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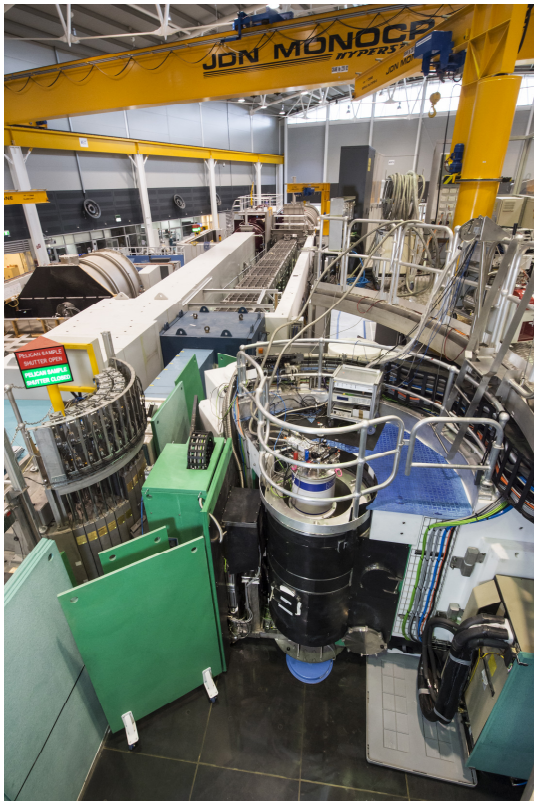
Australian Centre for Neutron Scattering (ACNS)

Pelican

Cold-Neutron Time-of-Flight Spectrometer

Pelican is well suited to the study of dynamics of atoms and magnetic moments. This covers topics as scientifically diverse as the motion of water molecules surrounding bio-molecules to the measurement of spin correlations in quantum magnets.



Time-Of-Flight spectroscopy

When neutrons interact with a sample they change direction and velocity. This change in velocity allows us to determine the change in energy of the sample and the change in directions tells us information about the associated structure.

What makes Pelican special?

By utilising a large triple monochromator Pelican has a very high neutron flux. Coupled with the large detector consisting of 200, 1 m high position sensitive detectors, allows for very fast measurements. This high flux and rapid detection means Pelican is ideal for single crystal measurements as well as powders. Further Pelican is also optimised for polarised neutron measurements using a supermirror bender and a ^{3}He analyser.

Applications

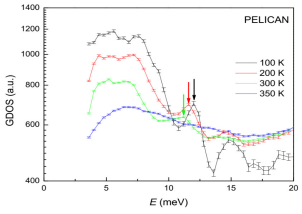
Inelastic and quasi elastic scattering can provide valuable information in a wide variety of scientific and technological applications including:

- Crystal field excitations
- Phonon density of states
- Self diffusion of hydrogenous species
- Spin correlations
- Methyl group tunnelling
- Phonons and magnons in single crystals

CASE STUDIES

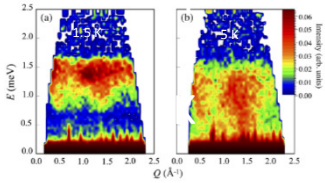
Barocaloric effect s in plastic crystals.

Barocaloric materials are those which undergo a large entropy change when a hydrostatic pressure is applied. Such technology could potentially be applied as a solid state refrigerant. Plastic crystals where there is a phase change from fully ordered to a disordered crystal are ideal candidates for barocaloric effects. Time-of-flight inelastic neutron scattering is able to probe the atomic motions in the disordered phase as well as the vibrational density of states. The latter showed strong anharmonic effects, which can be related directly to the entropy change (*Nature* **567**, 2019, 508)



Exotic quantum magnets.

Topological magnetic phases were the subject of the 2016 Nobel prize. Inelastic neutron scattering is sensitive to magnetic fluctuations in such phases. For example the spin dynamics of S=1 chains are known to show the so-called Haldane gap. The example shown to the left shows the opening of such a gap at low temperatures in the natural mineral fedotovite (*Phys Rev lett*, **120**, 2018, 77201).



SPECIFICATIONS

Pelican is located on the cold neutron guide CG1 in the neutron guide hall.

Wavelength range:
2.345-6 Å

Energy resolution:
65 μeV (6 Å), 135 μeV (4.69 Å), 800 μeV (2.345 Å)

Sample size:
1.25 cm diameter, 8 cm high.

Sample Type:
Powder, liquid, glass, single crystals

Monochromator:
Three PG002 monochromators

Detector:
200 one metre high ^{3}He PSD's spanning 125 degrees.
Detector solid angle 0.8 steradians (5 m^2 detector coverage)
Q range 0.2 Å^{-1} to 4.5 Å^{-1}
Q resolution 0.05 Å^{-1}

Sample Environment Available:
Cryofurnace 1.5 K – 800 K
Dilution insert 0.05 K – 1.2 K
Vacuum furnace 20 °C – 1600 °C

Polarisation analysis:
Incident beam polariser: super mirror bender
Polarisation analysis: ^{3}He

INSTRUMENT SCIENTISTS

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