

Recent highlights from the cold-neutron triple-axis spectrometer

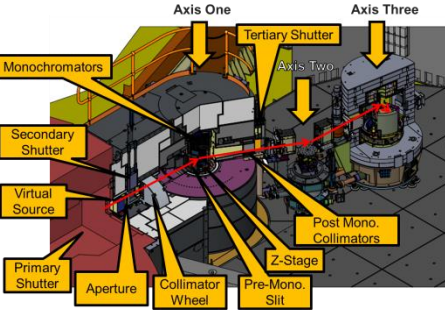
SIKA

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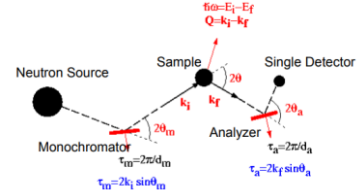
Triple axis spectrometer SIKA



Neutron Cross section

$$\frac{d^2\sigma}{d\Omega dE_f}$$

$$= \left(\frac{m}{2\pi\hbar}\right)^2 \frac{k_f}{k_i} \sum_{\lambda_i} P_{\lambda_i} \sum_{\lambda_f} |\langle \mathbf{k}_f, \lambda_f | \hat{U} | \mathbf{k}_i, \lambda_i \rangle|^2 \delta(E_{\lambda_i} - E_{\lambda_f} + \hbar\omega)$$



$$\text{Nuclear scattering } \left(\frac{d\sigma}{d\Omega}\right)_{\text{nuclear}} = N \frac{(2\pi)^3}{v_0} \sum_{\tau} \delta(\mathbf{Q} - \tau) |F_N(\mathbf{Q})|^2$$

$$\text{Magnetic scattering } \left(\frac{d\sigma}{d\Omega}\right)_{\text{mag}} = N \frac{(2\pi)^3}{v_0} \sum_{\tau} \delta(\mathbf{Q} - \tau) |F_M(\mathbf{Q})|^2$$

$$\text{Phonon } \left(\frac{d^2\sigma}{d\Omega dE_f}\right)_{\text{phonon}} = \frac{\sigma_c k_f (2\pi)^3}{4\pi k_i v_0} \frac{1}{2M} \exp(-2W) \sum_{\tau, \alpha} \frac{(\mathbf{Q} \cdot \mathbf{e}_s)^2}{\omega_s} (n_s + 1) \delta(\mathbf{Q} - \mathbf{q} - \tau) \delta(\omega - \omega_s) + (n_s) \delta(\mathbf{Q} + \mathbf{q} - \tau) \delta(\omega + \omega_s)$$

$$\text{Magnon } \left(\frac{d^2\sigma}{d\Omega dE_f}\right)_{\text{spin wave}} = \left(\gamma r_0 \frac{g}{2} F(\mathbf{Q})\right)^2 \frac{k_f (2\pi)^3}{k_i v_0} \exp(-2W) \frac{1}{2} S \left(1 + \left(\frac{Q_z}{Q}\right)^2\right) \sum_s \sum_{\tau, \alpha} (n + 1) \delta(\mathbf{Q} - \mathbf{q} - \tau) \delta(\omega_q - \omega) + (n) \delta(\mathbf{Q} + \mathbf{q} - \tau) \delta(\omega_q + \omega)$$

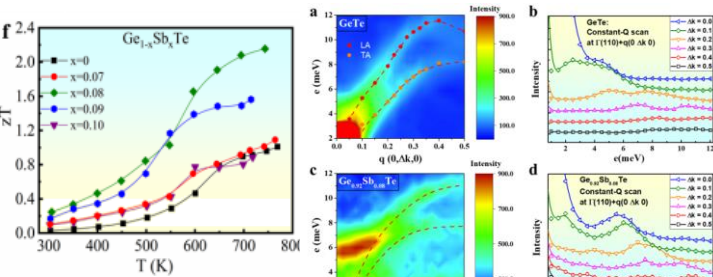
$$\text{Crystal field } \left(\frac{d^2\sigma}{d\Omega dE_f}\right)_{\text{crystal field}} = N \left(\gamma r_0 \frac{g}{2} F(\mathbf{Q})\right)^2 \frac{k_f}{k_i} \exp(-2W) P_{\Gamma_n} \sum_{\alpha} \left(1 - \left(\frac{Q_{\alpha}}{Q}\right)^2\right) |(\Gamma_n | J^{\alpha} | \Gamma_n)|^2 \delta(\hbar\omega + E_{\Gamma_n} - E_{\Gamma_n})$$

The SIKA's dance floor consist of 34 solid granite tiles. The instrument could be used for both thermal cold neutron TAS. The best energy resolution of 0.0275 meV (FWHM) is provided at $E_i = 2.6$ meV

Recent Success 1:

Phonon dispersion of thermoelectric material GeTe

A record high zT of 2.2 at 740 K is reported in $\text{Ge}_{0.92}\text{Sb}_{0.08}\text{Te}$ single crystals, the $\text{Ge}_{0.92}\text{Sb}_{0.08}\text{Te}$ exhibits significant modification to phonon dispersion



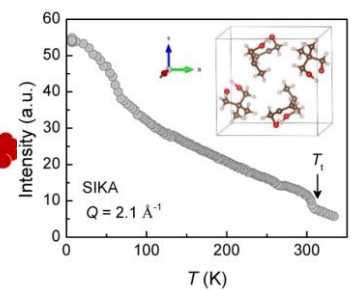
R. K. Vankayal *et al.*
Adv. Sci. 2002494 (2020)

Recent Success 2:

Balocaloric Effect (BCE) on the Plastic Crystal



EISF (elastic incoherent scattering factor) identifies three fold C3 reorientation modes of hydrogen atoms. Anharmonic lattice dynamics in BCE, supported by PELICAN, AMATERAS and DFT theoretical calculations.

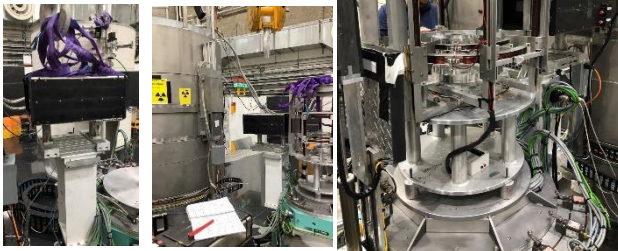


Bing Li *et al.* Nature 567(2019) p506

Progress on SIKA: Polarized neutron scattering

³He polarisation

Polarized neutron is under commission for inelastic and elastic neutron scattering experiment on SIKA
That will be focused topic in 2020-2021

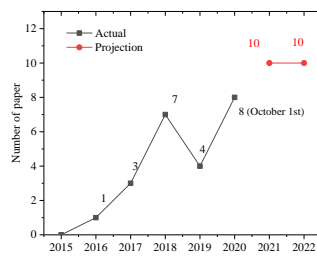


Pasteur coil

References

- SIKA-the multiplexing cold-neutron triple-axis spectrometer at ANSTO
C.-M. Wu, G. Deng, J.S. Gardner, P. Vorderwisch, W.-H. Li, S. Yano, J.-C. Peng and E. Imamovic; Journal of Instrumentation, Volume 11, October (2016) P10009
- Current Status of the Taiwanese Cold Triple Axis Spectrometers, SIKA, at ANSTO
Yano Shinichiro, G. N. Iles, J. -Ch. Peng, Ch.-M. Wu
Journal of Surface Investigation: X-ray, Synchrotron and Neutron Techniques 14, S207-S212 (2020)

Publications



Year	Published
2015	0
2016	1
2017	3
2018	7
2019	4
2020	8