

Experimental Report

26/02/2014

Proposal:	TEST-2310	Council:	10/2012	
Title:	Effect of a high magnetic field on the spin dynamics of ortho-II YBa ₂ Cu ₃ O _{6.5}			
This proposal is a new proposal				
Research Area:				
Main proposer: LOEW Toshinao				
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Local Contact: IVANOV Alexandre				
Samples: YBa ₂ Cu ₃ O _{6.5}				
Instrument	Req. Days	All. Days	From	To
IN8	5	5	25/07/2013	30/07/2013
Abstract:				

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Summary: With this experiment we investigated the magnetic field effect on the spin excitations for an array of fully detwinned and highly ordered ortho-II phase $\text{YBa}_2\text{Cu}_3\text{O}_{6.55}$ crystals ($T_c=61\text{K}$, $p=0.11$) on IN8, after an earlier unsuccessful experiment on IN14 [1]. We could observe a suppression of the resonance mode at $E=34\text{meV}$ with applied magnetic field consistent with [2]. However, we could not yet clarify the field effect on the low energy spin excitations present in this sample, which are gapped below T_c .

Sample and setup: Our sample is a mosaic of about 100 detwinned $\text{YBa}_2\text{Cu}_3\text{O}_{6.55}$ single crystals coaligned on a silicon plate (total mass of the crystals: 2.5g). We used IN8 equipped with a 10T vertical field magnet. Measurements were performed with focusing PG(002) monochromator and analyzer with fixed final wave vector $k_f=2.662\text{\AA}^{-1}$.

Report: The $\text{YBa}_2\text{Cu}_3\text{O}_{6.55}$ sample was aligned in the $(H, K, 3K)$ scattering plane. Both energy and H -scans were performed through the antiferromagnetic wave vector $(1.5, 0.5, 1.5)$. The scattering plane used here implies a tilt of the ab -plane of our sample by 45 degrees around the crystallographic a -axis, which results in a field of 7T parallel to the c -axis. As our sample is superconducting with $T_c=61\text{K}$, we heated above T_c when changing the magnetic field. Besides the suppression of the resonance mode, we could resolve a small gain in intensity around 39meV in applied field.

References

- [1] T. Loew *et al.*, ILL experimental report 4-01-1185.
- [2] P. Dai *et al.*, *Nature* **406**, 965 (2000).

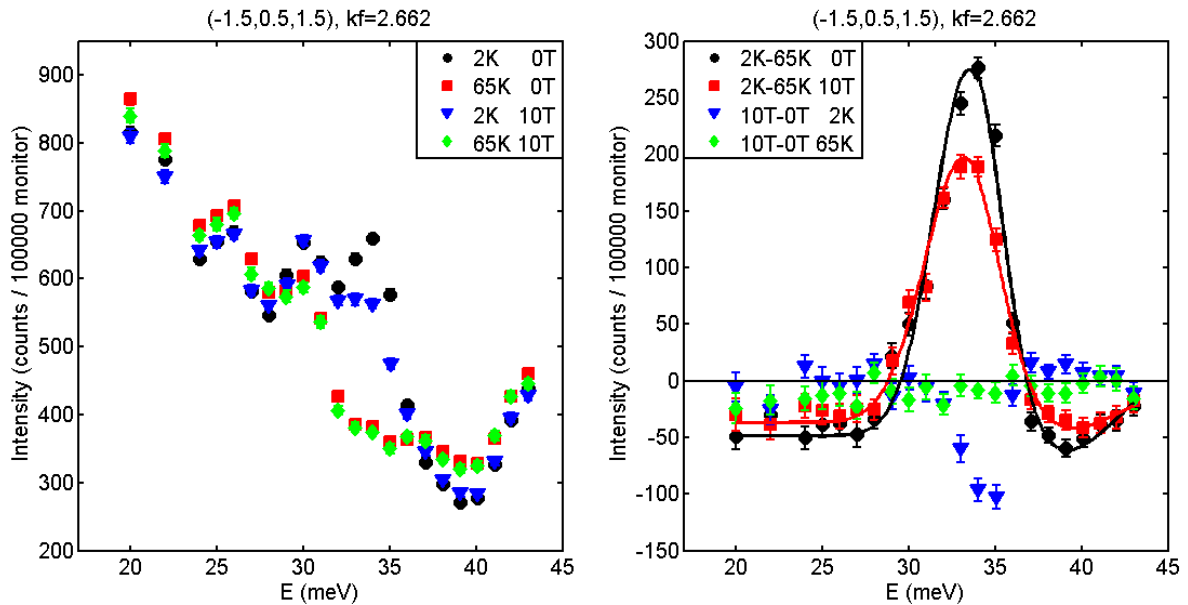


Figure 1 First magnetic field effect data on our $\text{YBa}_2\text{Cu}_3\text{O}_{6.55}$ ($T_c=61\text{K}$, $p=0.11$) sample. Effect of an applied field $B=10\text{T}$ on the resonance mode which is centered at 34meV and $Q=(-1.5, 0.5, 1.5)$. Left: raw data for $T=2\text{K}$ and $T=65\text{K}$ (above T_c) with and without applied magnetic field. Right: temperature and field differences of the scans.