

# NIST Summer School on Neutron Spectroscopy

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## Spin Polarized Inelastic Neutron Scattering

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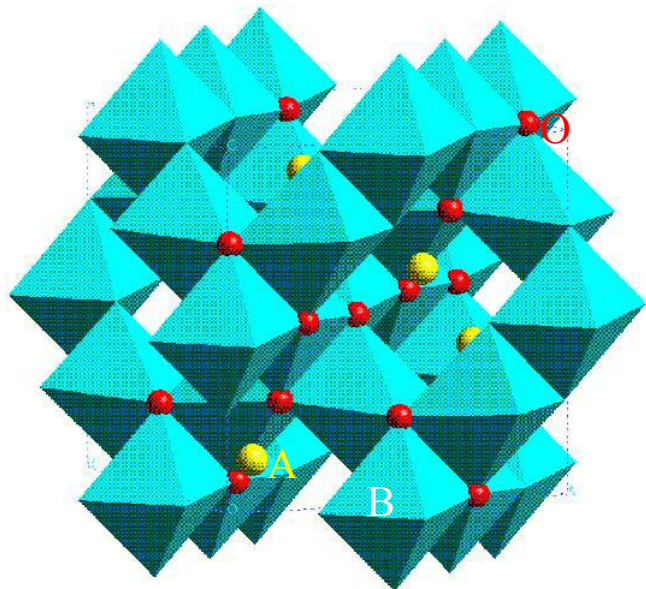
Kapil Gupta

Jose Rodriguez

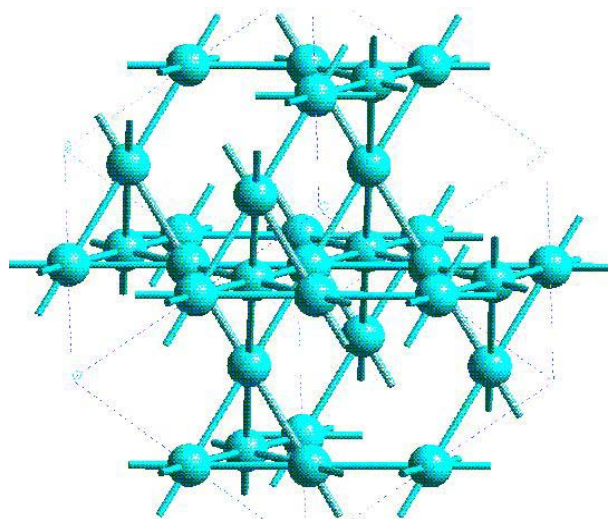
Mike Lewis

# ZnCr<sub>2</sub>O<sub>4</sub>-Space Group-Fm3d

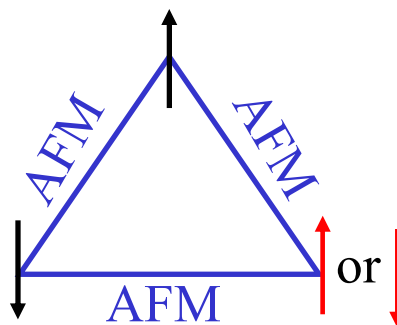
## Edge-sharing octahedra



## Corner-sharing tetrahedra (B sites)



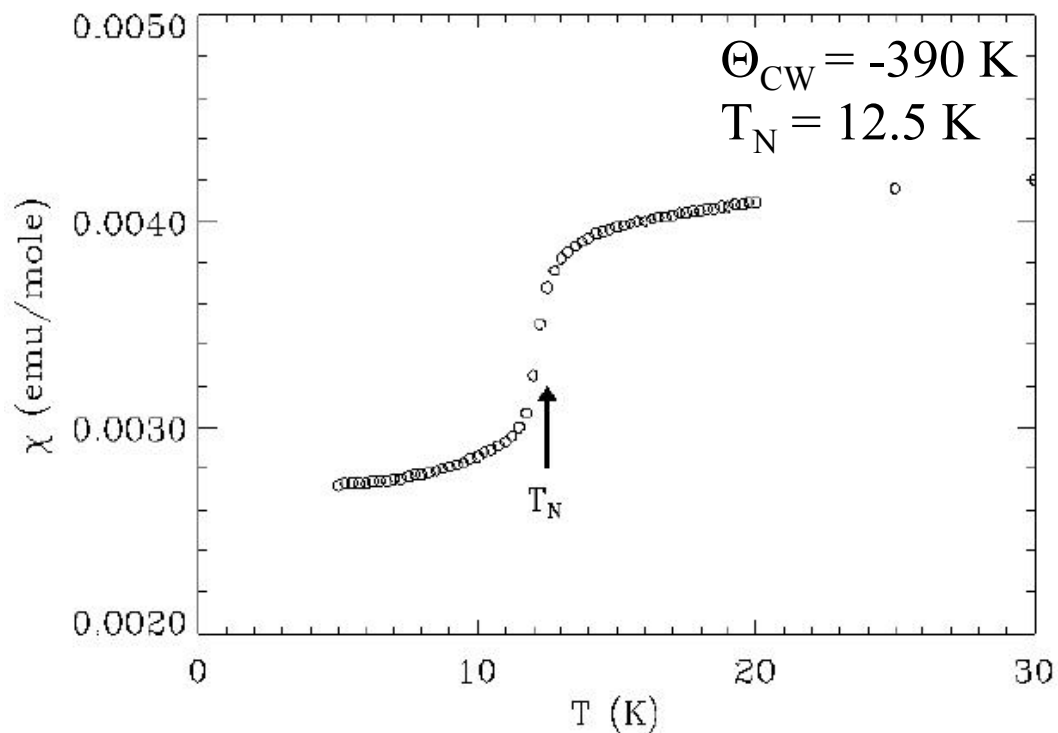
## Magnetic frustration



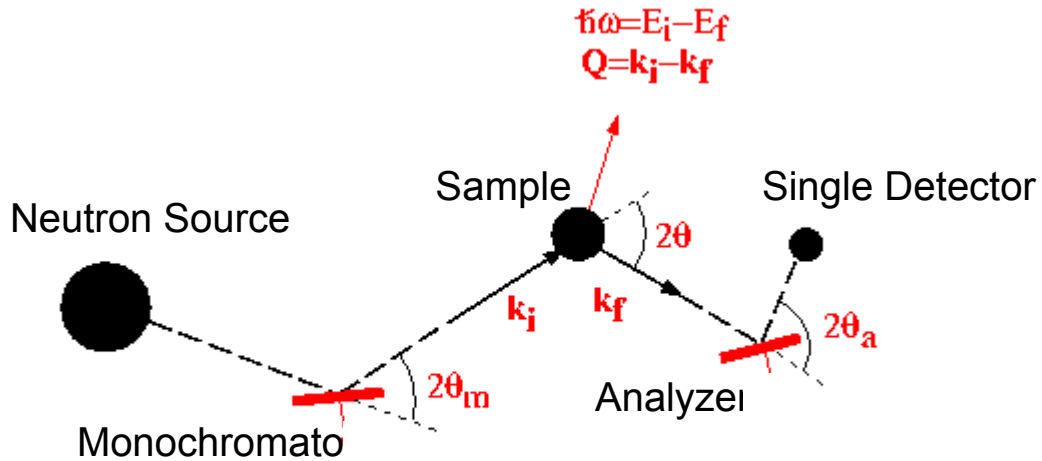
$$H = -J \sum S_i \cdot S_j$$

All exchange interactions can not be satisfied.

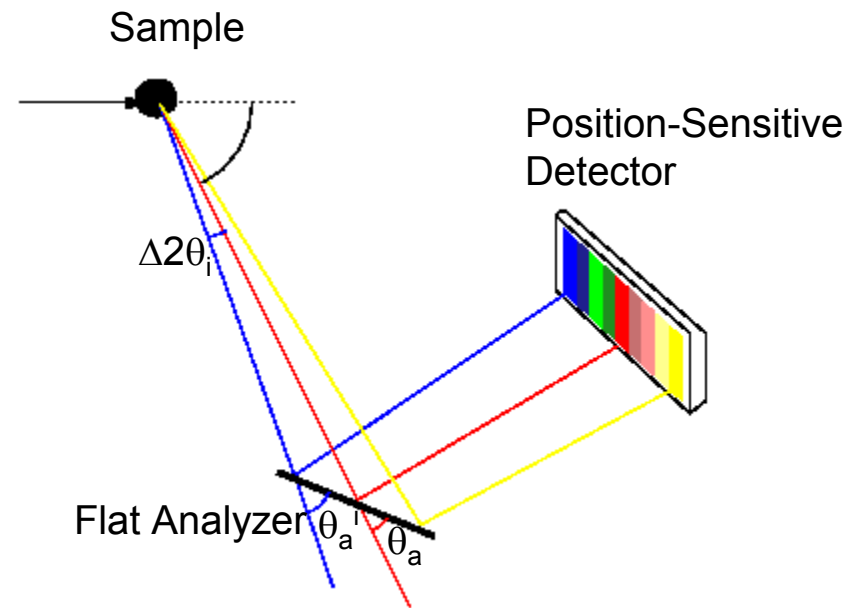
## Magnetic Phase Transition in ZnCr<sub>2</sub>O<sub>4</sub>



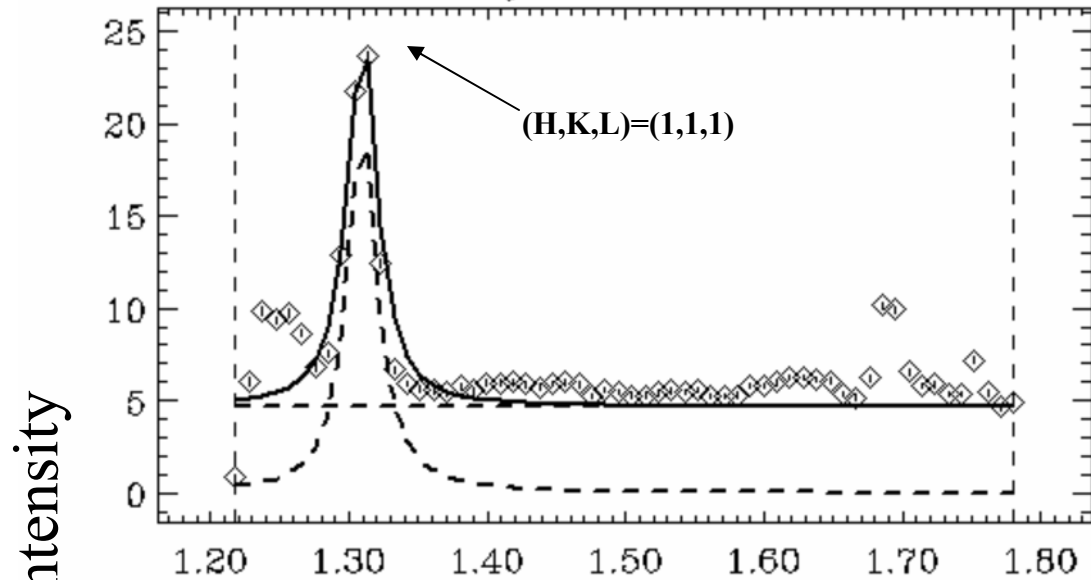
# SPINS



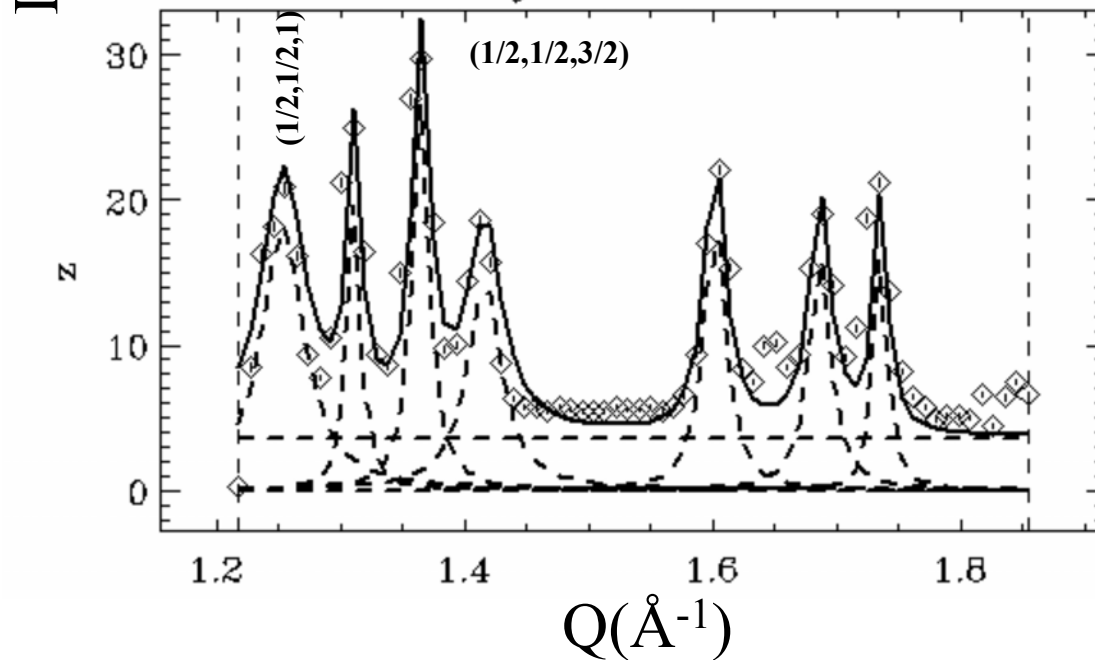
Increased data acquisition  
Rate over conventional TAS  
By an order of magnitude.



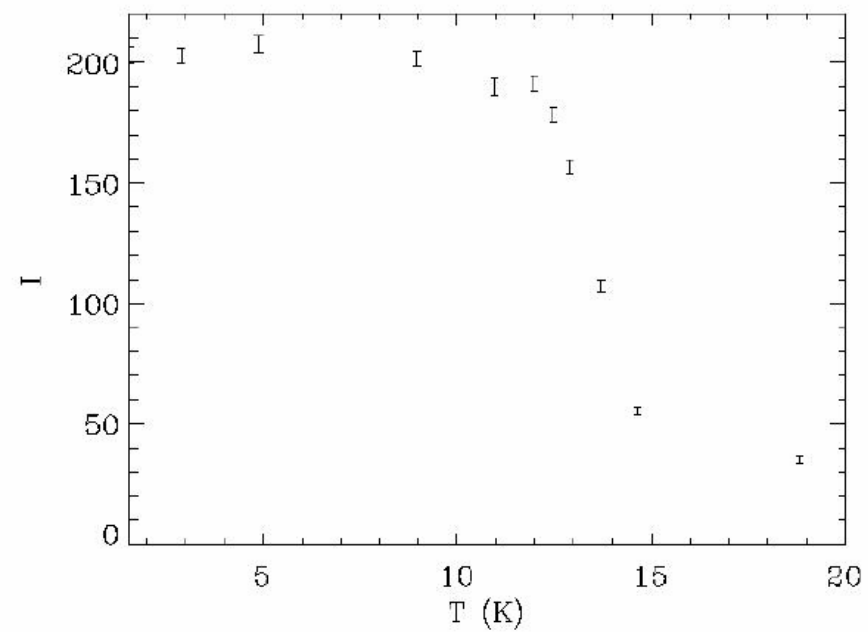
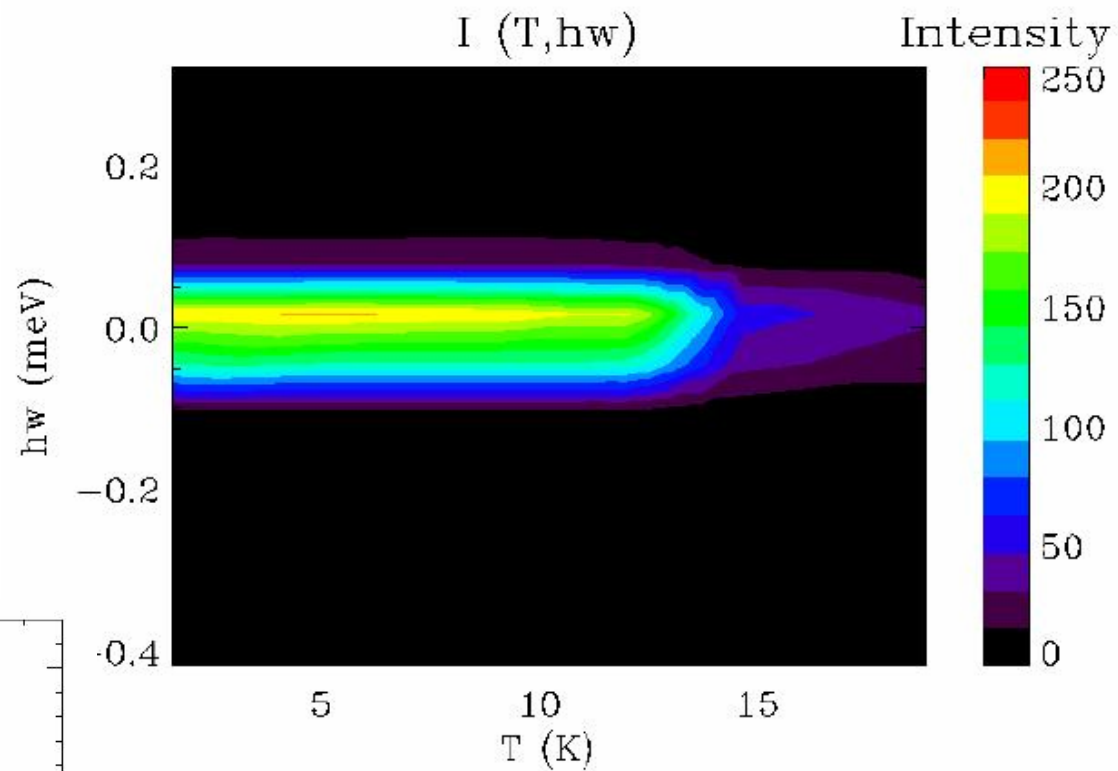
# Exploring Statics



- $Q$  resolution  $\sim 0.02 \text{ \AA}^{-1}$
- Doubling of the unit cell

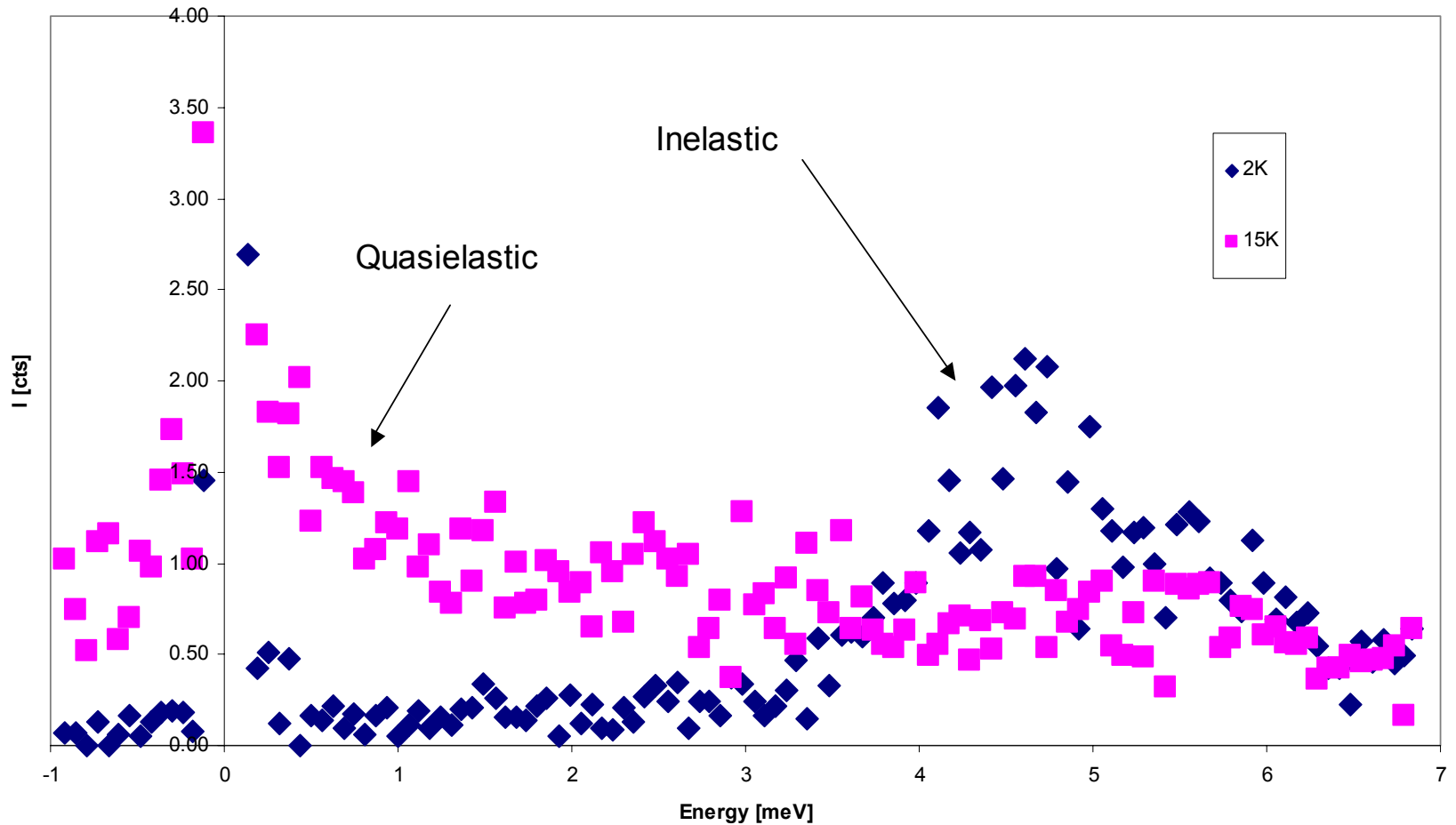


# Order Parameter

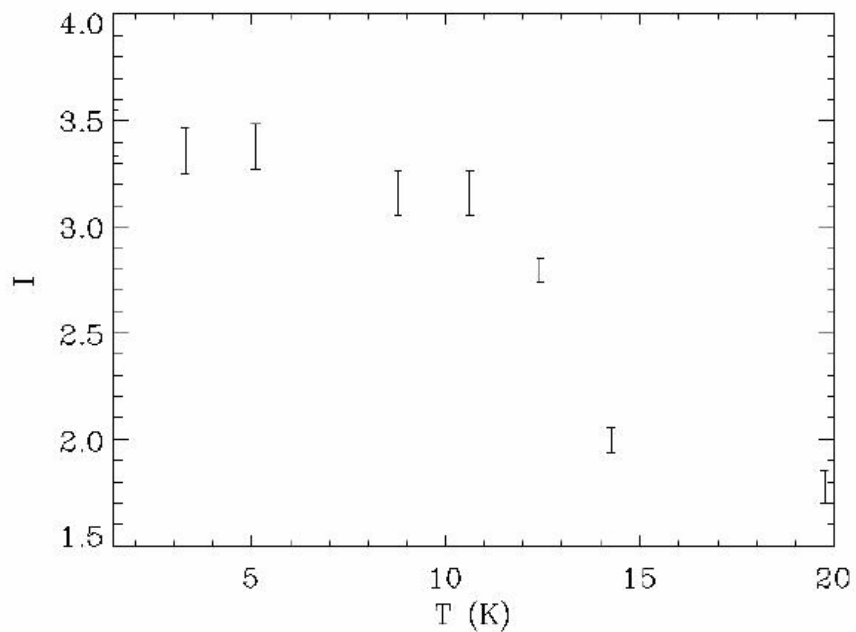
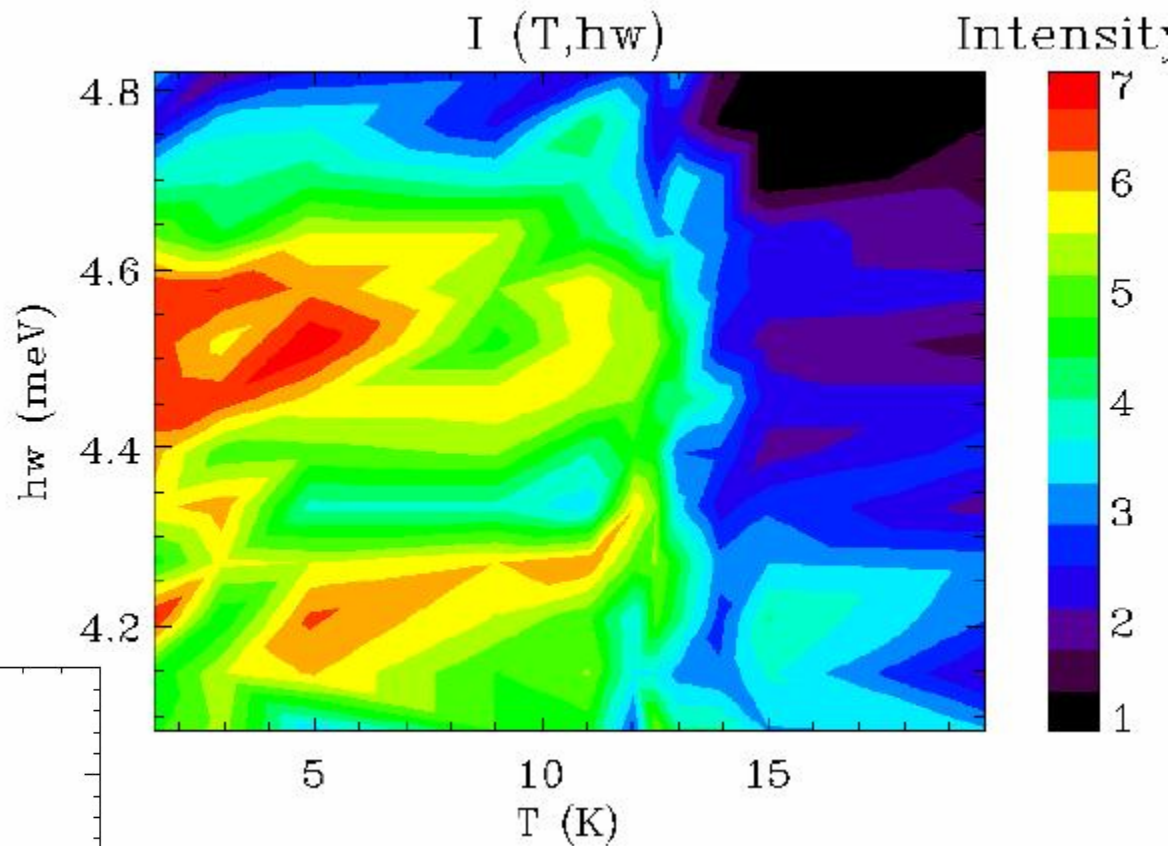


# Exploring Dynamics

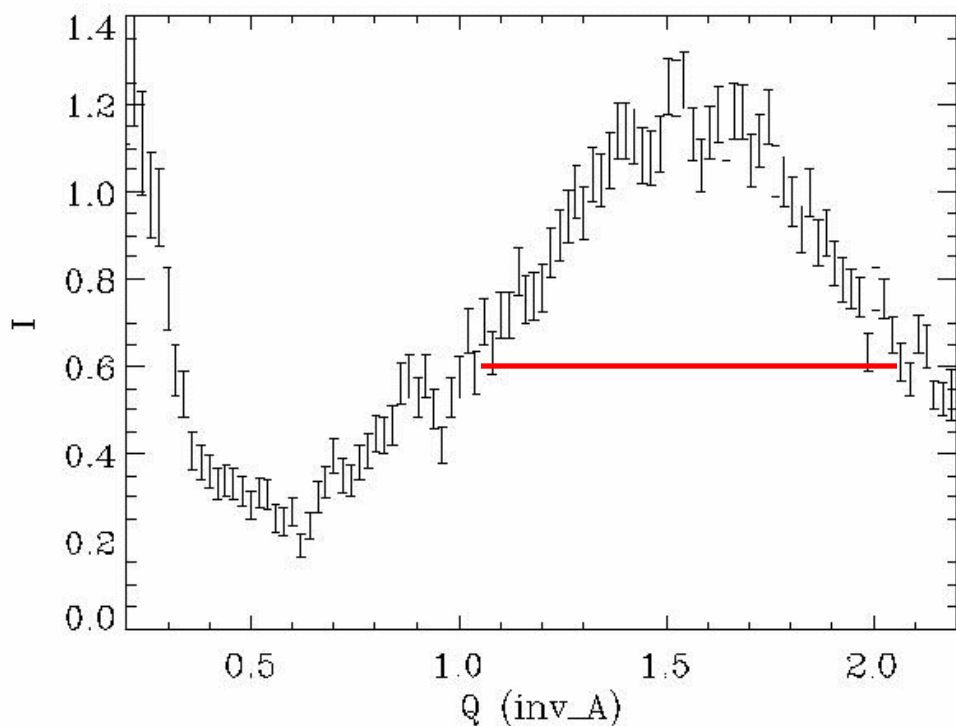
Energy scans at fixed Q at 2K and 15K



# Inelastic Resonance Peak

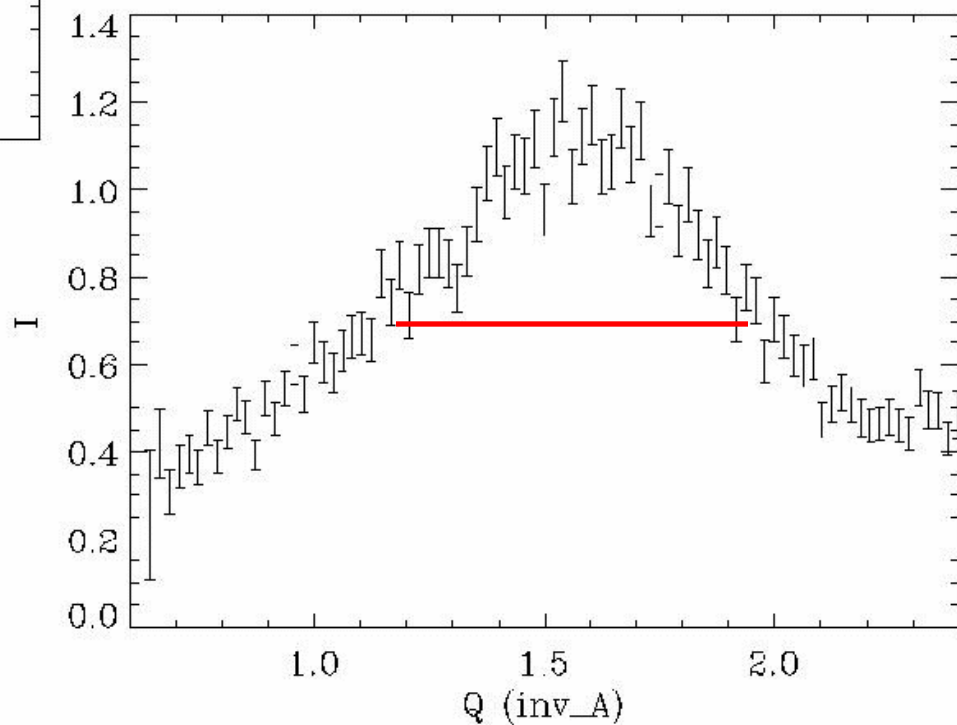


# $\xi$ -Correlation Length



$T=15\text{K} > T_N$   
 $0.6\text{meV} < E < 1.4\text{meV}$   
HWHM= $\kappa \sim 0.45\text{\AA}$   
 $\xi \sim 2.2\text{\AA}$

$T=1.5\text{K} < T_N$   
 $4.2\text{meV} < E < 1.4\text{meV}$   
HWHM= $\kappa \sim 0.36\text{\AA}$   
 $\xi \sim 2.8\text{\AA}$





# Summary

- SPINS probes both the static crystal and magnetic state of the system.
- SPINS probes the dynamic behavior of the system.
- SPINS is a relatively fast spectroscopy technique.
- SPINS is ideal for studying specific regions in  $Q$ - $\omega$  space.

Acknowledgements:

- NIST
- NSF
- NCNR