

Australian Centre for Neutron Scattering (ACNS)

Quokka

Pinhole Monochromatic Small Angle Neutron Scattering (SANS)

The Quokka small angle neutron scattering instrument is a 40 m long pinhole instrument used to determine the structure of materials on the nanoscale in a wide variety of scientific disciplines.

Small angle scattering

By studying the way in which radiation is scattered by a sample at small angles, it is possible to determine the size, shape and orientation of nanoscale structures within a sample.

What makes Quokka special?

Quokka is a world-class SANS instrument with high flux and a state of the art high count rate detector. A wide range of sample environments that can be positioned at the sample position is available, including some that are unique worldwide.

Applications

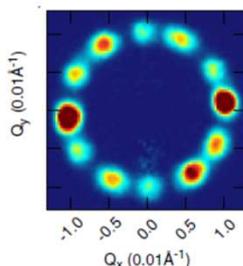
Small Angle Neutron Scattering can provide valuable information in a wide variety of scientific and technological disciplines including:

- Surfactants, colloids and polymers
- Food science
- Biological macromolecules (including proteins, DNA/RNA and viruses)
- Biological membranes
- Defects in materials
- Flux lattices in superconductors
- Magnetic nanostructures
- Alloys and ceramics

CASE STUDIES

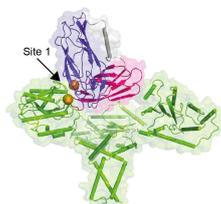
Skyrmion-lattice phases

Quokka has been used to study the thermodynamic stability of skyrmion-lattice phases in Cu_2OSeO_3 by applying a magnetic field at low temperature to the sample. Two distinct skyrmion-lattice phases can be stabilized through different thermal histories, which is surprisingly similar to the irreversibility observed in spin glasses. (K. Makino *et al.* Phys Rev B (2017), 95, 134412)



SANS study of a protein complex

Disulfide bonds often play a key role in defining a protein's structure and stability and are controlled by a class of proteins called 'Suppressor of Copper Sensitivity' proteins in some organisms. Two forms of the protein bind together and have been characterised by combining X-ray crystallography, SAXS and SANS. Deuteration of one of the proteins was performed at the Australian National Deuteration Facility. (EJ. Furlong *et al.* J Biol. Chem (2018) 293 (16) 5793-5805.)



SPECIFICATIONS

Wavelength range:

Monochromatic, velocity selector from 2-20 Å

Wavelength resolution:

7-18% (conventional selector); 4-14% (high resolution selector)

Number of movable guide sections in collimator:

9

Cross-section of guides in collimator:

50mm x 50mm

Nominal specifications:

Q-range: 6×10^{-4} – $>0.7 \text{ \AA}^{-1}$

Polarisation capability:

Fe/Si supermirror for incident polarisation, polarised ^3He for analysis.

Optics:

MgF_2 lens focusing optics.

Detector:

1 m x 1 m square pad detector from Brookhaven National Laboratory; located on encoded rails and translatable from 1.3 m to 20 m from sample and offset by up to 450 mm.

INSTRUMENT SCIENTISTS

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