Experimental report

19/09/2016

Proposal: 5-41-839 **Council:** 4/2015

Title: The antiferromagnetic structure of FeSe single crystal under pressure

Research area: Physics

This proposal is a new proposal

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Samples: FeSe

Instrument	Requested days	Allocated days	From	To
D10	6	6	22/10/2015	28/10/2015

Abstract:

The magnetism of FeSe and its relation to superconductivity remain to be the main problems for iron based superconductivity. The microscopic model, magnetic ground state, nematicity, and pairing symmetry are among the main concerns. Very recently, experimental evidences indicate that antiferromagnetic transition occurs under pressure. This is important for the solution of the above concerned problems. Confirming the antiferromagnetic transition and determining the magnetic order by neutron scattering experiment are thus urgent. We propose to do neutron diffraction experiment on a high quality FeSe single crystal to illuminate its magnetism under pressure.

Experimental report of proposal 5-41-839

The antiferromagnetic structure of FeSe single crystal under pressure

FeSe superconductor being the simplest iron based superconductor has attracted intense research interest because it possesses the most unusual properties. It shows a structural transition at T~ 90 K but unlike the parent compound of iron pnictides, it does not order at low temperature. Recent transport and μSR measurements have suggested that FeSe exhibits an antiferromagnetic static under applied pressure [1-3]. Therefore, it is important to confirm the magnetic transition under pressure and determine the antiferromagnetic structure of FeSe.

One piece of single crystal with mass of 10 mg was loaded in the PE pressure cell with ab plane in the scattering plane. The measurements were done at 2 GPa.

We performed transverse and longitudinal scans through the possible magnetic wavevectors **Q** = (1 0 0) and (1 1 0) and equivalent wavevectors at 5 K to search for magnetic Bragg peaks but no clear signal was observed (Fig. 1). Then we repeated those scans at 50 K which is above the magnetic transition temperature determined from the transport measurement. However, no distinct difference was found. According to the μSR measurements, the magnetic moment in FeSe is ~0.2 μB at this pressure which might be too small to detect. It is also possible that the magnetic structure of FeSe is different from our predictions. Therefore, more investigation is needed to solve this issue.

Reference

[1] T. Terashima et al., arxiv 1502.03548

[2] M. Bendele et al., Phys. Rev. Lett. 104, 087003 (2010)

[3] M. Bendele et al., Phys. Rev. B 85, 064517 (2012)

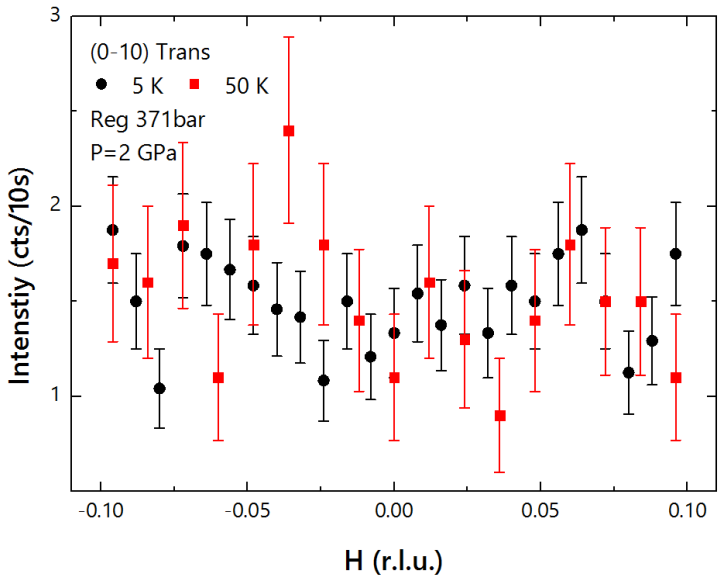

Fig 1. Transverse scan at Q = (0, -1, 0) at 5 and 50 K. No clear magnetic Bragg peak or intensity difference is observed.

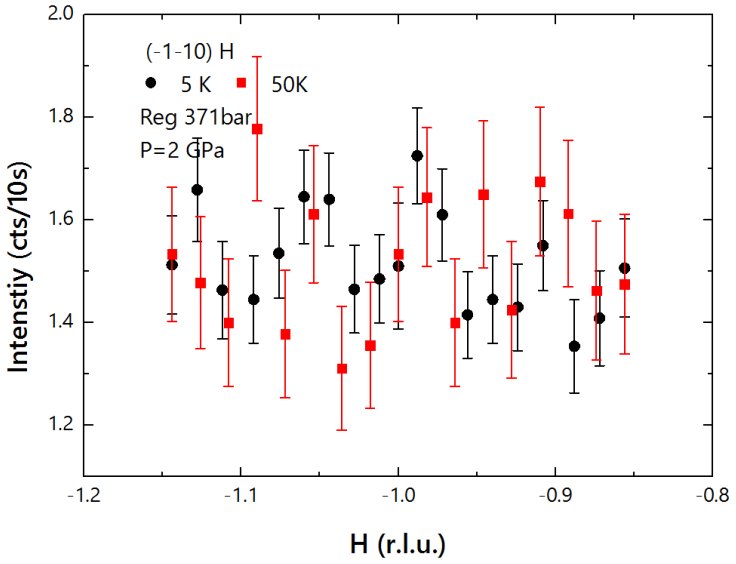

Fig 2. Transverse scan at Q = (-1, -1, 0) at 5 and 50 K.