EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

ESRF

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office via the User Portal:
https://wwws.esrf.fr/misapps/SMISWebClient/protected/welcome.do

Deadlines for submission of Experimental Reports

Experimental reports must be submitted within the period of 3 months after the end of the experiment.

Experiment Report supporting a new proposal ("relevant report")

If you are submitting a proposal for a new project, or to continue a project for which you have previously been allocated beam time, you must submit a report on each of your previous measurement(s):

- even on those carried out close to the proposal submission deadline (it can be a *"preliminary report")*,
- even for experiments whose scientific area is different form the scientific area of the new proposal,
- carried out on CRG beamlines.

You must then register the report(s) as "relevant report(s)" in the new application form for beam time.

Deadlines for submitting a report supporting a new proposal

- 1st March Proposal Round - **5th March**
- 10th September Proposal Round - **13th September**

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report in English.
- include the experiment number to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.

ESRF	**Experiment title:** Study of dynamic charge-density-wave correlations in HgBa2CuO4+d	**Experiment number**: HC-4395
Beamline: ID32	**Date of experiment**: from: 17 Nov 2021 to: 23 Nov 2021	**Date of report**: 1 Mar 2022
Shifts: 18	**Local contact(s)**: Flora Yakhou-Harris	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Zachary Anderson, University of Minnesota School of Physics and Astronomy *

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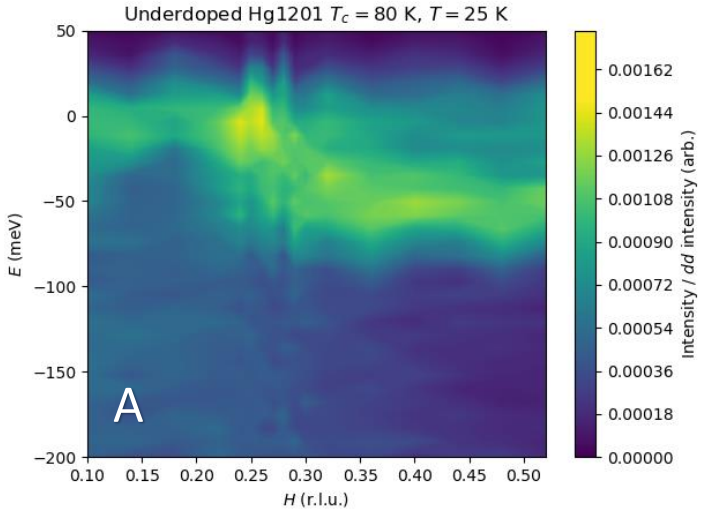
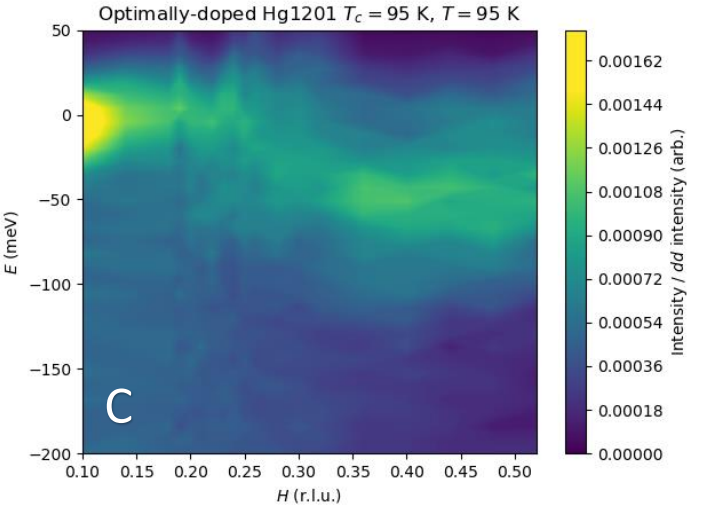
Report:

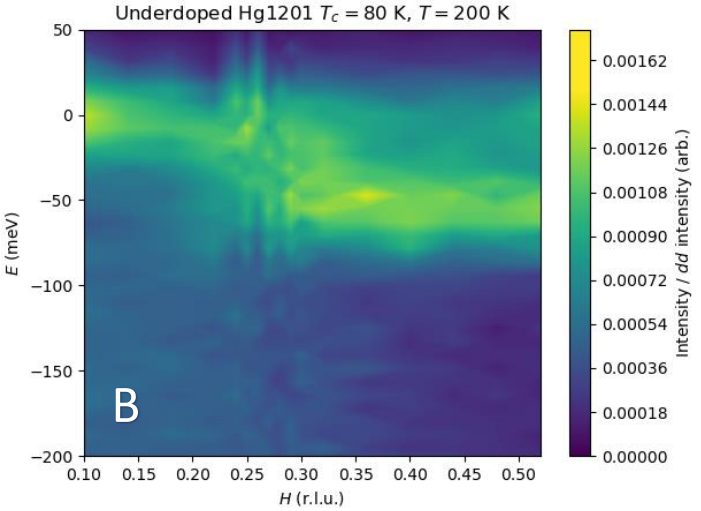
This experiment was a follow up to HC-3030, in which we also used ID32 to measure charge-density-wave correlations in $HgBa_2CuO_{4+\delta}$ (Hg1201). In that previous experiment, dynamic CDW correlations were observed above the doping dependent CDW short-range-ordering temperature T_{CDW} [1]. Our follow-up experiment extended that work to additional temperatures, and to additional samples at other oxygen doping levels, namely a lightly-underdoped sample with superconducting T_c = 80 K and $T_{CDW} \approx$ 150 K, and an optimally-doped sample with superconducting T_c = 95 K and no static CDW order. RIXS measurements were performed in dependence on temperature and momentum transfer on both samples using a σ-polarized scattering geometry. We observed the expected static short-range CDW order below T_{CDW} in the lightly-underdoped sample (Fig. A), as well as a dynamic mode that potentially emanates from q_{CDW} and disperses toward the Brillioun zone boundary at ~ 50 meV. This mode was actually visible in our data from HC-3030, however, the improved quality of the new data reveals it more clearly. This mode is also visible in the absence of static correlations, above T_{CDW} (Fig. B). Notably, it is also observed in the optimally-doped sample which does not display static CDW order, both at low and high temperatures (Figs. C, D). A detailed analysis of these data is still ongoing.

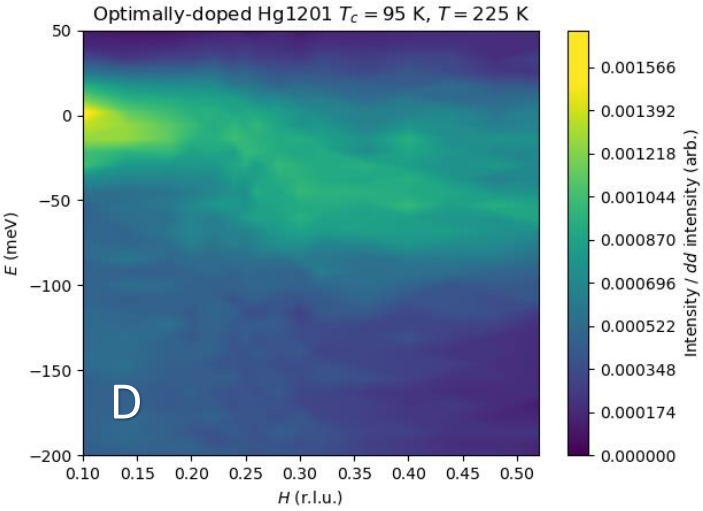
References:

[1] B.Yu *et al.*, Phys. Rev. X **10** 2 (2020)


Underdoped Hg1201 $T_c = 80$ K, $T = 25$ K
A
E (meV)
H (r.l.u.)
Intensity / dd intensity (arb.)


Optimally-doped Hg1201 $T_c = 95$ K, $T = 95$ K
C
E (meV)
H (r.l.u.)
Intensity / dd intensity (arb.)


Underdoped Hg1201 $T_c = 80$ K, $T = 200$ K
B
E (meV)
H (r.l.u.)
Intensity / dd intensity (arb.)


Optimally-doped Hg1201 $T_c = 95$ K, $T = 225$ K
D
E (meV)
H (r.l.u.)
Intensity / dd intensity (arb.)