Experimental report

16/09/2019

Proposal: 4-02-546 **Council:** 10/2018

Title: Study of the normal state magneticfluctuations in LSCO superconductor under applied magnetic field

Research area: Physics

This proposal is a continuation of 4-02-526

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Samples: La_1.95 Sr_0.05 Cu O_4
La_1.93 Sr_0.07 Cu O_4

Instrument	Requested days	Allocated days	From	To
THALES	4	4	13/06/2019	17/06/2019
IN8	4	0		

Abstract:

The promoter of this proposed experiment is the result of our recent neutron scattering experiment which shows a change in behavior of the magnetic signal across the transition from an insulator to a superconductor in LSCO. Our superconducting sample displayed a spectral weight shift, upon application of a magnetic field, of low energy fluctuations to even lower energies, picked up in the elastic channel. Interestingly enough, we observed a similar field suppression of the low energy fluctuations in a non-superconducting sample. However the lost spectral weight was not recovered in the elastic signal. We propose a search for a field enhancement of the signal in the high energy regime for our non-superconducting sample at IN8. At the same time we would like to study the temperature driven normal state of our superconducting sample at Thales in order to better understand the role of magnetic fluctuation in the emergence of superconductivity.

A study of elastic and dynamic stripes in non-superconducting LSCO with x = 0.07, at Thales

Ana-Elena Țuțueanu, Tim Tejsner, Astrid Roemer, Martin Böhm, Paul Steffens, Kim Lefmann

The purpose of the experiment was to study the normal non-superconducting region of the phase diagram by driving a x = 0.07 superconducting LSCO sample outside the superconducting dome, by increasing temperature above T_c, and investigating the effect of an applied magnetic field on the low energy fluctuations.

Results

The inelastic measurement performed at 40 K (outside the superconducting dome) showed no magnetic field effect. This supports the scenario of vortex induced slowing down on magnetic fluctuations in superconducting LSCO.

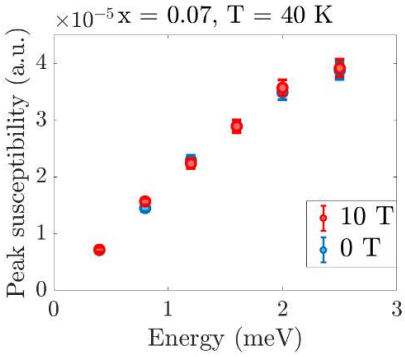

Fig. 1 Magnetic field effect on spin fluctuations outside the superconducting dome.

We have also studied the temperature dependence of the magnetic field effect and were able to correlate the spectral weight shift from the inelastic suppression to the elastic signal enhancement to the emergence of superconductivity (around the superconducting critical temperature).

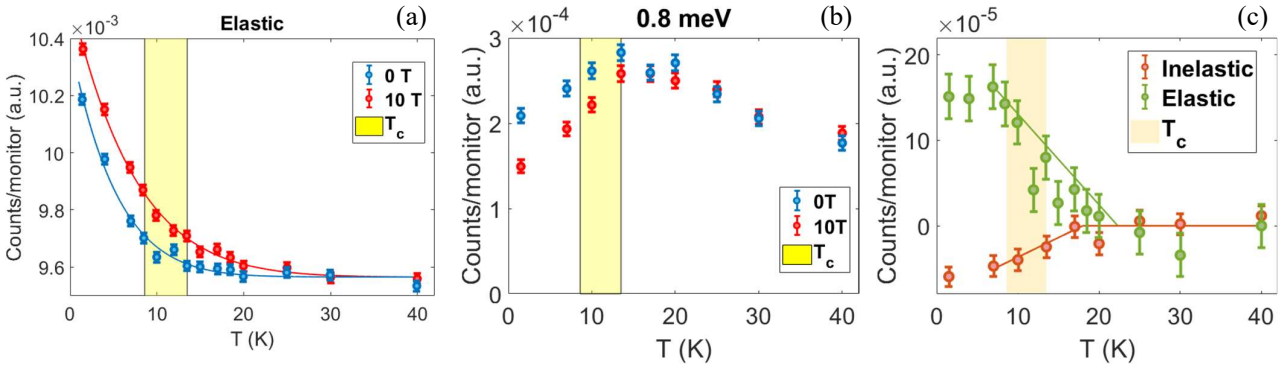

Fig. 2 Magnetic field effect on (a) static and (b) dynamic spin stripes as a function of temperature. (c) Temperature dependence of the magnetic field effect (between 0 T and 10 T) in both the elastic and inelastic channels as shown in sub-figures (a) and (b).