Recent progress and development plans of SACLA BL1

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on behalf of SACLA

Contents of this Breakout session

“Advanced science by frontier spectroscopies with soft X-ray FEL”

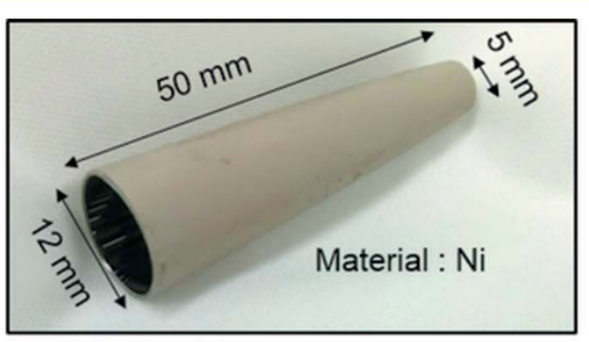
Recent achievements at SACLA BL1

1. “Development of soft X-ray FEL focusing system using a Wolter mirror”
   Dr. H. Motoyama (Univ. Tokyo)
2. “Some examples of soft X-ray second harmonic generation”
   Dr. C. Schwartz (UC Berkeley)
3. “Development of time-resolved soft X-ray absorption spectroscopy for liquid sample”
   Dr. H. Iwayama (IMS)
4. “Observation and application of ultrafast magnetism”
   Prof. A. Tsukamoto (Nihon Univ.)

Round table discussion

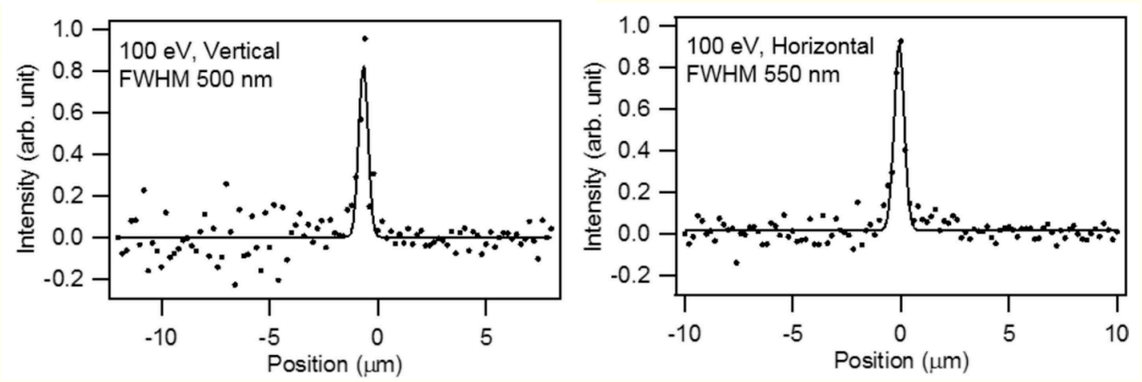
Research Highlights at SACLA BL1

New focusing system and its application

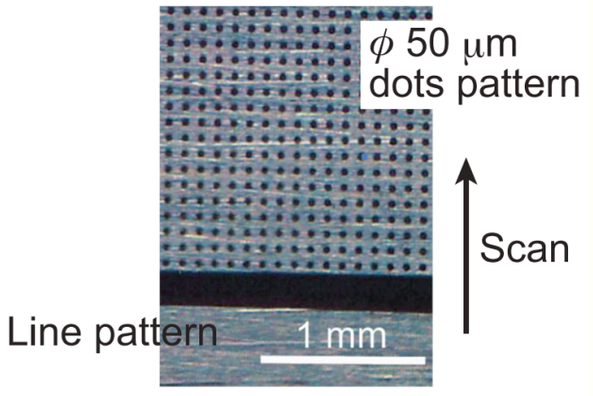


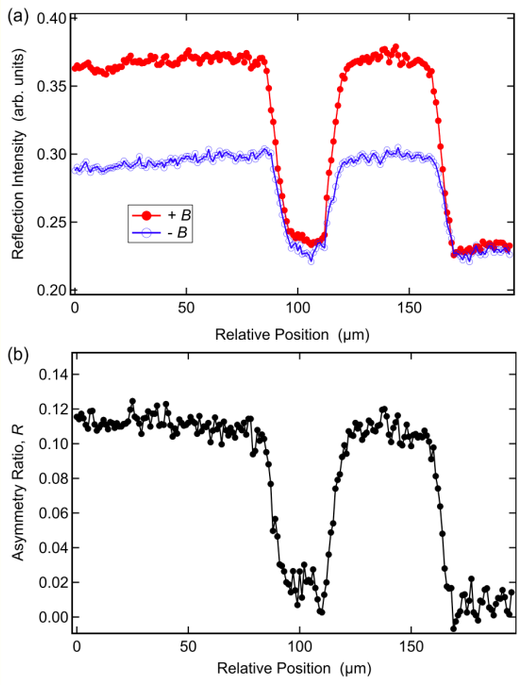
presented by Dr. Motoyama

H. Motoyama *et al.*, JSR **26**, 1406 (2019)
Y. Kubota *et al.*, APL **117**, 042405 (2020)

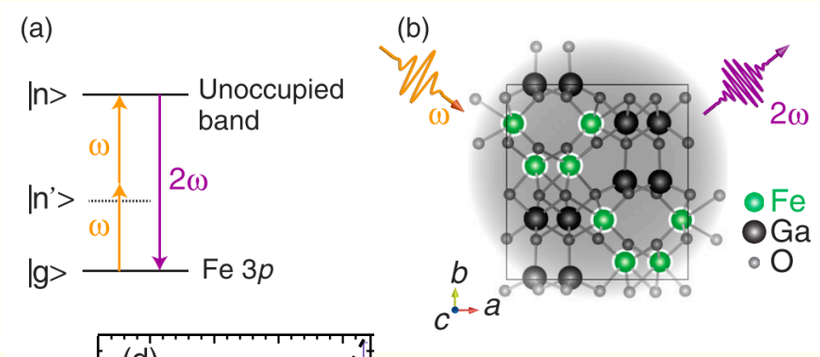


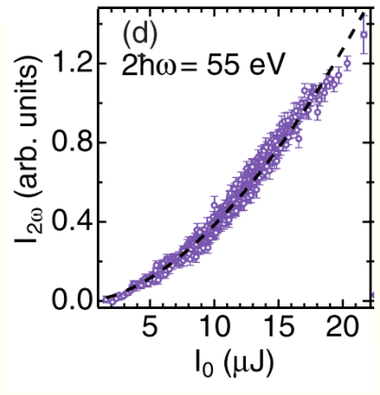
Scanning MOKE
for Fe film





Nonlinear optics in soft X-ray range



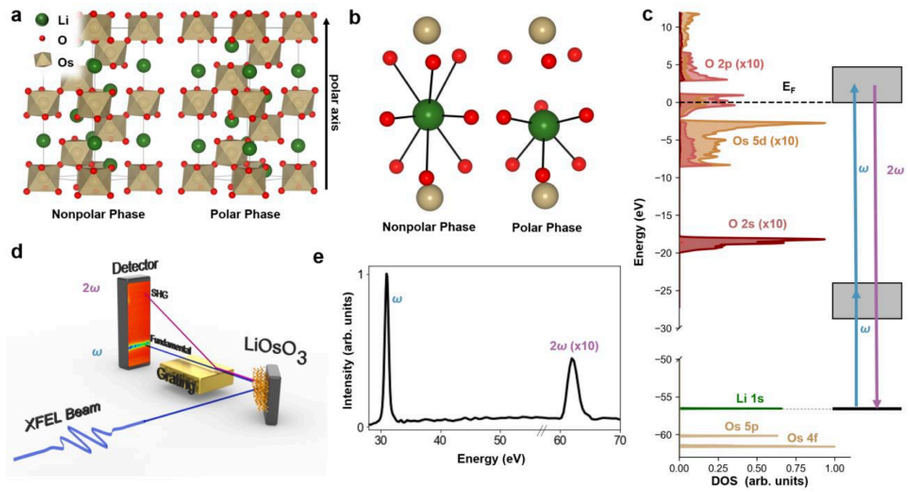


Resonant SHG in $GaFeO_3$

Sh. Yamamoto *et al.*, PRL **120**, 223902 (2018)

Resonant SHG in $LiOsO_3$

E. Berger *et al.*, arXiv:2010.03134



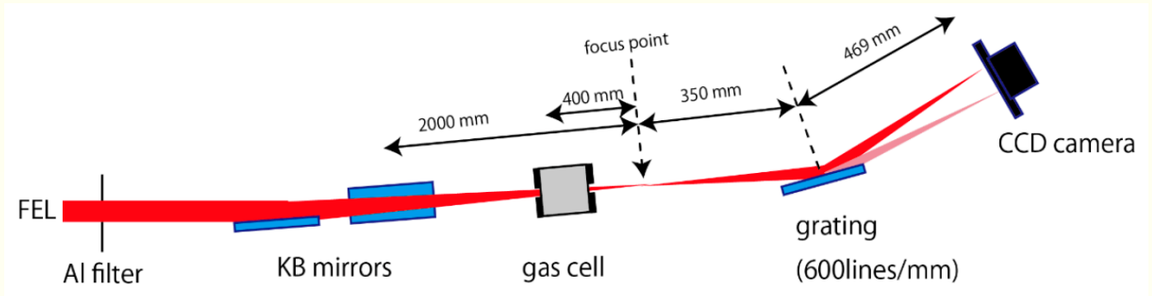
presented by Dr. Schwartz

Research Highlights at SACLA BL1

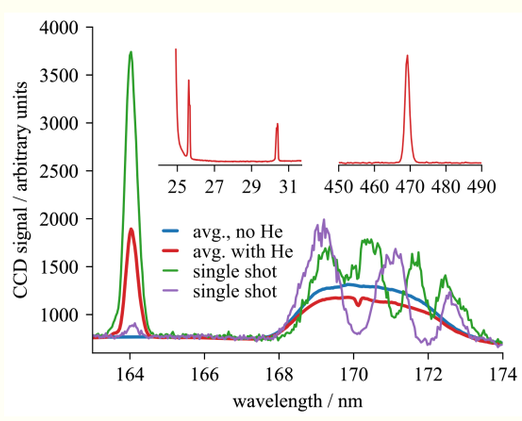
Spectroscopy with SXFEL

J. R. Harries *et al*., PRL **121**, 263201 (2018)
H. Iwayama *et al*., Apps. Sci. **10**, 7852 (2020)

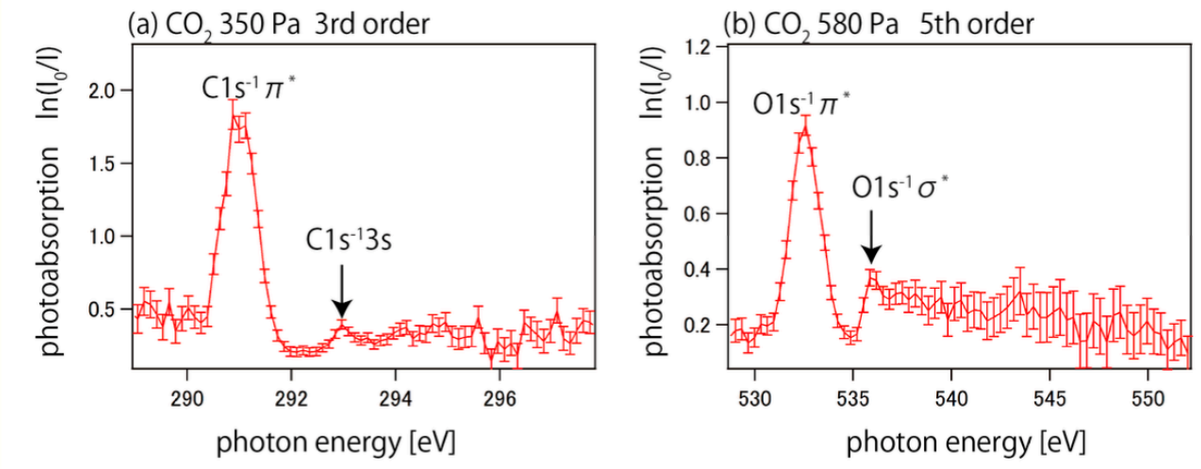
presented by Dr. Iwayama



Superfluorescence from He

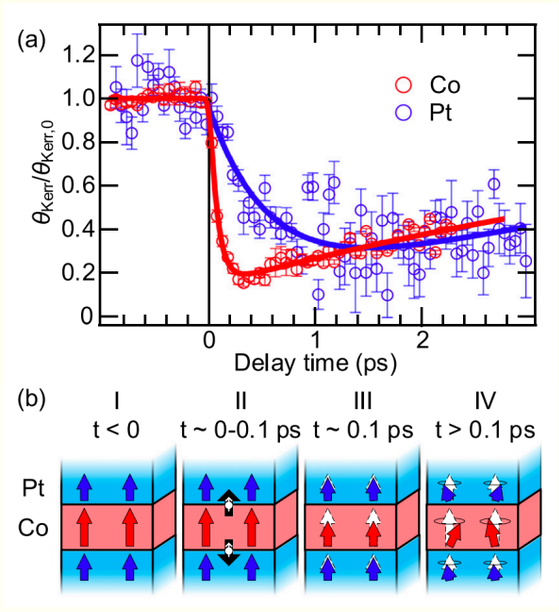


NEXAFS spectra of CO_2
with 3rd and 5th order harmonics



Magnetic dynamics

with pump-probe MOKE method



K. Yamamoto *et al*., APL **116**, 172406 (2020)

Multilayer magnetic films
Co/Pt

Ferrimagnetic material
GdFeCo

S. El Moussaoui *et al*., in preparation

presented by Prof. Tsukamoto

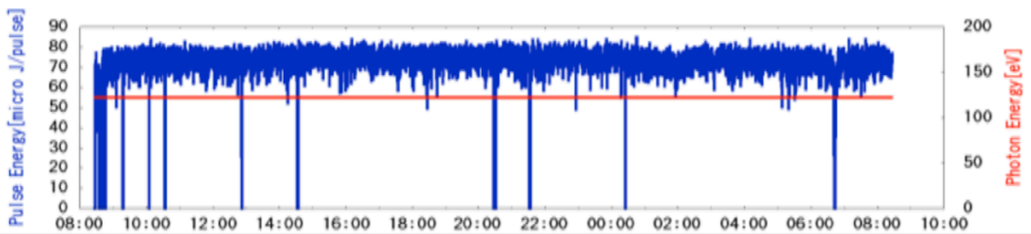
From Facility Side

Undulators Problem at BL1

2017/11/29	SACLA Operation Status	08:26:20

Operation Mode	
BL1 Study	
Hutch in Use	
BL1 EH4a	
Pulse Energy	Photon Energy / Wavelength
72.2 micro J/pulse	122.3 eV / 10.1 nm
Repetition Rate	Intensity Fluctuation in 30 shots (STD)
60 Hz	19.2 %

BL1
72 μJ@122 eV
60 Hz

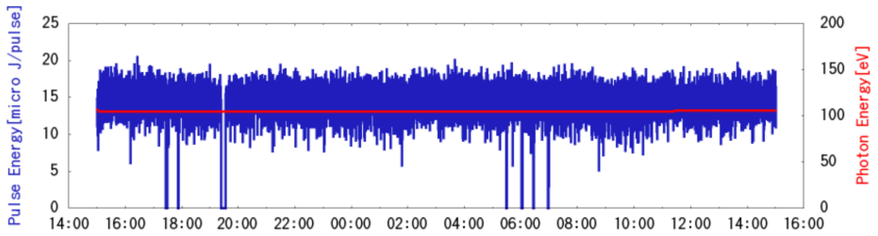


demagnetization of the undulator

2021/2/27	SACLA Operation Status	15:00:50

Operation Mode	
BL1 User Operation	
Hutch in Use	
BL1 EH4a	
Pulse Energy	Photon Energy / Wavelength
16.4 micro J/pulse	106.0 eV / 11.7 nm
Repetition Rate	Intensity Fluctuation in 30 shots (STD)
60 Hz	49.3 %

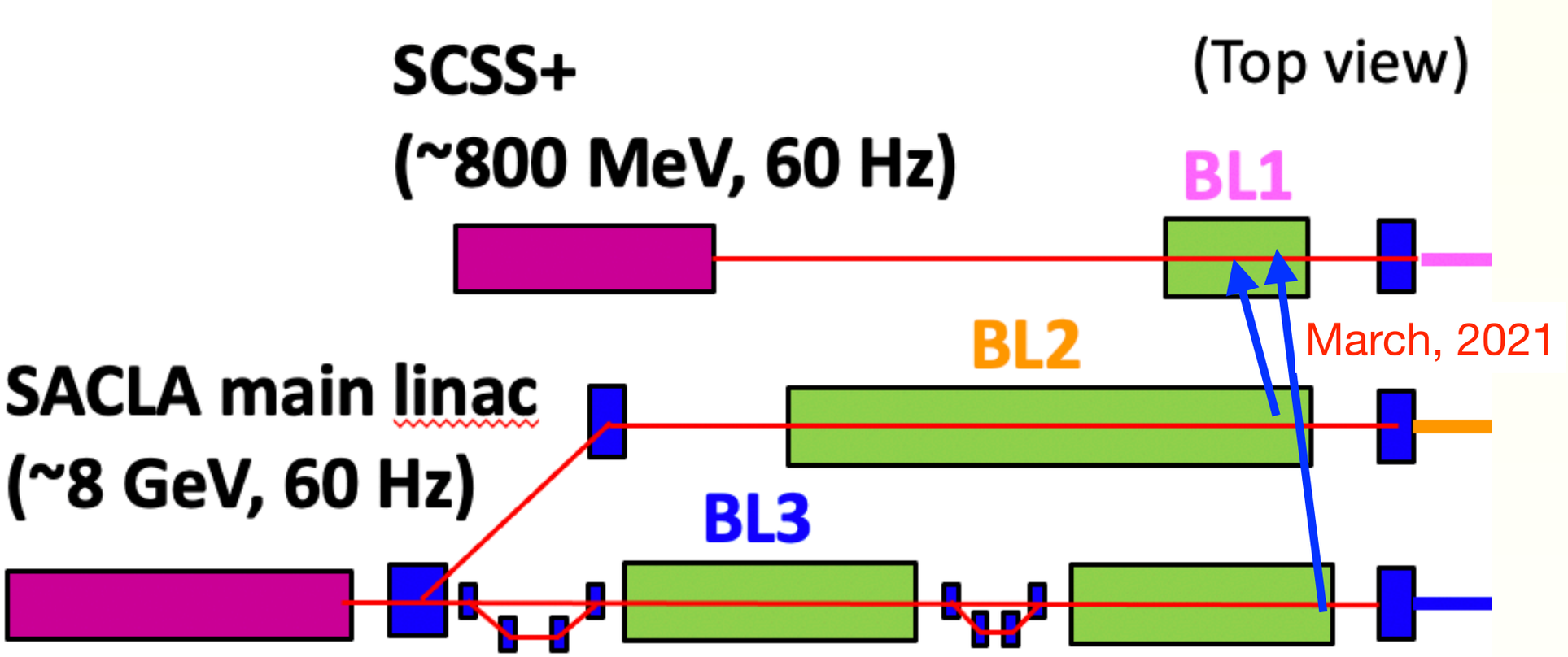
BL1
16 μJ@106 eV
60 Hz



Countermeasure

Replace the two undulators in BL1 with those used in BL2 and BL3.
→The pulse energy could be recovered.

We are also considering upgrading the undulator of BL1, which is optimized for the envelope of the low energy e-beam, in future.



For round table discussion

- **We plan to keep the current photon-beam parameters with the new undulator.**
  - The pulse energy (not only fundamental but also high harmonics) will increase.

- However, we could consider extending the parameter ranges.
  e.g., **circular polarization**

- **A strategy that is aware of our uniqueness and strengths compared to other facilities (with high photon energy and rep. rate) is very important.**

Your inputs are very welcome!