NEUTRON SCATTERING RESEARCH IN INDIA

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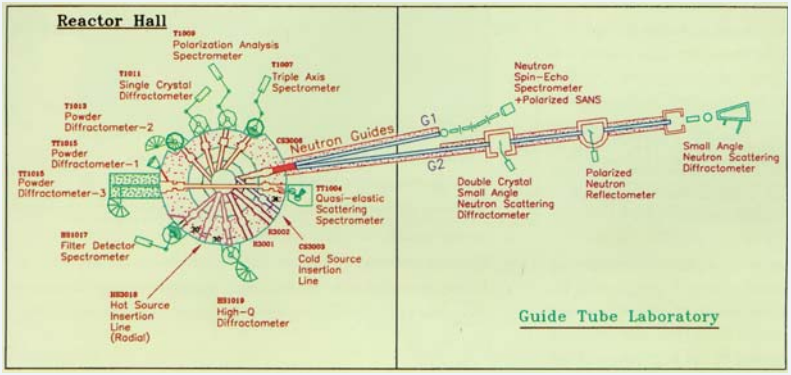
The National Facility for Neutron Beam Research is regularly utilized in collaboration with about 200 users from universities and other academic institutions.

There are at present 30 universities' projects running under the aegis of UGC-DAE CSR. School/Workshops are arranged regularly since 1990 for awareness of neutron scattering.

In addition, India has contributed to significant international cooperation (through IAEA-RCA and others) involving supply of neutron spectrometers and research collaboration with major neutron scattering laboratories abroad.



Experimental Facilities at Dhruva Reactor

Facility includes

Diffraction (Structure)

- **Small-angle scattering** (large molecules, thin films)
- **Wide-angle scattering** (crystals, strain distribution)
- **Very-large angle scattering** (glasses, liquids)
- **Reflectometry** (surfaces, interfaces, thin films)
- **Neutron polarization analysis**

Spectroscopy (Dynamics)

- **Inelastic scattering**
- **Quasielastic scattering**

- **Fundamental Quantum Physics - Neutron Optics**
- **Neutron Imaging - Tomography/Radiography**

Neutron Beam Research

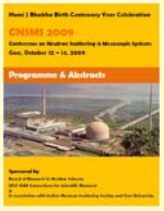
Structure, Dynamics and Magnetism of a wide variety of materials have been investigated.

- **Technological and industrial materials**: Magnetic materials, High-T_c superconductors, Macro emulsion, Ferrofluids, Polymers, Maraging steel, Cement, Catalysts, Negative Thermal Expansion Materials, Nanomaterials, Porous Materials, Minerals etc
- **Amorphous & glassy systems**: Phosphate glasses, Ge-Se glasses, Hydrogen bonding in deuterated alcohol.
- **Thin Films and Multilayers**: Magnetic moment density in semiconductor - metal multilayers, surface morphology of metallic thin films.
- **Applied work**: Neutron radiography of two phase coolant flow in coolant channels and Zirconium hydride blisters.
- **Fundamental Physics**: First neutronic observation of non-cyclic phases, First neutron interferrometric separation of Geometric and Dynamical phases.

Recent Schools and International Conferences in India

International Symposium on Neutron Scattering held at BARC, Mumbai, January 15-18, 2008.

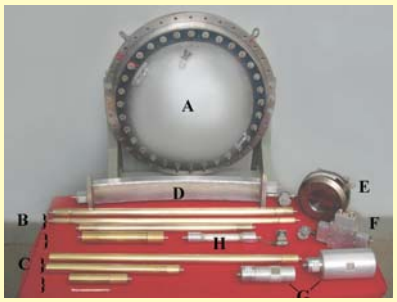
School and Conference on Neutron Scattering & Mesoscopic Systems held at Mumbai and Goa, October 5-14, 2009



Neutron Beam Instrumentation

- In-house development of neutron spectrometers.
- Self reliance in design and fabrication, control and data acquisition systems, etc.
- Development of neutron detectors.
- Novel technologies for beam tailoring.
- International Collaboration with Rutherford Appleton Laboratory, UK at the spallation neutron source ISIS. Contribution towards IRIS and OSIRIS spectrometers.
- Several instruments exported to Korea, Indonesia, Phillipines and Bangladesh through the aegis of IAEA.

Development of various Detectors



A : 2-D PSD for neutrons

B : 1-D PSD for neutrons

C : Neutron Proportional Counters,

D : 1-D Curvilinear PSD for neutrons

E : 2-D PSD for x-ray

F : Microstrip Detector for x-rays and neutrons

G : X-ray Proportional counters

H : 1-D PSD for x-ray

International Collaboration

- Tripartite agreement between India, Philippines and IAEA during sixties (RCA-IAEA). Later, India collaborated with Korea, Indonesia, Bangladesh and other countries.

- Neutron instruments built in BARC were installed and used in some of these countries. Asian collaborative programs with BARC have been supported by IAEA.

- BARC has been collaborating with ISIS facility, Rutherford Appleton Laboratory, UK since early Eighties. We have been a regular user of the ISIS facility for carrying out neutron experiments since 1985.

- Researchers from India availed advanced sources at UK, USA, Germany, France, Switzerland, Japan and other countries to carry out front line research.