Neutron and **X-ray Scattering** of **Quantum Materials**

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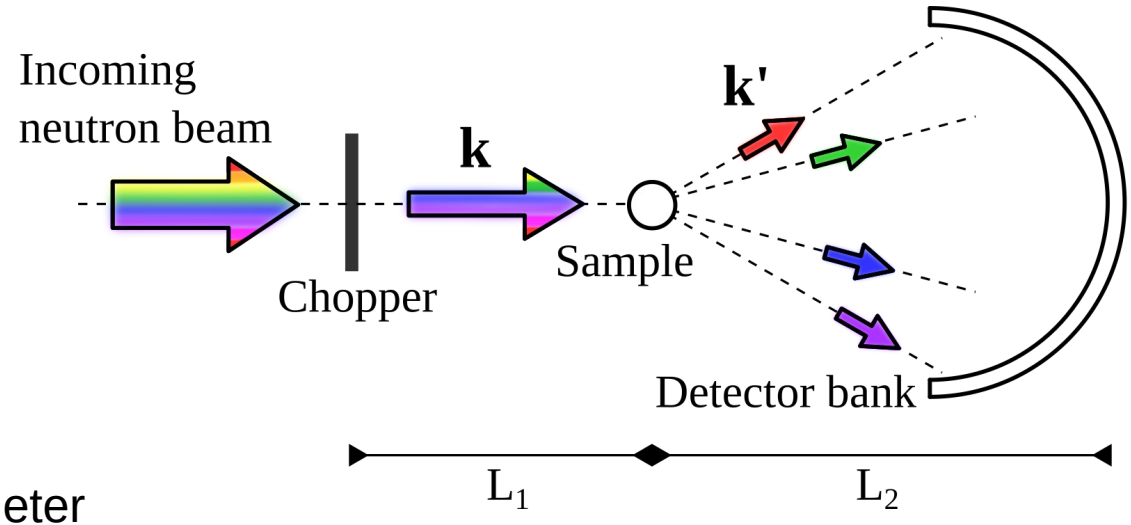
Outline for today

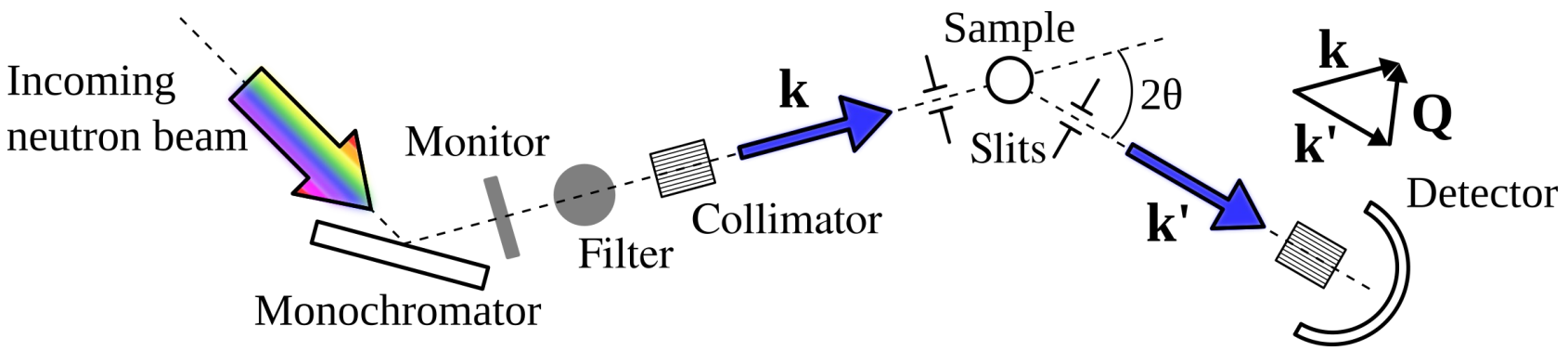
- Recap from last week (Chapters 5 and 19)
- Diffraction from magnetic structures in more detail
- (Polarised neutrons)

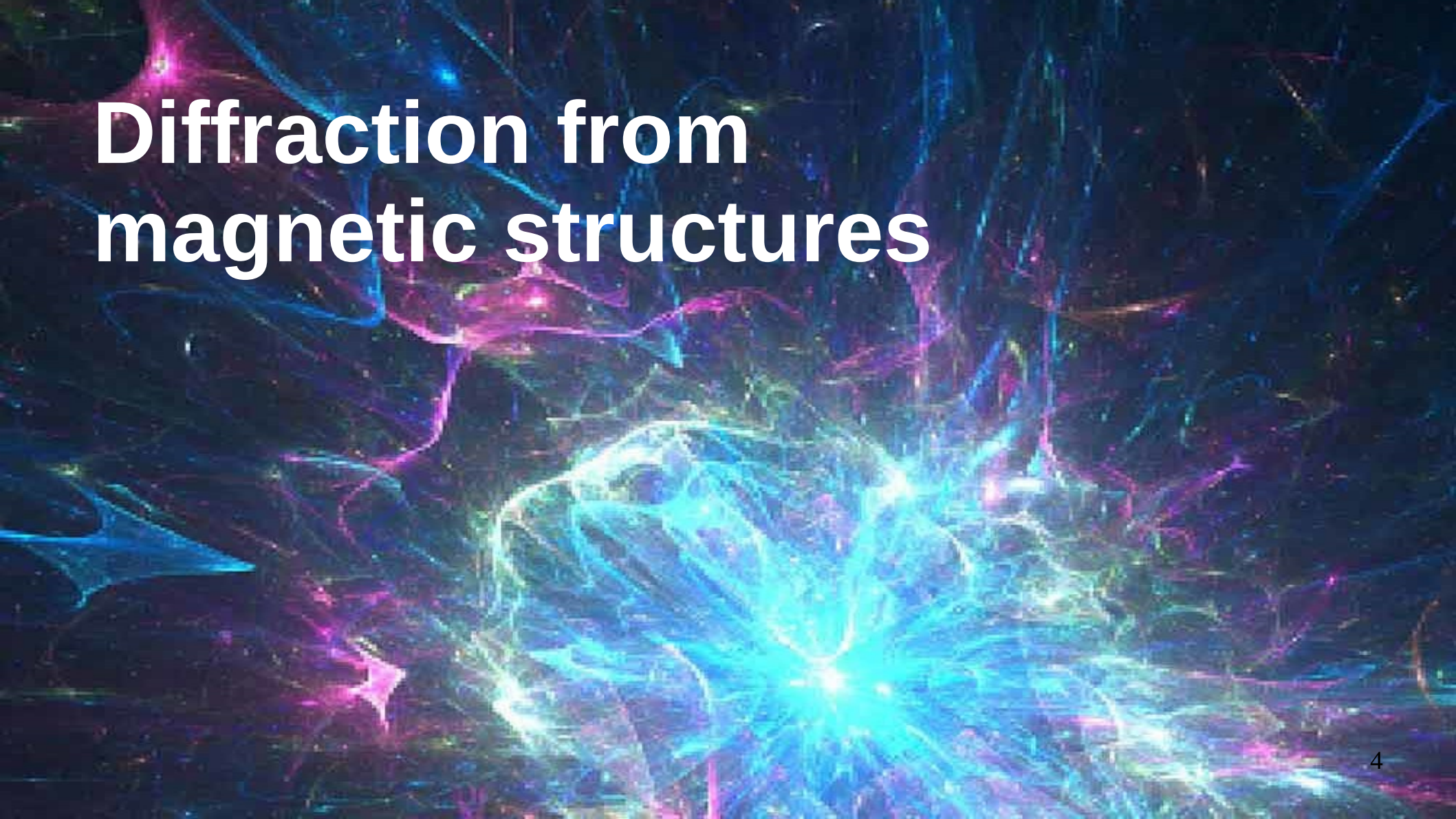
From last week: Neutron instrumentation

Time-of-flight diffractometer



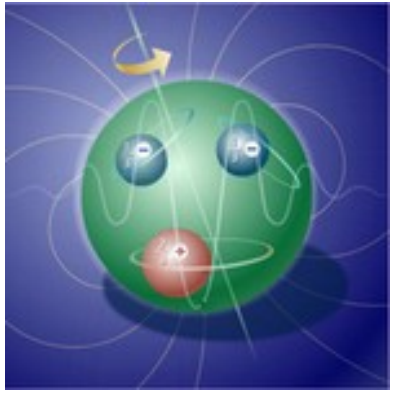
Two-axis diffractometer

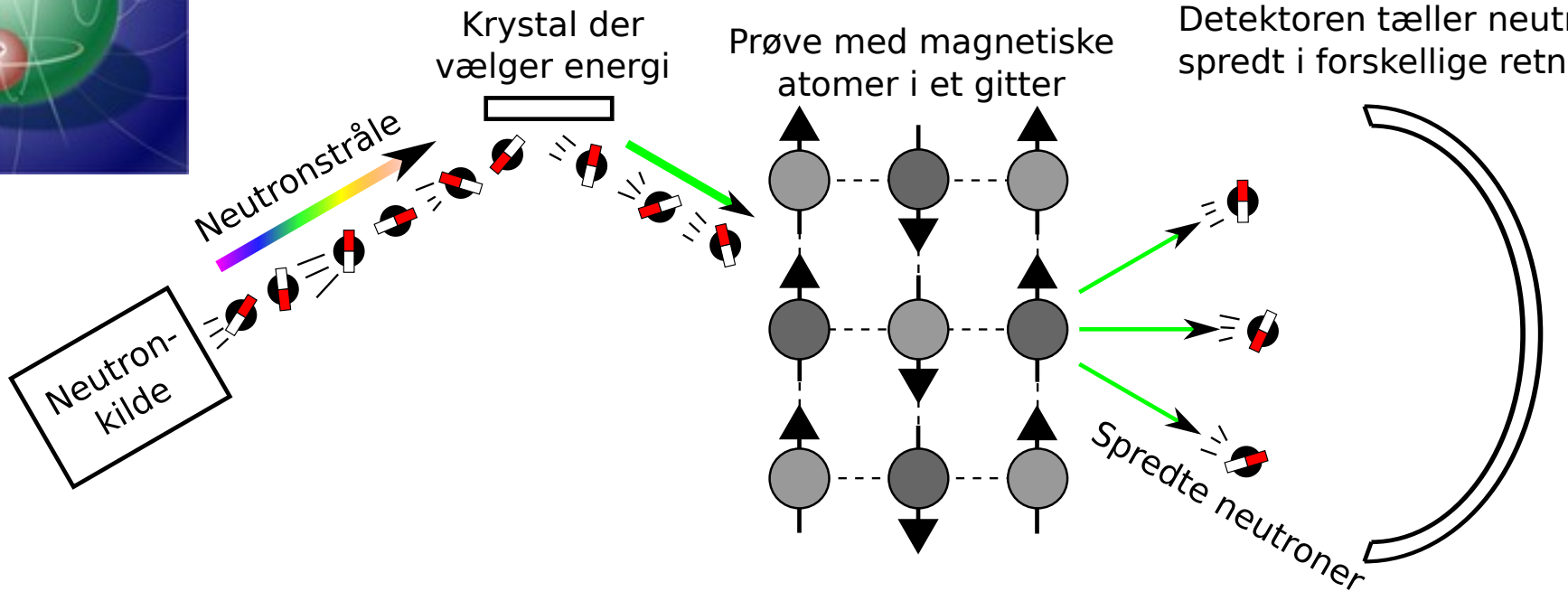




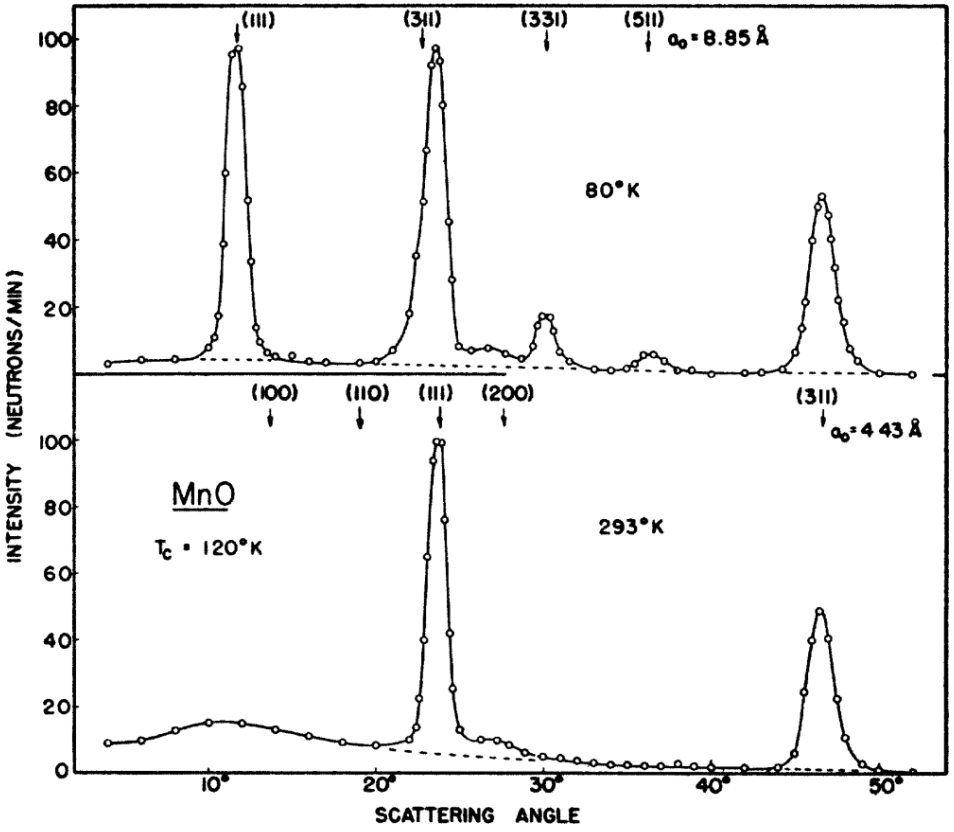
Diffraction from magnetic structures

The neutron magnetic dipole moment

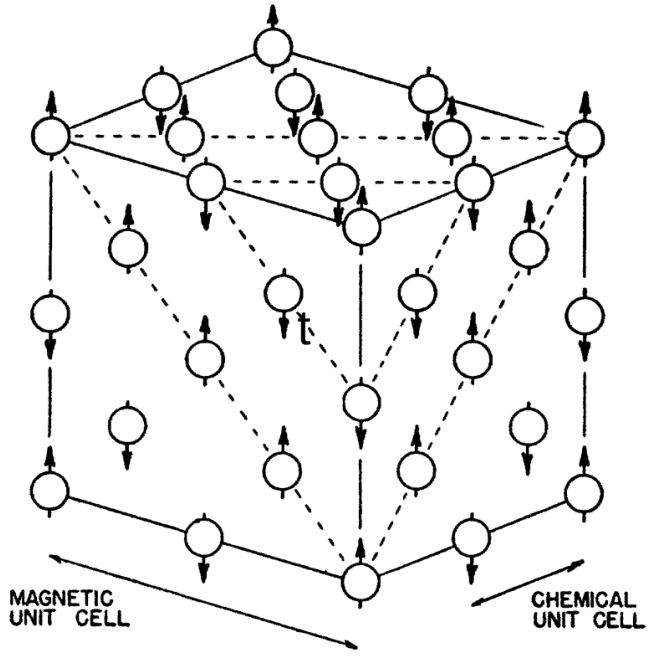




Discovery of the very first antiferromagnet



MnO, T_N = 120 K

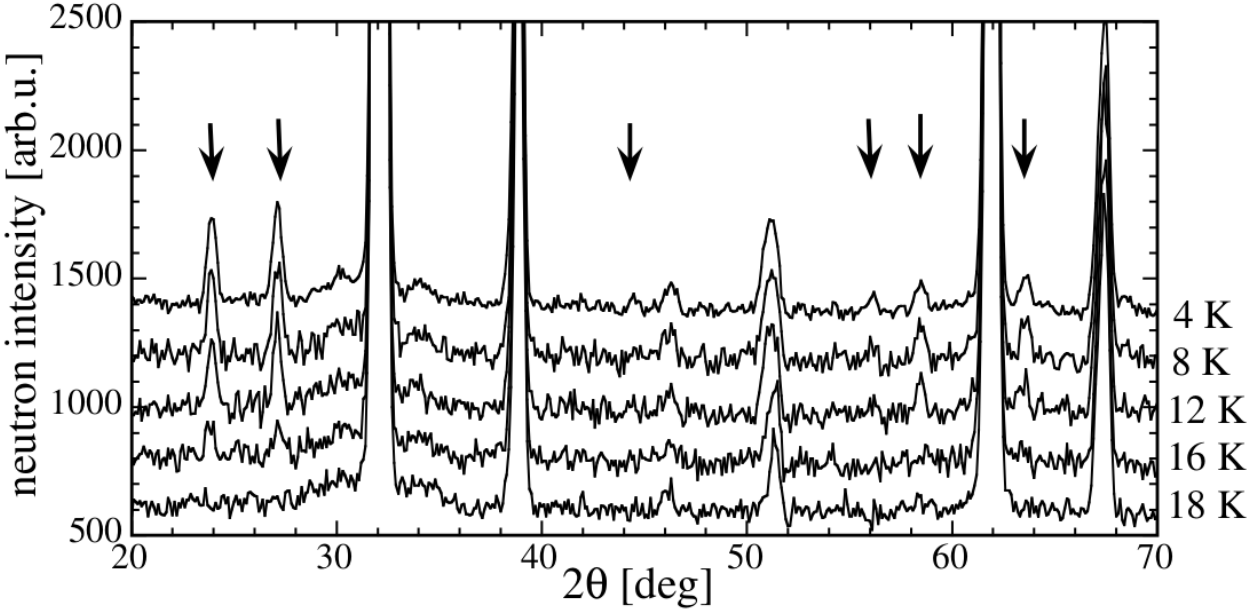


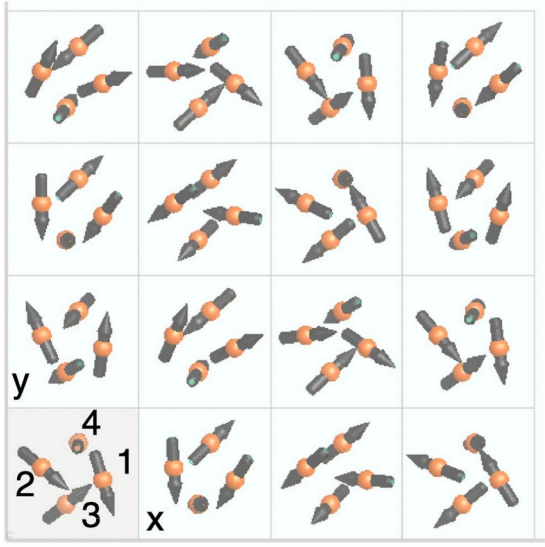
Shull, Strauser and Wollan, *Phys. Rev.* **83**, 333-345 (1951)

The world's most complicated magnetic structure

$Cu_2Te_2O_5X_2$ (X = Br, Cl)

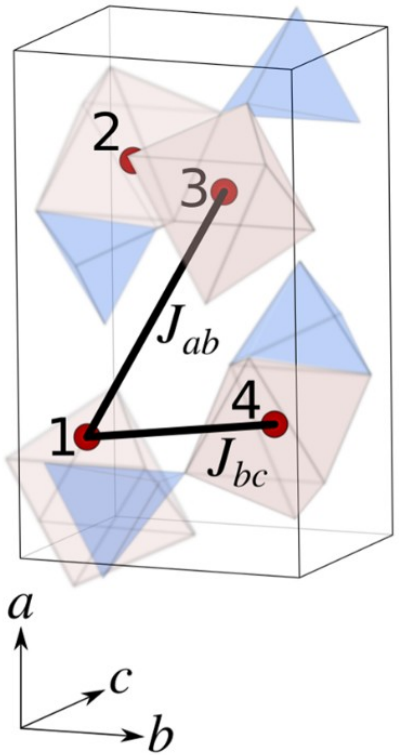
$\mathbf{Q}_{Br}$ = (0.158, 0.354, 0.5), T_N = 11 K
$\mathbf{Q}_{Cl}$ = (0.150, 0.422, 0.5), T_N = 18 K

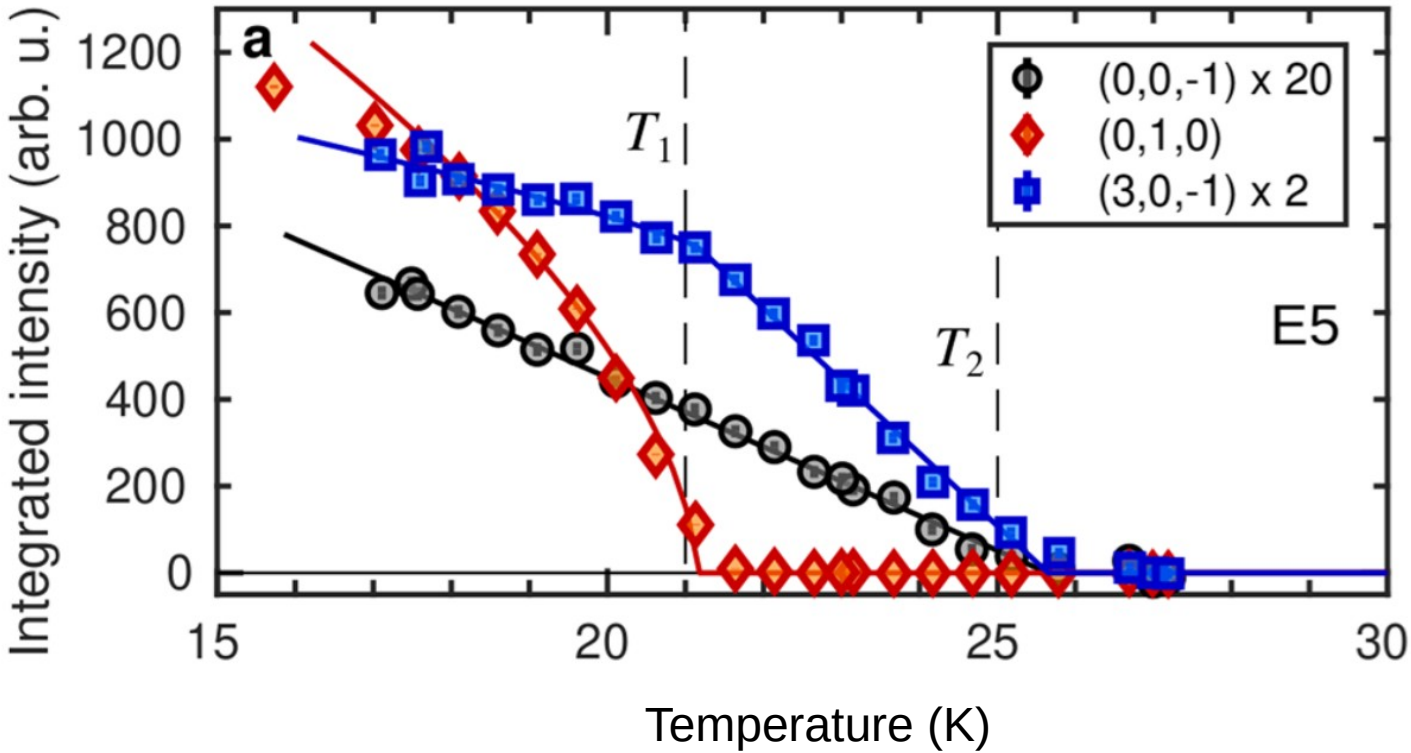




O. Zaharko *et al.*, *Phys. Rev. Lett.* **93**, 217206 (2004)

Unravelling the magnetic structure of $LiNi_{0.8}Fe_{0.2}PO_4$ with polarised neutrons





E. Fogh *et al.*, *Nature Comms.* **14**, 3408 (2023)

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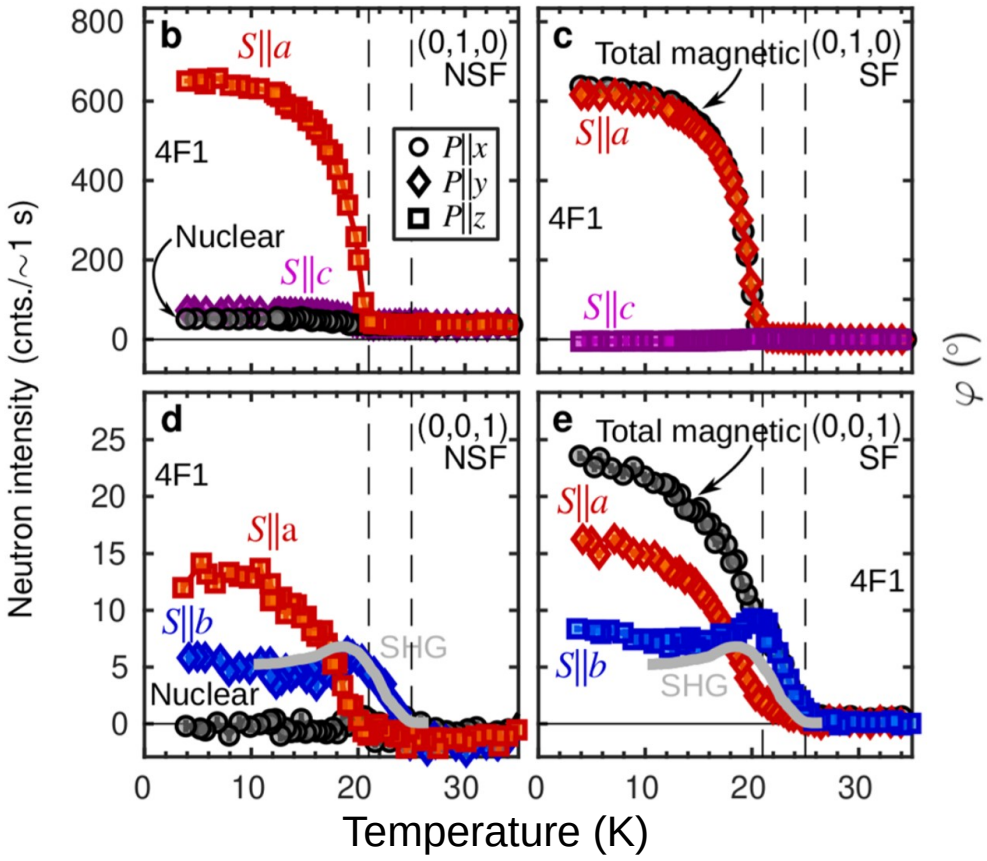

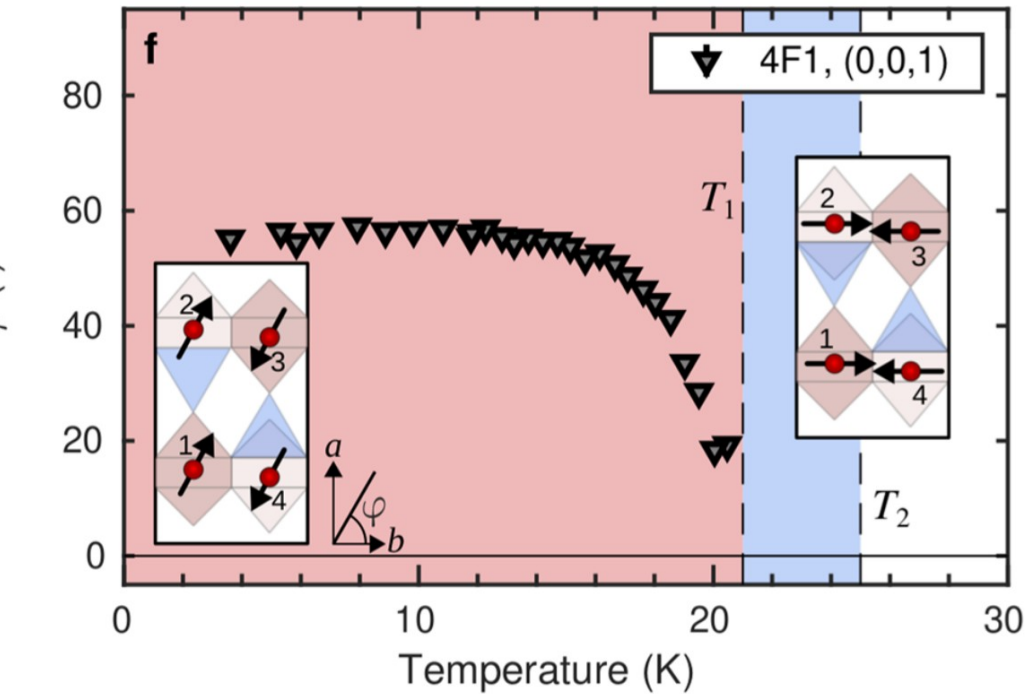

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