ABSTRACT
For PM-FM being the archetypal magnetic phase transition, when such transition is suppressed to zero temperature, however, FM QCP is found to be avoided. Without successful direct neutron scattering results, existence of a FM QCP in clean band metal, such as NbFe₂, still remains controversial. A neutron scattering simulation is build here, predicting expected experimental results for both ferro- and ferrimagnetic GS near quantum criticality of intermetallic compound NbFe₂.

INTRODUCTION
- Quantum Criticality
- 2nd order quantum phase transition \( T_C \rightarrow 0 \)
- Unstable Ferromagnetic Quantum Critical Point
- Non Fermi-liquid behaviour
- Unconventional superconductivity (c)

RESULTS
- 4 magnetic models for the ground state of NbFe₂
- Nb ions have small moments
- FM: spins on site Fe(2a) and Fe(6h) align in same direction
- FiM: spins on site Fe(2a) and Fe(6h) align antiparallelly
- Reported (102) peak: strong magnetic, weak nuclear reflection
- Normalised magnetic peaks by nuclear reflection background

NºFe₂
- C14 Laves Hexagonal
- Space group: P6₃/mmc
- 12 Unit cells
- \( Fe(2a), Fe(6h), Nb(4f) \)

MAGNETIC NEUTRON SCATTERING
- Nuclear/magnetic structure of crystal
- described by scattered Bragg peaks
- In reciprocal space \( Q = (hkl) \)
- Amplitude: structure factor \( F \)
- Test: AFM BCC
- Assumptions:
  - monatomic of \( Fe^{2+}[4] \)
  - \( m_{\text{corner}} = 1, m_{\text{centre}} = -1 \)
- Bound scattering length \( b_i \) is independent of \( Q \)
- Magnetic form factor \( f_i(Q) \) decays with \( Q \)

CONCLUSION
- Observable magnetic peak on \( Q = (102) \), agrees with experimental findings
- Magnetic scattering insignificant after \( 2\theta = 40^\circ \) for chosen wave-vector \( k_f = k_f = 1.5\AA^{-1} \)
- FM GS: strong magnetic peak at \( (100) \), weak nuclear reflection
- FiM GS: weak magnetic peak at \( (212) \), weak nuclear reflection
- \((102), (312)\): allowed peaks for both FM and FiM GS cases
- Observation on \( Q = (100) \) is key for classification of nature of GS of stoichiometric NbFe₂.