several orders of magnitude in counting efficiency. With such an instrument large regions of energy-momentum space can be measured in one setting of the instrument.

On the Occasion of Prof. Albert Furrer's 60th Birthday

Felix Altorfer, LNS ETH & PSI

On December 2, the Swiss neutron user community gathered at PSI to participate at the SINQ user meeting, but also to join the celebration of Albert Furrer's 60th birthday. He hardly needs an introduction, but nevertheless a few facts shall be listed to demonstrate his long lasting influence on neutron scattering in Switzerland:

Swiss Neutron News joins all good wishes for your 60th birthday, Albert.

He completed his Ph. D. work in 1970 on the lattice dynamics of lead, followed by his habilitation in 1979. He became head of the then newly founded Laboratory for Neutron Scattering in 1984 (and *doubled* the number of LNS members under his leadership up to 1999) and in 1990 he became Professor at ETH Zürich. In 1991 he was responsible for the inauguration of the Swiss Society for Neutron Scattering and also the European Neutron Scattering Association for which he served as chairman from 1996-1999.

The official part of the celebrations started after the morning's SINQ user meeting with a joint seminar with the μSR-user community where the speakers paid their respect to A. Furrer: H.U. Güdel (Uni Bern) gave a talk on "*Magnetic excitations in spin clusters: From magnetic dimers to wheels and cages*", followed by J. K. Kjems (Risø) and his description of "*Crystal field transitions and other excitations*".

During the ensuing break, Heinz Heer presented on behalf of the Laboratory for Neutron Scattering the *Pictorial Chronicles of Neutron Scattering in Switzerland* to the celebrant. The chronicles cover the development of neutron scattering in Switzerland from its beginning up to the present (copies can be ordered from H. Heer). The audience was then struck by the performance of a string quartet that played pieces by Albert's favorite composer Tschaikowski.

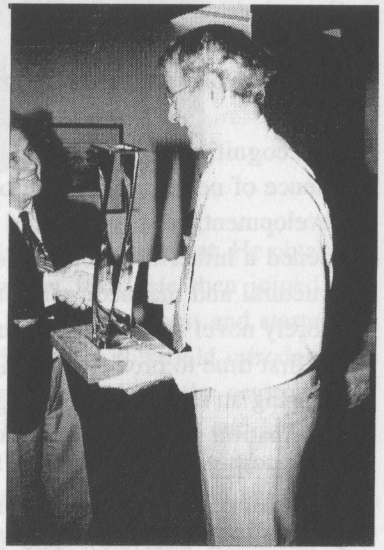
Nobel laureate K.A. Müller (Zürich) helped to turn the attention from music back to science when he gave an introduction to "*Local and periodic properties near phase transitions*". μSR-scientists came finally to their rightful share of the seminar when R. Cywinski (St. Andrews) discussed the aspects of both methods in his talk "*Neutron scattering and μSR: Complementary or competing techniques ?*".

The neutron community spent the evening at Habsburg Castle, where friends and colleagues enjoyed the excellent meal and found time to shower Albert Furrer with presents.

During the seminar's break a string quartet played tunes of Albert's favorite composer Tschaikowski.

Dr. Weber (AUSTRON project, Vienna) left no stone unturned to find a specimen of the AUSTRON target and Prof. Aksenov (Dubna) thanked for the long and fruitful collaboration between scientists from Eastern European countries and the LNS by offering bottles of Vodka and a pack of genuine Russian cigarettes.

Prof. W. Hälg went back in time and described the very first steps of Albert Furrer in the field of neutron scattering by presenting documents and letters dating back to 1965-1975. This thread was then picked up by Max Koch again, who on behalf of the technical staff of LNS had come successfully back from a tour through the storage area of PSI and presented Albert with a beautiful crafted sculpture which turned out to be a mechanical spin rotator. Spirits were high until the very end of the evening at midnight when the focus of all attendants went back to their regular duties as neutron scatterers….



The spin rotator: Back from rusty days, now shiny and new.

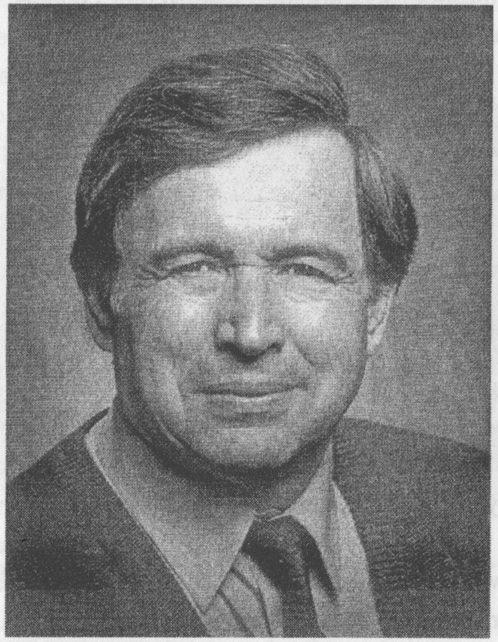
1999 Walter Hälg Prize
of the
European Neutron Scattering Association (ENSA)

The prize was made available to the European Neutron Scattering Association (ENSA) by a donation of Professor Walter Hälg who is the initiator of neutron scattering in Switzerland. It will be awarded biannually to a European scientist for outstanding, coherent work in neutron scattering with long-term impact on scientific and/or technical neutron scattering applications. The prize (10'000 CHF) was awarded for the first time in a special ceremony session of the 2nd European Conference on Neutron Scattering (ECNS'99), 1-4 September 1999, Budapest.

A large number of nominations were submitted for the 1999 Walter Hälg Prize. They were examined by a Selection Committee which consists of authorities representing the major scientific disciplines. The Selection Committee decided to award the prize to

Professor Ferenc Mezei (Hahn-Meitner-Institut, Berlin)

in recognition of his innovative and outstanding contributions to the science of neutron scattering over the past three decades. His conception, development, construction and application of neutron spin echo techniques opened a hitherto unobtainable energy and time domain for the study of structural and magnetic relaxation processes. The spin echo method is an entirely novel approach to neutron scattering techniques, which allowed for the first time to break the strong coupling between intensity and resolution by using an ingenious encoding mechanism (i.e., the neutron spin) to store information on the neutron state before and after the scattering event. Ferenc Mezei also introduced entirely novel concepts in instrumentation (e.g., Mezei spin flippers, supermirrors and principles of generalised polarisation analysis). The insights provided by neutron spin echo measurements have had far reaching implications for our understanding of condensed matter ranging from magnetic materials to polymers, proteins, glasses, superconducting vortices, solitons, zeolites and quantum fluids (e.g., ^{4}He).



Ferenc Mezei studied physics at Eötvös University, Budapest. He obtained his diploma in 1965 and his Ph.D. degree in 1968. He then joined the Central Research Institute for Physics (KFKI) in Budapest and started to work in neutron scattering. His first publication in this field introduced a novel approach in high resolution neutron spectroscopy, the neutron spin echo method (1972). In 1972 he moved to the Institut Laue-Langevin (ILL), Grenoble, which operates the world's most powerful neutron source. There he built the neutron spin-echo spectrometer IN11 which has been in user operation since 1978. In 1984 he accepted a joint appointment in Berlin as a full professor at the Technical University and as a group leader at the Hahn-Meitner-Institut (HMI). In 1992 he became the director of the Berlin Neutron Scattering Centre (BENSC) at the HMI, until he joined Los Alamos National Laboratory as the first John Wheatley Scholar in 1997.

7th Summer School on Neutron Scattering in Zuoz

More than 80 people from 16 different countries came to Zuoz in order to attend the 1999 School on "Neutron Scattering in the Next Millennium". The organisers aimed for a programme that covers to a large extent nonconventional, unusual or innovative neutron scattering experiments which either have novel applications or provide a new insight into science and technology. The idea was to learn how neutron scattering could evolve in the next millennium.

The meeting opened on the first day with introductory lectures presented by several PSI staff members on the principles of neutron scattering as well as instrumental aspects, followed by lectures on a novel approach to neutron scattering in terms of coherence volumes by R. Gähler (Munich) and Brillouin scattering by B. Dorner (Grenoble). Theoretical concepts and applications in the investigation of soft condensed matter were presented by R. Klein (Konstanz) and P. Schurtenberger (Fribourg), respectively, with particular emphasis on colloidal systems. The "magnetism day" was devoted to molecular magnetism and low-dimensional systems. J. Villain (Grenoble) and H.U. Güdel (Bern) explained the novel relaxation mechanisms in molecular magnets (spin tunnelling) and the power of neutron scattering to unravel the spin excitations, respectively. The dynamical aspects of low-dimensional magnetism were introduced by G. Müller (Kingston) and T. Perring (Didcot), with emphasis on collective excitations and quantum spin fluctuations. Neutron scattering in the study of modern materials was discussed with respect to industrial applications by G. Aeppli (Princeton), magneto-electronic heterostructures by H. Zabel (Bochum), and nanocrystalline systems by R. Hempelmann (Saarbrücken). Selected aspects in instrumentation for neutron scattering were the topic of the final day. Optimum selection and transport of neutrons by a variety of neutron optical elements were described by I.S. Anderson (Grenoble), and methods and perspectives of neutron scattering at high pressure up to 30 GPa were discussed by S. Klotz (Paris).

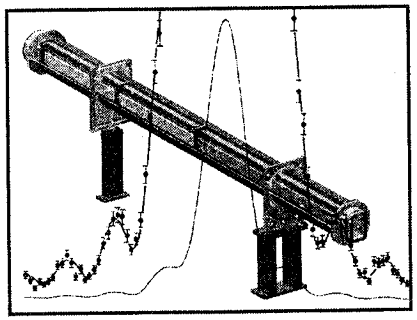
The participants of the 7th Summer School in "down-town" Zuoz

Almost forty poster presentations by the participants were an essential input to the programme of the school. The posters were discussed in a dedicated session as well as in six seminars devoted to particular aspects of neutron scattering. The excursion day featured a bus trip to southern Germany to see the total solar eclipse. For those who preferred to stay in the Engadine valley, a hiking tour, a visit to the Swiss National Park and river rafting were the alternatives. During the final banquet our indefatigable secretary, Renate Bercher, was promoted to the "Angel of Zuoz", for taking care of everything around the School. We also celebrated the sixtieth birthday of Walter Fischer who was the initiator of the Zuoz Summer Schools on Neutron Scattering and who has been the School Chairman since the beginning in 1993. A miraculous rocket show spread these happy news over the midnight heaven of Zuoz.

Workshop on "Neutron Optics for the Next Millennium"

P. Böni, Laboratory for Neutron Scattering ETH and PSI, CH-5232 Villigen PSI

The European Workshop on Neutron Optics for the Next Millennium (NOP99) was held at Paul Scherrer Institut in Villigen Switzerland on November 25 – 27 1999. It was organized jointly by Paul Scherrer Institute and the Forschungszentrum Jülich as a final meeting of the 10-Member European Network on Neutron Instrumentation XENNI.
The aim of NOP99 was to bring together scientist, who are involved in improving neutron optical components for neutron scattering instruments and building new instruments. Despite a concentration of other meetings in 1999, for example ECNS'99 in Budapest, a large number of 73 scientists from all over the world participated at NOP99. One reason being that during the last few years significant progress has been made in the fields of supermirrors, crystal monochromators, focusing devices etc. as well as simulation techniques. Moreover, new neutron source projects in Germany, USA, Australia, Japan and Taiwan have encouraged scientists from all five continents to participate at NOP99.
An international advisory and program committee selected 16 speakers for invited talks in 7 sessions. In addition, 32 contributed posters were displayed covering a broad range of instrumentation and techniques. In addition, the two companies CILAS and SwissNeutronics had their products on display. Half an afternoon was spent for a



visit of SINQ, the new Swiss spallation source that uses a guide system that makes full use of supermirror technology and modern focusing devices. Thanks to the rather generous allocation of time for the different sessions there was plenty of time for lively discussions.
NOP99 was a very successful meeting showing that even in the next millennium there is substantial room for new and unconventional developments for the optimization of neutron instruments. This is clearly reflected in these proceedings. I should like to thank PSI, FZ-Jülich and the Neutron round table for financial support. In additon, we acknowledge the support of three young Russian scientists by the Swiss National Science Foundation.
Finally, I would like to thank the co-chairman B. Alefeld for the very pleasant joint effort to organize this workshop, the treasurer Hans Grimmer for keeping record of the finances and in particular the editors D. Clemens, Michael Prager and Ulrich Rücker who did an enormous task. Finally, I thank Renate Bercher, Margit Braun-Shea and Denise Castellazzi for taking care of the administrative tasks.

Erfolge für PSI-Mitarbeiter und SINQ an der ECNS'99

Albert Furrer

An der 2[nd] European Conference on Neutron Scattering (1.-4. September 1999, Budapest) wurden aus gegen 200 Bewerberinnen und Bewerber zehn "Young Scientists Awards" ausgerichtet für hervorragende und innovative Arbeiten auf dem Gebiet der Neutronenstreuung. Ich freue mich, dass zu den Gewinnern auch zwei Doktoranden meines Labors gehören:

Nordal Cavadini

Daniel Rubio

Zudem hat auch **H. Kohlmann** (Universität Genf) einen Preis erhalten. Alle drei Schweizer Gewinner haben ihre Arbeiten vorwiegend an der SINQ durchgeführt, was eindrücklich beweist, dass die an der SINQ aufgebaute Instrumentierung erstklassige Forschung ermöglicht.

Neue Mitglieder

P. Böni

Die Zahl der neuen Mitglieder nimmt weiter zu und nähert sich der Zahl 200. Wir begrüssen:

- Ralph Schenker, Departement für Chemie, Universität Bern
- Sam Werner, University of Columbia, Missouri, USA
- Kristiaan Temst, Katholieke Universiteit Leuven, Belgium
- Daniel Andreica, IPP-ETHZ, Villigen PSI
- Sergei Kozhevnikov, Frank Laboratory for Neutron Physics, Dubna, Russia
- Evgeny Clementyev, Laboratory for Neutron Scattering ETH & PSI, Villigen, Switzerland

Zur Zeit zählt die schweizerische Gesellschaft für Neutronenstreuung 198 Mitglieder.

Job Opportunities at LNS

Open positions at the Laboratory for Neutron Scattering ETH & PSI can be found on Internet under:

http://www.psi.ch
click on **Job Opportunities**
click on **Postdoc Positions for Physicists / Crystallographers**

8^{th} Summer School on Neutron Scattering in Zuoz

The Summer School on Neutron Scattering will take place in Zuoz from

August 5 - 11 2000.

Konferenzen 2000

Datum	Ort	Thema
26.-29.1.2000	Grenoble	Int. Workshop on Dynamics in Confinement http://www.ill.fr/Events/confit.html
2.-11.2.2000	Trieste	School on magnetic properties of condensed matter (neutron and synchrotron radiation) http://www.ictp.trieste.it
20.-25.2.2000	Houston	6^{th} Int. Conf. on "Materials and Mechanisms of Supercondonductivity http://m2s-conf.uh.edu
27.2.-9.4.2000	Grenoble	HERCULES 2000: Neutron & Synchrotron Radiation http://www.polycnrs-gre.fr/hercules.html
13.-17.3.2000	Montreux	18^{th} General Conference of the Condensed Matter Division of the EPS (CMD18-2000) http://www.eps-cmd18.ch
31.3.-6.4.2000	Klosters	Major Trends in Superconductivity in the New Millennium (MTSC 2000) www.mpi-stuttgart.mpg.de/CONF/mtsc2000
6.-10.4.2000	Klosters	Symposium on Itinerant and Localized States in HTSC www.mpi-stuttgart.mpg.de/CONF/mtsc2000
2.-12.5.2000	Les Houches	Recent Developments of Neutron Scattering in Condensed Matter Research http://www-llb.cea.fr
20.-25.6.2000	Gatchina	Polarised Neutrons (PNCMI-2000) http://www.pnpi.spb.ru/nrd/pncmi/pncmi.html
24.-28.6.2000	Berkeley	Induced Cooperative Phenomena http://www.sainc.com/icp2000
23.-25.7.2000	Tsukuba	Int. Symposium on Physics in Local Lattice Distortions http://www.etl.go.jp/~lld2k
5.-11.8.2000	Zuoz	8^{th} Summer School on Neutron Scattering http://www.psi.ch
6.-11.8.2000	Recife	International Conference on Magnetism http://www.icm2000.org.br
17.-21.9.2000	Madrid	4^{th} International Conference on f-elements http://www.icmm.cisc.es/icfe4
25.-30.9.2000	Rome	Stripes and high-T_c superconductivity http://www.roma1.infn.it/~stripes/home.html

Generalversammlung 2. Dez. 1999

PSI, Villigen, Auditorium (WHGA/001), 13.15 Uhr

PROTOKOLL

1. **Begrüssung**

K. Yvon, der Präsident der SGN begrüsst die 38 Anwesenden zur Generalversammlung 1999 der Schweizerischen Gesellschaft für Neutronenstreuung, insbesondere den Vizedirektor des PSI, Prof. R. Eichler und die Ehrenmitglieder W. Hälg und K. A. Müller.

2. **Protokoll der GV vom 27.11.1998**

Das Protokoll der GV vom 27.11.1998 (siehe Swiss Neutron News Nr. 14) wird genehmigt und verdankt.

3. **Jahresbericht des Präsidenten**

Im Jahresbericht orientiert der Präsident über die verschiedenen Aktivitäten der SGN seit der letzten Generalversammlung.

- Am 26. Sept. 1999 fand eine Vorstandssitzung der SGN über das Thema 'Neutronenquellen' statt. Der Vorstand ist am ILL gut repräsentiert: K. Yvon ist der Vorsitzende des Scientific Counsels und P. Böni ist Mitglied des Instrument Subcommittee's.
- Das BBW hat mit dem ILL den Vertrag bis 2003 verlängert und bezahlt einen Beitrag von 3.5%.
- SINQ: Die Verkürzung des Targets E, eine Erhöhung des Strahlstromes und signifikante Verbesserungen an den Spektrometern haben zu wesentlichen Flusserhöhungen geführt.
- Die SGN wird nächstes Jahr Meinungen zu den Projekten ESS und Austron einholen.
- 1999 hat kein Meeting der SGN mit einer anderen Gesellschaft stattgefunden.
- Im Jahr 2000 ist ein Meeting der SGN mit der Schweizerischen Kristallographischen Gesellschaft SKG geplant.
- Die SGN hat traditionsgemäss die Sommerschule in Zuoz moralisch und finanziell unterstützt.
- Es wird gewünscht, dass ein direkterer Zugang von der Webpage des PSI zur Webpage der SGN ermöglicht wird (http://www.psi.ch/sgn).

4. **Jahresrechnung des Kassiers**

Vermögen 1.1.1998 2016.75

	Einnahmen SFr	Ausgaben SFr
Mitgliederbeiträge (Kasse)	450.00	
Mitlgiederbeiträge (PC)	790.00	
Beitrag Sommerschule Zuoz		604.50
Essen Vorstandssitzung		86.50
Logo SGN (Yvon/Allenspach)		25.80
Taxen für Postcheck		36.00
Nettozins	10.20	
Verrechnungssteuer		3.55
Total	1250.20	756.35
Einnahmen 1998		493.85
Vermögen 31.12.1998		2510.60

5. **Bericht der Revisoren**

Die Rechnungsrevisoren haben die Belege, die Abrechnung und die Bilanz für das Jahr 1998 überprüft und für in Ordnung befunden. Sie schlagen den Anwesenden die Annahme der Jahresrechnung und die Entlastung des Vorstands vor. Die Anträge werden einstimmig genehmigt.

6. **Budget für das Jahr 2000**

	Einnahmen SFr	Ausgaben SFr
Mitgliederbeiträge	1400.-	
Sommerschule Zuoz		650.-
Diverses		150.-
Taxen für Postcheck		39.-
Zins	12.-	
Verrechnungssteuer		4.-
Total	1412.-	843.-
Einnahmen 2000		569.-

Das Budget 2000 wird von den Anwesenden einstimmig genehmigt.

7. **Bericht eines Mitglieds des SINQ Ausschusses**

Prof. P. Schurtenberger präsentiert den Report des wissenschaftlichen Komitees der SINQ:

- stabile Situation bei den eingegangenen Proposals
- erfreulich hohe ausländische Proposalzahl
- Statistik für das Jahr 1999:
  - 222 Experimente
  - 145 Teams
- Performance der Quelle:
  - potentiell sehr gute Quelle
  - anfängliche Befürchtung, dass Flusserhöhung vom PSI nicht unterstützt wird, hat sich nicht bestätigt.
  - Herbst 1999: Verkürtzung Target E, Erhöhung des Strahlstroms
  - Gratulation an Betreiber der Instrumente und Quelle sowie an die Gruppe Probenumgebung
  - Problem: kein thermisches Spektrometer verfügbar

8. Bericht des schweizerischen Repräsentanten am ILL

Prof. K. Yvon berichtet aus dem wissenschaftlichen Ausschuss des ILL:

- Der Strahlzeitanteil der Schweiz liegt in den letzten Jahren zwischen 4% - 6% und übersteigt damit den finanziellen Beitrag des BBW von 3.5%. Es ist damit zu rechnen, das die Strahlzeitvergabe sich dem Level von 3.5% annähern wird.
- Die Inbetriebnahme der SINQ hat zu keiner wesentlichen Abnahme der Strahlzeitanträge der schweizerischen Teams am ILL geführt.
- Das Steering Committee hat im Rahmen des Millenniumprogramms den Bau der fünf Projekte thermal LADI, Strain Scanner, fast SANS Detektor, D3C und IN20B genehmigt.

Frage von K. Krämer: Keine Strahlzeit für akzeptierte Proposals

Antwort von B. Dorner: Scientific Committee schlägt vor, ILL-Direktor entscheidet, Frage der Länderquoten.

9. Bericht des Repräsentanten der SGN/SSDN an der ENSA

Prof. A. Furrer berichtet:

- Internetadresse der European Neutron Scattering Association (ENSA): http://www.psi.ch/ensa
- zwei Meetings des ENSA Committee's:
  - Januar 1999 in San Sebastian
  - September 1999 in Budapest

- ECNS'99 in Budapest:
  - Walter Hälg Preis an Ferenc Mezei
  - Young Scientist Awards: Drei von zehn Preisen gehen an die Schweiz
- ICNS 2001: München
- ECNS 2003: Montpellier
- Technology Cooperation Initiative
- Strategy on European Neutron Sources: In naher Zukunft sollte ein Dokument über die schweizerischen Pläne gemacht werden (ILL, ISIS, Austron, ESS)
- Wahl eines neuen Executive Board:
  - Chairman: R. Cywinski (St. Andrews)
  - Vice-Chairman: F. Barocchi (Florence)
  - Secretary: L. Börjesson (Gothenburg)

10. Bericht des Vertreters des PSI im ESS Council

Prof. R. Eichler, Vizedirektor des PSI, berichtet vom ESS Council:

- bisheriger Chairman: J. Kjems (Risø, Dänemark)
- neuer Chairman: Tindemanns (Niederlande)
- Zentrales Design Team soll in Jülich aufgebaut werden
- Mitgliederbeiträge:
  - ca. CHF 100000
  - ca. 2 Personen
- persönliche Meinung von R. Eichler:
  - Politiker werden mit drei Anlagen ILL, ISIS und ESS nicht einverstanden sein
  - falls ja zu ESS, was soll aufgegeben werden?
  - Wissenschaftler soll Vorsitz im ESS-Council haben
  - PSI trägt bereis viel zu ESS bei in Form der flüssig-Metall-Targetentwicklung (CHF 10 Mio).
  - R. E. wünscht Vorschäge von der SGN

Diskussion:

- K. A. Müller: Wo wird gebaut? Antwort: Noch nicht klar.
- H. U. Güdel: Kein Konflikt zwischen ILL und ESS wegen verschiedenen Zeitskalen.
- B. Dorner: Neuer Reaktorbehälter am ILL hat eine Lebensdauer bis 2015 (20 Jahre), kann ersetzt werden.

- W. Fischer: Mindestens 50% der Konzepterstellung und Planung für die Spallationsquellen in den US und Japan wurden als Vorarbeit für die ESS in Europa geleistet.

11. Aktivitäten der SGN/SSDN im Jahre 2000

- Tagung mit der Schweizerischen Kristallographischen Gesellschaft.
- Benutzerversammlung wird von Ende 2000 vermutlich auf Januar 2001 verschoben.

12. Varia

Der Präsident der SGN, Prof. K. Yvon, gratuliert im Namen der SGN Prof. A. Furrer zu seinem 60. Geburtstag, würdigt dessen Rolle als "Champion" der schweizerischen Neutronenstreugemeinde (Gründungspräsident der SGN) und überreicht eine Zürcher Zinnkanne mit eingraphiertem SGN Logo.

Um 14:13 Uhr wird die Behandlung der Traktanden abgeschlossen.

Der Sekretär der SGN, Dr. P. Böni

Neutron powder diffraction with ^{nat}Eu

Holger Kohlmann, Laboratoire de Cristallographie, 24 Quai E. Ansermet, CH-1211 Genève 4 ; Holger.Kohlmann@cryst.unige.ch

Neutron diffraction experiments have been carried out on several hydrides containing ^{nat}Eu (natural isotopic mixture). The absorption has been lowered by taking advantage of its wavelength dependence and the use of annular samples. From neutron powder diffraction data of deuterated samples taken at the high intensity diffractometers D20 and D4B (ILL, Grenoble) the crystal structures could be solved and refined, thus providing the first complete structural data of europium hydrides and the first reliable Eu-D distances.

Absorption coefficients of most materials for neutrons are low unlike for X-rays. However, few elements, such as Cd, Sm, Eu and Gd, show resonance effects for thermal neutrons with excessively high neutron absorption cross sections σ_a, thus making neutron diffraction experiments seemingly impractical. This problem may be overcome by two different methods : 1) Due to the large isotopic effect pure isotopes with a lower σ_a (e. g. ^{153}Eu) may be used – a generally very expensive method. 2) Neutron absorption can be lowered by taking advantage of its wavelength dependence, a method which was successfully tested for europium hydrides [1]. The advantages of the second method are the much lower costs and the availability of natural isotopic mixtures.

The neutron absorption cross section σ_a of ^{nat}Eu shows a resonance peak at λ = 42.1 pm (12125 barns) and a local minimum at λ = 72.9 pm (860 barns, Fig. 1). Preliminary calculations of the transmission of ^{nat}Eu containing compounds showed that at the latter wavelength neutron diffraction might be feasible. This prompted us to perform neutron powder diffraction experiments on several europium deuterides on the high intensity diffractometers D20 and D4B (ILL, Grenoble) at wavelengths close to the minimum of σ_a (^{nat}Eu) (Fig. 2, Table 1). To reduce the absorption double-walled vanadium cylinders with typically 10 mm outer diameter and 0.6 mm annular sample thickness were used as sample holders. The data collection times ranged between 6 and

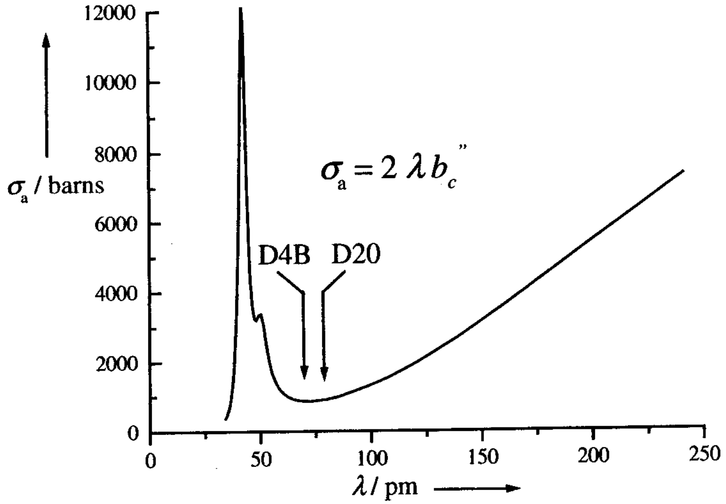


Fig. 1 : Calculated neutron absorption cross section of ^{nat}Eu (data for b_c'' taken from Ref. [2]). Wavelengths used in the neutron powder diffraction experiments are indicated by arrows.

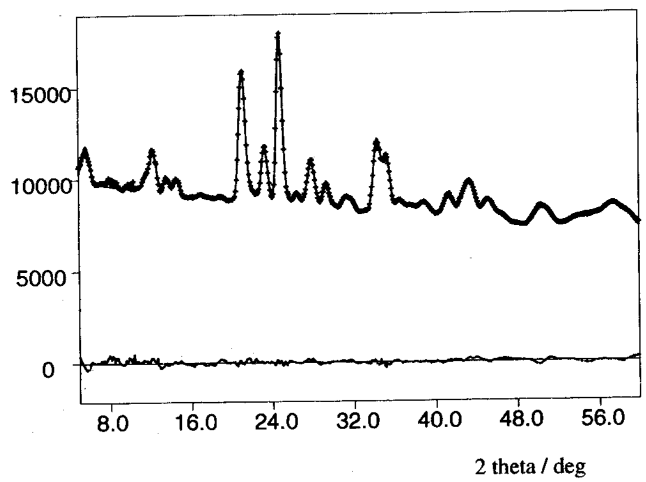


Fig. 2 : Observed (dotted), calculated (solid line) and difference (below) neutron powder diffraction pattern of $EuMg_2D_6$ taken on D20 at λ = 80.45 pm (T = 293 K). Intensity in total detector counts.

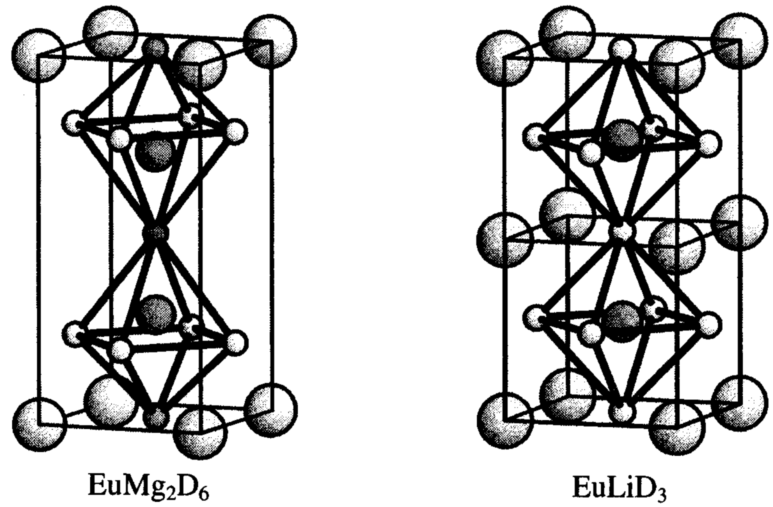


Fig. 3 : The crystal structures of $EuMg_2D_6$ (left) and $EuLiD_3$ (right ; two unit cells). Large, middle-sized and small spheres represent Eu, Mg (left) / Li (right) and D, respectively.

13.5 h, the sample mass between 0.9 and 2.1 g. For all investigated compounds the deuterium positions were located and the crystal structures were refined (Table 1). The metal atom substructure had been determined before by X-ray powder diffraction.

Table 1: Crystal structure data of investigated europium deuterides (T = 293 K)

compound	instrument ^{a}	μ / cm$^{-1,b}$	structure type	space group	$\overline{d}$(Eu-D)/pm	ref.
$EuMg_2D_6$	D20	8.09	$EuMg_2D_6$	$P4/mmm$	258.0(2)	[3]
$EuMgD_4$	D20	12.53	$BaZnF_4$	$Cmc2_1$	253(2)	[3]
Eu_2MgD_6	D4B	15.62	K_2GeF_6	$P\,\bar{3}m1$	263.4(10)	[4]
EuD_2	D4B	20.67	$PbCl_2$	$Pnma$	255.1(4)	[5]
$EuLiD_3$	D4B	15.83	$SrTiO_3$ (RT)	$Pm\,\bar{3}m$	267.82(2)	[5]
$EuPdD_3$	D4B	15.71	$SrTiO_3$ (RT)	$Pm\,\bar{3}m$	268.63(3)	[4]

^{a}: λ = 80.45 pm at D20, λ = 70.50 pm at D4B; ^{b}: calculated for the used wavelength

Due to the low resolution at high diffraction angles 2θ only data up to 60° (D20) and 74° (D4B) were used for the refinements. The calculated interatomic distances show a satisfactory precision. The considerably larger estimated standard deviations in the case of $EuMgD_4$ (Table 1) reflect the strong influence of the sample holder geometry. In this particular case we used a sample with a larger annular thickness resulting in a decrease of transmission. Annular samples reduce also the 2θ dependence of the absorption drastically as compared to full cylinders. Therefore no correction of the diffraction data for absorption effects was necessary [3, 5].

These *ab initio* structure determinations provide the first complete crystal structure data on europium hydrides. Due to its high absorption europium has been one of the few white spots on the map of metal hydrides. Those are of interest as potential hydrogen storage materials and because of their fascinating chemical and physical properties. In the Eu-Mg-H system three new phases have been synthesised [3, 4], of which $EuMg_2D_6$ crystallises in a new structure type (Fig. 2 and Fig. 3, left). That is closely related to the cubic perovskite type, which is adopted by $EuLiD_3$, by omitting every other Eu layer ($EuMg_2D_6$ vs. $Eu_2Li_2D_6$, compare Fig. 3 left- and right-hand side). Hereby an anisotropy is introduced which appears in the strong distortion of the MgD_6 polyhedra in $EuMg_2D_6$ compared to the regular LiD_6 octahedra in $EuLiD_3$ and in the strongly compressed EuD_{12} cubo-octahedra in $EuMg_2D_6$ compared to their regular counterparts in $EuLiD_3$. This distortion results in shorter mean Eu-D distances for $EuMg_2D_6$ (Table 1) and in an unusual coordination of the D atom in the middle of the unit cell which has only two Mg neighbours (Fig. 3, left). The structural relationship between the structure types of $EuMg_2D_6$ and the cubic perovskite ($EuLiD_3$) can be proven by crystallographical group-subgroup relationships [3]. In Eu_2MgD_6 with an anti-cuboctahedral EuD_{12} coordination a similar shortening of the mean Eu-D distances due to distortion is observed (Table 1). For ninefold coordination two types of EuD_9 polyhedra were found : trigonal prisms with one capping atom per prism face in EuD_2 and trigonal prisms with one prism faces capped by two and another one capped by one D atom in $EuMgD_4$.

For all investigated compounds (Table 1) analogous, isostructural strontium compounds can be found except for $EuMg_2D_6$ which is unique so far. In europium deuterides the distances Eu-D are somewhat shorter than the Sr-D distances in the corresponding strontium compounds which is in accordance with the slightly smaller ionic radius of Eu^{2+} compared to Sr^{2+}. In agreement with these crystal chemical considerations magnetic susceptibility measurements indicate Eu to be in the divalent state [3-5]. All investigated compounds order ferromagnetically at low temperatures

[3-5]. In view of their colour (red or brown), crystal structure (Table 1), full occupancy of deuterium sites and magnetic properties EuD_2, Eu_2MgD_6, $EuMgD_4$, $EuMg_2D_6$ and $EuLiD_3$ are presumably non-metallic, salt-like hydrides whereas $EuPdD_3$ is probably metallic.

It was shown that neutron powder diffraction with ^{nat}Eu is feasible if the power of modern neutron diffraction is fully exploited. This underlines the importance of instrumental developments in neutron science for solid state research. For the first time the complete crystal structure of europium hydrides could be determined, providing the first reliable Eu-D distances. The quality of the data allows detailed structure determination and refinement, but a better resolution is certainly desirable for future investigations of more complicated crystal structures. Depending on the complexity of the crystal structure and the absorption coefficients, a compromise has to be found for each material between a good transmission which requires usually short wavelengths and the generally better resolution at higher wavelengths. For compounds with moderate linear absorption coefficients reliable results may also be obtained at higher wavelengths above the minimum of σ_a as demonstrated recently for a cadmium compound [6]. For the elements with the highest neutron absorption for thermal neutrons, ^{nat}Sm and ^{nat}Gd, σ_a drops to values of 200 and 500 barns at λ = 50 pm. Hence, neutron diffraction should also be feasible with natural isotopic mixtures of those elements.

I would like to thank Prof. K. Yvon for his support, Dr. P. Fischer for fruitful discussions, Dr. T. Hansen and Prof. H. Fischer for help with the neutron diffraction experiments.

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[6] M. Bortz, M. Gutmann, K. Yvon, *J. Alloys Compd.* **1999**, *285*, L19-L21

Schweizerische Gesellschaft für Neutronenstreuung (SGN)
Société Suisse pour la Diffusion des Neutrons (SSDN)
Swiss Society for Neutron Scattering

Anmeldeformular / Registration Form

Name / surname:..

Vorname / first name:..

Akad. Titel / title:...

Geschäftsadresse / business address:...

....

....

Telefon / phone:..

Telefax / fax:..

E-Mail / e-mail:...

Privatadresse / home address:..

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Zustelladresse: [ ] Geschäft [ ] Privat
Mailing address: [ ] business [ ] private

Datum / date: Unterschrift / signature:

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Bitte senden an / Please send to:

Sekretariat SGN, c/o Laboratorium für Neutronenstreuung, CH-5232 Villigen PSI

(Jahresbeitrag / annual fee : Fr. 10.00)

SINQ

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Email: SINQ@psi.ch, Web: www.psi.ch/sinq

EXPERIMENT REQUEST

Proposal number

[ ] **Short term proposal (next allocation period)** [ ] **Long term proposal (2 years)**

Proposer *(to whom correspondence will be addressed)*
Name and first name:
Address:

Phone:
Fax:
Email:

Co-proposer:
Name: Address: *(if different from above)* Phone/Fax/Email:

Sample description

Substance and formula:

Mass: Size:

[ ] Polycrystalline [ ] Single crystal [ ] Multilayer [ ] Liquid [ ] Gas

Sample Container: Space group: Unit cell: a= b= c=

Hazard

Is there any danger associated with the sample or sample environment?
[ ] No [ ] Yes [ ] Uncertain If yes or uncertain, please give details of the risks associated:

Experimental details

Instrument	**Days**	**Sample cond.:** Temp., Pressure, Magn. field	**Exp. cond.:** E, ΔE, λ, Δλ, Q, ΔQ

Requested dates:	**Unacceptable dates:**

Title of Experiment:

Research funded by:

Scientific background/Aim of experiment: *(Please restrict to the space given within this box!)*

I certify that the above details are complete and correct.
Date: Signature of proposer: