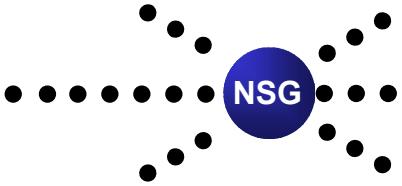
Neutron Scattering Group

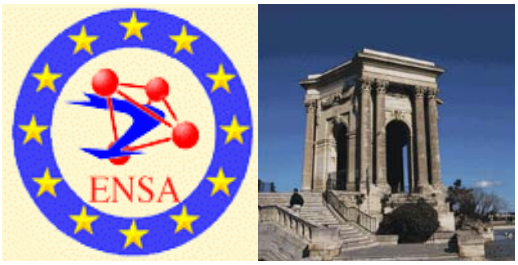
Newsletter






No: 1 – November 2003

# Conference Report




## 3rd European Conference on Neutron Scattering

September 3-6 2003 Montpellier, France

ECNS was held in Interlaken in 1996, Budapest in 1999 and in 2003 in Montpellier, France. At ECNS, scientists from a broad spectrum of disciplines such as physics, chemistry, biology, materials science, application and instrumentation meet and present their work to their fellow members of the European Neutron Scattering Community. With around 700 participants from 35 countries, we enjoyed 80 oral presentations across 3 parallel sessions including 9 plenary lectures and 15 invited talks, and over 600 posters across two poster sessions. The main themes of the conference were magnetism, chemical structure, soft matter, life sciences, and instrumentation and methods. There were also talks and posters on fundamental physics, disordered and frustrated systems, industrial and medical applications, and emerging applications of neutron scattering.

The program started with an opening ceremony in which the Walter Hälg Prize was presented to Professor R. A. Cowley (University of Oxford) who then went on to give the ENSA Award Lecture on rare-earth magnetic superlattices. One of the sessions I found most enjoyable was that on chemical structures and dynamics chaired by W. Kuhs (University of Goettingen, Germany). The invited speaker W. David (ISIS Facility, UK) spoke first on paramagnetic powder diffraction of $ZrW_2O_8$. His findings have revealed that in this system, the Zr-O bond is seen to contract causing the lattice constant to change, which can be monitored accurately using the high resolution powder diffraction instrument HRPD at ISIS. He then went on to discuss the different drug structures that can be studied using neutron powder diffraction and how this technique reveals properties not seen by x-ray diffraction (the method generally preferred by companies).

There were many interesting posters on show and it was difficult to get round them all in the short time available. I presented our paper, on the fabrication of $Nb_3Sn$ superconducting wire studied by neutron diffraction in the first poster session.

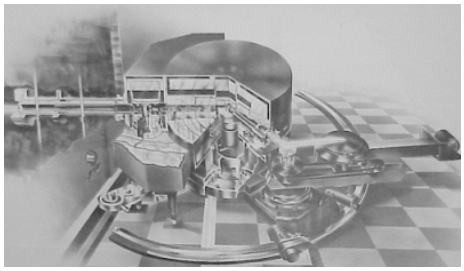
ECNS 2003 reflected the diversity of current research that falls under the umbrella of neutron scattering, and I wish to thank the Neutron Scattering Group of the neutron scattering group of IOP and the RSC for providing me with financial support to attend this important conference.

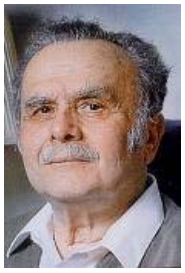
*Maisoon Al-Jawad*, University of Leeds.

# Spotlight

## Bertram Brockhouse

### *Nobel prizewinner in physics*





Brockhouse Diffractometer
[Photos courtesy of NPMR/NRC, Canada]

*Bertram Neville Brockhouse, physicist: born Lethbridge, Alberta 15 July 1918; Lecturer, University of Toronto 1949-50; Research Officer, Atomic Energy of Canada Ltd 1950-59, Head, Neutron Physics Branch 1960-62; Professor of Physics, McMaster University, Canada 1962-84 (Emeritus); FRS 1965; OC 1982, CC 1995; Nobel Prize in Physics (jointly with Clifford G. Shull) 1994; married 1948 Doris Miller (four sons, two daughters); died Hamilton, Ontario 13 October 2003.*

Bertram Brockhouse pioneered and developed the technique of neutron inelastic scattering. He built the first really successful spectrometers of both of the main types - the triple axis and time-of-flight instruments - and made pioneering measurements of the motions of atoms in metals, semiconductors, insulators and liquids and of the spin waves in magnetic materials that now form the basis of our understanding of condensed matter physics.

His instruments have been copied and further developed throughout the world and are still the most generally useful neutron inelastic scattering instruments. They provide basic information about all new materials. This work was performed between 1952 and 1962 and in 1994 he was belatedly awarded the Nobel Prize jointly with Clifford Shull, who simultaneously pioneered the elastic scattering of neutrons from condensed matter.

Bert Brockhouse was born in 1918 in Lethbridge, Alberta. His family moved to Vancouver and he graduated from high school in 1935. He became a laboratory assistant and then a self-employed radio repairman both in Vancouver and in Chicago. During the Second World War he served in the Royal Canadian Navy Reserve as an electronics technician. He studied at the University of British Columbia after the war and graduated in 1947 with first class honours in mathematics and physics. He then transferred to the University of Toronto where he obtained his doctorate thesis on the magnetic properties of ferromagnetic metals.

In 1950 Brockhouse went to Atomic Energy of Canada Ltd (AECL) at the Chalk River Nuclear Laboratories in Ontario, joining the group of Don Hurst, who wanted to develop neutron scattering techniques using the slow neutrons emerging from the new reactors. His first work used resonant absorbers to detect monochromatic neutrons and showed that the results for lead, aluminium and carbon were consistent with the Einstein theory for the density of states predicted 50 years before.

These experiments had poor resolution, about 0.05eV, and Brockhouse realised that the resolution needed to be improved. He therefore abandoned resonant detectors, although they are still used on some instruments today, and began building the first triple axis crystal spectrometer. This instrument used a crystal to obtain a mono-energetic incident neutron beam and the energy of the scattered beam was determined by another single crystal monochromator.

The initial tests with this instrument were disappointing, so Brockhouse then started a programme of improvements by growing better crystals, by developing new detectors and by reducing the background. This programme was delayed by an accident to the NRX reactor in 1952 and Brockhouse worked at the Brookhaven National Laboratory, at Upton, New York, for a year.

On his return to Chalk River he continued to make improvements to his triple axis spectrometer and in 1955 he made the first measurements of both the energy and wavevector of some of the lattice vibrations (phonons) in aluminium, showing that well-defined phonons existed in metals and that neutron scattering could be used to determine their properties. These early experiments were performed with an incident neutron energy that was fixed, with a scattering angle that was fixed and by scanning the energy of the analyser.

The spectrometer is, however, far more useful when it is used to perform more flexible scans. This is easily done with computer control now, but was a substantial problem in the late 1950s. Brockhouse solved these problems and in 1960 produced a constant Q spectrometer operated by punched paper tape from the one computer on the AECL site.

It was with this spectrometer that he determined the atomic motions in lead, sodium, germanium, sodium iodide (NaI) and potassium bromide (KBr). These measurements measured the inter-atomic forces and showed the existence of Kohn anomalies in metals, while, with Bill Cochran, who died in August, he developed and exploited the shell model for describing semiconductors and insulators. He also made the first measurements of the spin wave spectrum in magnetic materials in magnetite and in metallic cobalt.

As well as developing the triple axis crystal spectrometer, Brockhouse also pioneered other neutron scattering instruments. He developed the beryllium filter analyser that replaced the analysing spectrometer of the triple crystal instrument by a large polycrystal of beryllium. This had a high count rate but relatively poor angular definition. He also developed the time-of-flight technique by producing a pulsed incident beam by using a rotating single crystal. The energy of the scattered neutrons was then determined by the time-of-flight of the neutrons to the detector. He used this type of instrument to study the atomic motions in water, molten lead and liquid argon.

In 1962 Brockhouse left AECL and joined McMaster University in Hamilton, Ontario, where he served as Professor until his retirement in 1984. He trained some distinguished students and built new spectrometers both at the McMaster reactor and at AECL. The results obtained were useful contributions to the field but not as groundbreaking as his earlier work.

Later, his interests shifted to the philosophy of physics and to concerns over the cost of scientific research. He became concerned about the waste of energy in the community and his home and choice of car were evidence of these concerns. Nevertheless, the field of neutron scattering that he started has prospered and new facilities are currently being built in the UK, the US, Germany and Japan.

While at AECL Brockhouse found time to take part in three Gilbert and Sullivan operettas and in a production of a Shaw play. He was a Canadian patriot and greatly enjoyed his music.

He received many honours and awards for his research, including the Buckley Medal of the American Physical Society, the Tory Medal of the Royal Society of Canada and the Duddell Medal of the Institute of Physics. He was a Fellow of the Royal Societies of Canada and of London and an Officer of the Order of Canada as well as being a joint recipient of the 1994 Nobel Prize.

Many of his colleagues and students owe a great debt of gratitude to Bert Brockhouse. He inspired us to work long and hard and to perform experiments correctly and convincingly. There are many "absent-minded professor" stories but his insistence on good experimental technique and his concern not to waste time or money are more important. He had excellent intuition and a dedication to research and was liked and revered by those who had the pleasure of working with him.

***Roger Cowley, Oxford***

[Reprinted by permission from *The Independent*, Obituaries, 21 October 2003]

# Prize

***Neutron Scattering Group – Willis prize***

The Neutron Scattering Group of the Institute of Physics and the Royal Society of Chemistry intends to award the next Willis prize at the NMUM in 2004. Nominations for the prize should be forwarded to

Robert.Richardson@Bristol.ac.uk

by 31st December 2003.

# What's on

**30 March 2004**


Congress provides a forum to bring together those working at the cutting edge in materials research in academia, industry and other research organisations. The programme will be of interest to those working in all fields of materials science and technology, whether they be based in materials science, chemistry, physics or engineering groups. A series of themes will offer representatives of government, the financial markets and the media an opportunity to understand the significance and opportunities from materials innovation in the economy, improving people's quality of life while conserving the Earth's resources.

**More details:**
http://www.iom3.org/congress2004/venue.htm

**19 May 2004**

Structure, Properties and Applications of Surfactants
At SCI Belgrave Square, on 19 May 2004.

# Contact

Editor: A. Zarbakhsh, Queen Mary, University of London.

Contributions for the next issue:

Please e-mail to

a.zarbakhsh@qmul.ac.uk

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