



Experiment title:
Low-q study of transverse acoustic modes in copper-oxide superconductors

Experiment number:
HS-2445

Beamline:
ID28

Date of experiment:
from: 31 March 2004 to: 06 April 2004

Date of report:
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Shifts:
18

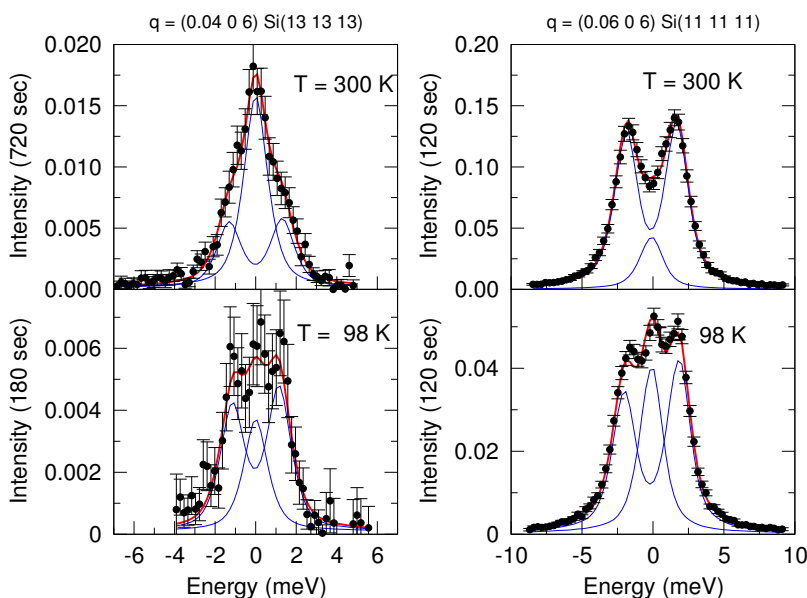
Local contact(s):
Dr. Alexei BOSSAK

Received at ESRF:

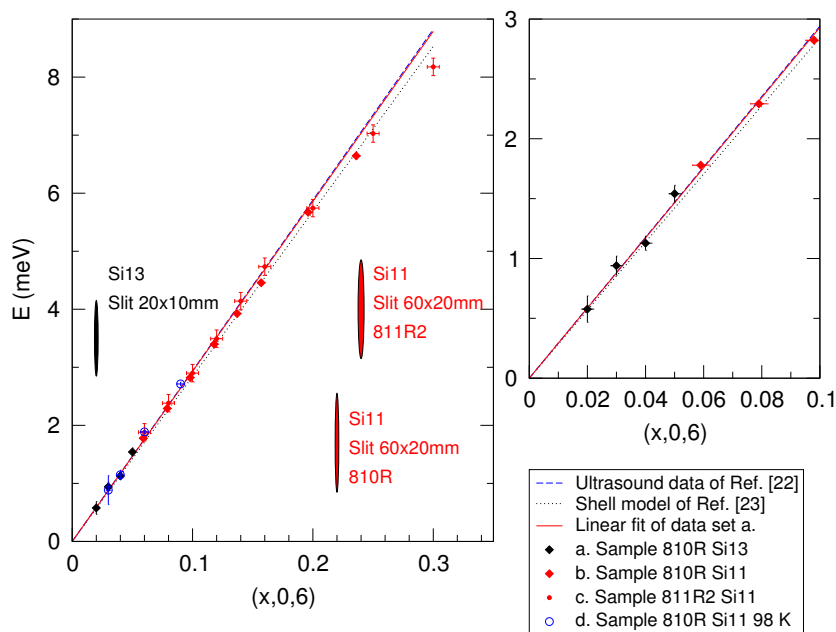
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Report:

High-resolution ($\Delta E=1.3$ meV) inelastic X-ray scattering (IXS) in optimally doped untwinned $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ single crystals show that the dispersion of transverse acoustic phonons in the a -direction remains linear with no softening due to bending modes in the long wavelength limit, down to $q=0.02$. The sound velocity is found to be 2700 ± 70 m s $^{-1}$, in excellent agreement with ultrasound measurements, and unchanged upon cooling from room temperature to 98 K. These results rule out a strong coupling between bending dynamics of the CuO_2 planes and charge carriers in cuprates.



Comparison between the TA phonon peaks at 300 and 98 K measured using the Si (11 11 11) and (13 13 13) reflections. Solid lines are a fit of the data as described in Ref. 1.



Dispersion relation of the in-plane TA phonon at room temperature and 98 K for the two $YBa_2Cu_3O_{7-\delta}$ crystals labelled as 810R and 811R. The right panel shows in detail the very low q data for the former. Vertical lines indicate the energy and momentum resolutions that depend upon the Si (11 11 11) or (13 13 13) reflection used, slit openings and crystal mosaicity (See Ref. 1).

References

- [1] Andrea Gauzzi, Matteo D'Astuto, Francesca Licci, Alexei Bossak, Michael Krisch *preprint cond-mat/0411120* (2003).