ISIS Neutron and Muon Source

Access for Brazilian researchers

UKRI Science and Technology Facilities Council

ISIS Neutron and Muon Source

Introduction to ISIS Neutron and Muon Source

The ISIS Neutron and Muon Source is based at the STFC Rutherford Appleton Laboratory in Oxfordshire, UK, and is a world-renowned centre for research in the physical and life sciences.

At ISIS, scientists use beams of neutrons and muons to study materials at the atomic level. The facility operates a suite of 35 experiment stations, each optimised to study different atomic and molecular properties of materials.

The neutron and muon beams at ISIS can be used to study a broad range of science areas, from fundamental physics, including magnetism and superconductivity, to chemistry and catalysis, polymers, biosciences, engineering, geology, and a wide range of advanced and applied materials.

Neutrons provide complementary information to that given by X-rays and other methods. Muons are a more unusual probe of materials, but give complementary information to neutrons, particularly in studies of magnetism, superconductivity and ionic conductivity.

Scan the QR code to view recent science highlights from ISIS.

www.isis.stfc.ac.uk/Pages/Science-Highlights.aspx

Why use neutrons?

STUDY DYNAMICS

Neutron energies are comparable to the time scales of molecular diffusion, vibrations and rotations.

STUDY STRUCTURE

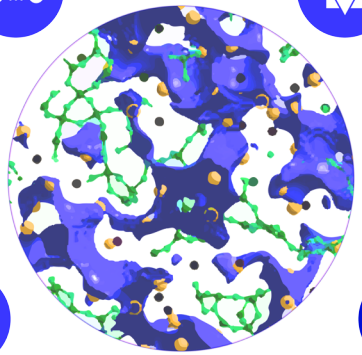
Neutron wavelengths are comparable to the spacings of atoms and molecules.

PENETRATION POWER

Neutrons can penetrate deep into matter (including many different metals) enabling the study of large samples - even within complex sample environments.

STUDY MAGNETISM

The neutron's magnetic moment can be used to study the microscopic magnetic properties of materials.



NON-DESTRUCTIVE

Neutrons are suitable for the characterisation of delicate and precious samples.

VERSATILE SAMPLE ENVIRONMENTS

Sophisticated sample environments enable studies under operating conditions, including extreme temperatures and pressures.

SENSITIVITY TO LIGHT ELEMENTS

The neutron scattering power of nuclei varies in a quasi-random manner such that lighter atoms (e.g. H, Li) can be studied in the presence of heavier ones.

COMPLEMENTARITY

Neutron scattering is highly complementary to other techniques, such as X-ray scattering, electron microscopy, magnetic resonance and computational methods.

ISOTOPIC CONTRAST

Neutrons are sensitive to different isotopes of the same element, so isotopic substitution (e.g. H/D) can be used to highlight specific features.

Case study: ISIS and Brazil – quantum insights for greener magnets

From vehicle motors to computer hard drives – permanent magnets are critical to many modern technologies. However, the environmental and economic impact of relying on rare earth elements is driving efforts to find alternative magnetic materials.

One promising material is the intermetallic ferrimagnet, $NdCo_5$. By studying $NdCo_5$ using inelastic neutron scattering at ISIS, a team, led by Prof. Larrea from the University of São Paulo, gained greater understanding of the interactions responsible for magnetism in permanent magnets.

The research has also helped to refine the theoretical approaches used to describe magnetic interactions, opening new routes to design high-performance magnets that do not rely on rare earth elements.

"Neutron experiments reveal low-energy interactions in magnetism, fostering new material platforms for the realisation of sustainable and efficient hard magnets."

Prof Julio Antonio Larrea Jiménez

Laboratory for Quantum Matter under Extreme Conditions (LQMEC),
Institute of Physics, University of São Paulo

Using the ISIS Neutron and Muon Source

Researchers can apply to use ISIS instruments by submitting proposals to the facility and, if successful, facility time is normally scheduled within six months.

Researchers attend ISIS for their experiments and usually stay in on-site accommodation at the Rutherford Appleton Laboratory. Experiments typically last between 1-6 days and are assigned an ISIS scientist who provides advice on sample preparation, the practicalities of running the experiment and data analysis.

ISIS scientists can also offer support with proposals and advise on the best-suited instrument for a particular investigation.

The Rutherford Appleton Laboratory (RAL), where ISIS is located, is about a 1.5-hour journey from London. Visitors often fly into London Heathrow Airport and use public transport to reach RAL.

Funding for Brazilian researchers

STFC (ISIS) has been awarded a grant from the UK's International Science Partnerships Fund[1] to support Brazilian use of ISIS until March 2027. For a limited number of experiments, the award will pay for the costs of beamtime at ISIS, and will support the cost of travel, food and accommodation of Brazilian researchers coming to ISIS for experiments. The fund will also provide workshops and webinars for technical advice on muon and neutron science, the possibility of extended stays at ISIS for Brazilian researchers, and can support costs for researchers to disseminate their research at ISIS once back in Brazil.

1. The International Science Partnerships Fund is a long-term approach to international research and collaboration for the UK, led by the Department for Science, Innovation and Technology.

Important dates and next steps

Scan the QR code to learn more about ISIS and this funded call to support your research.

1 March 2024	ISIS proposal call opens
18 March 2024	**First Meeting of ISIS-Brazil Collaboration for Neutrons, IPEN**
19-20 March 2024	**ISIS Neutron Source Roadshow, University of São Paulo**
21-22 March 2024	**ISIS Neutron Source Roadshow, Federal University of Paraná**
26-27 March 2024	**ISIS Neutron Source Roadshow, Federal University of Ceará**
17 April 2024	ISIS proposal call closes
1 September 2024	ISIS proposal call opens
16 October 2024	ISIS proposal call closes
November 2024	**Neutron school in Brazil**

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