# 1st PEEM-3 Experiments

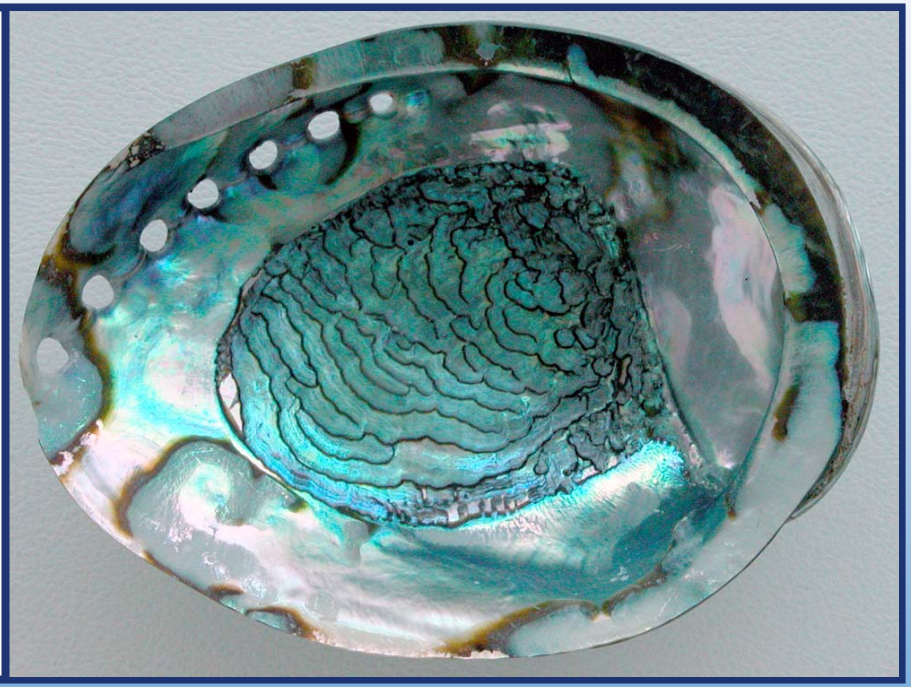
ADVANCED LIGHT SOURCE
EXPERIMENTAL SYSTEMS GROUP

- Linear Dichroism Imaging of Nacre
- Low Temperature Magnetic Imaging

# Abalone Nacre

Rebecca Metzler, Dong Zhou, Mike Abrecht, Sue Coppersmith, and Pupa Gilbert

- 95% aragonite ($CaCO_3$), + 5% organic matrix
- 3000x more resistant to fracture than aragonite
- Open questions:
  - Nacre microarchitecture (how single-crystals are oriented with each other)
  - Nacre formation mechanism



# Polarization-dependent Imaging Contrast (PIC) reveals new nacre architecture

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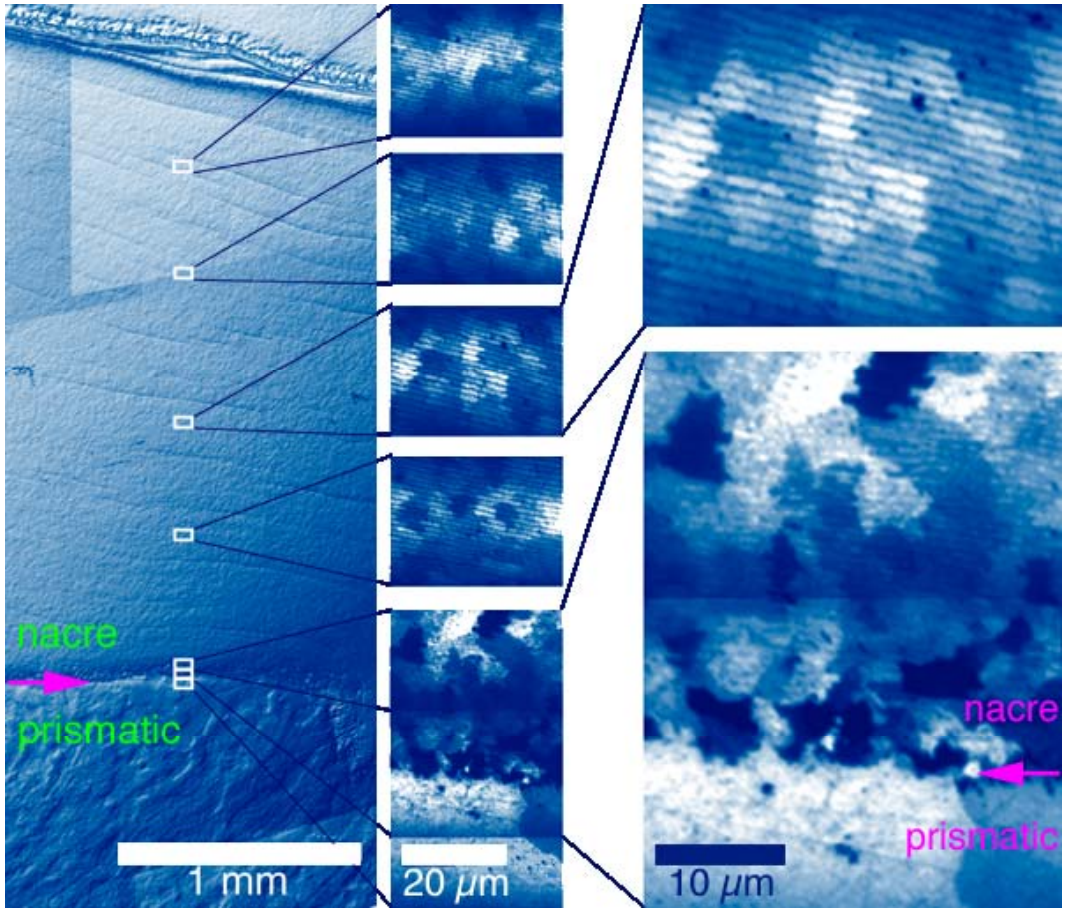
## Architecture of Columnar Nacre, and Implications for Its Formation Mechanism

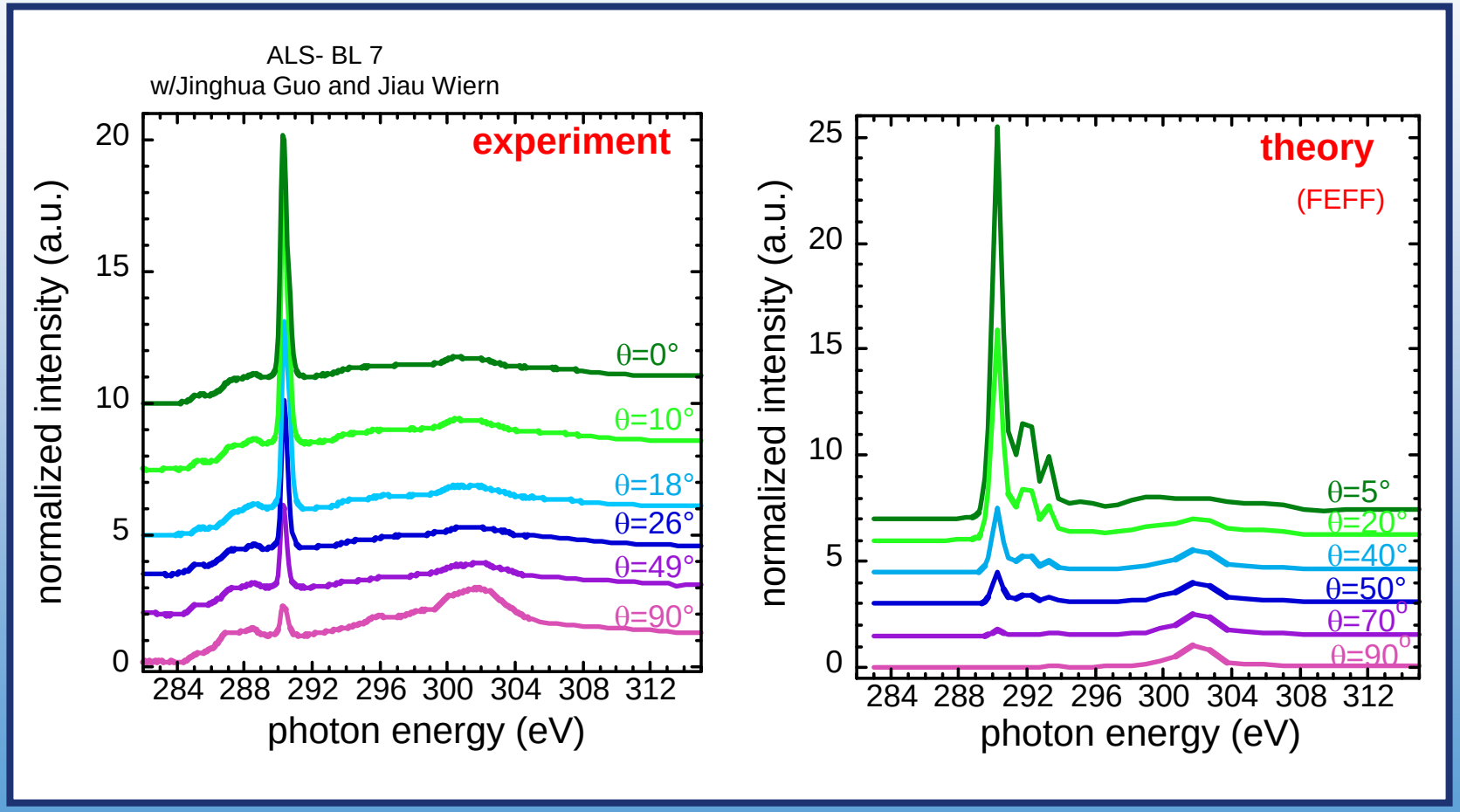
Rebecca A. Metzler,[1] Mike Abrecht,[2] Ronke M. Olabisi,[1] Daniel Ariosa,[3] Christopher J. Johnson,[4] Bradley H. Frazer,[2] Susan N. Coppersmith,[1] and P. U. P. A. Gilbert[1,*]




SRC
Home of Aladdin

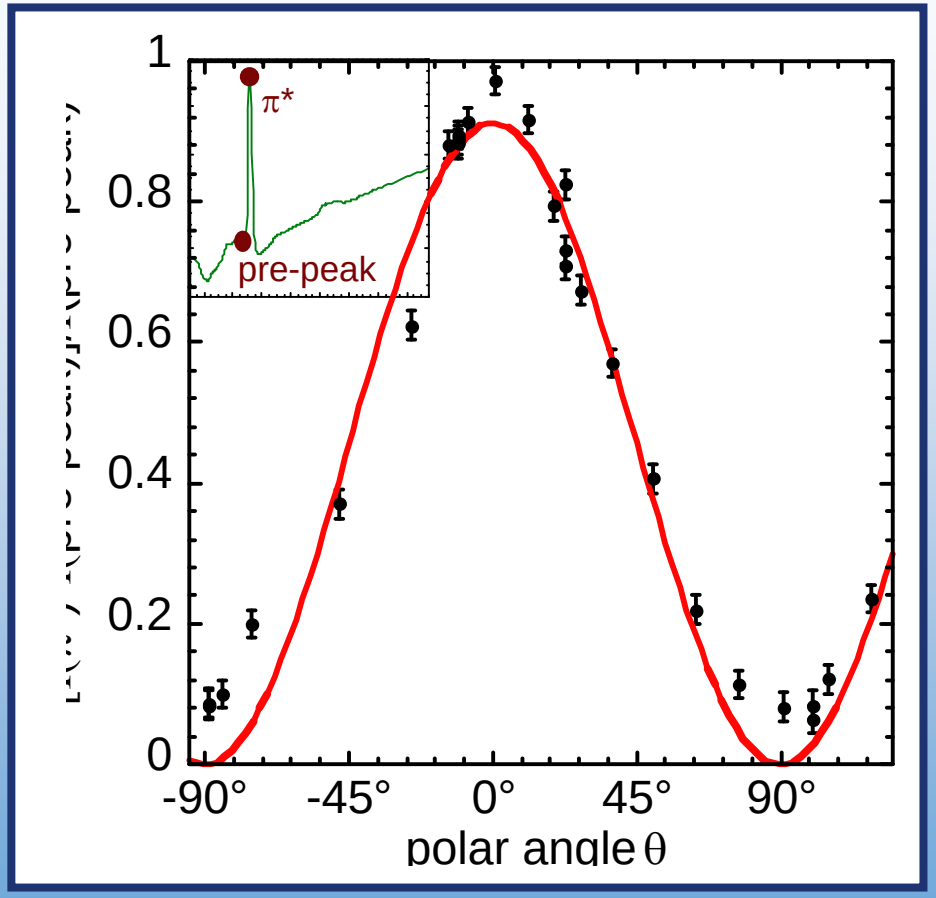
# Origin of Polarization-dependent Imaging Contrast (PIC) confirmed in geologic aragonite single crystals

## X-ray linear dichroism




RA Metzler, D Zhou.....J. Guo, J. Wiern.....SN Coppersmith, PUPA Gilbert. submitted.

# Polar dependence in aragonite single crystals

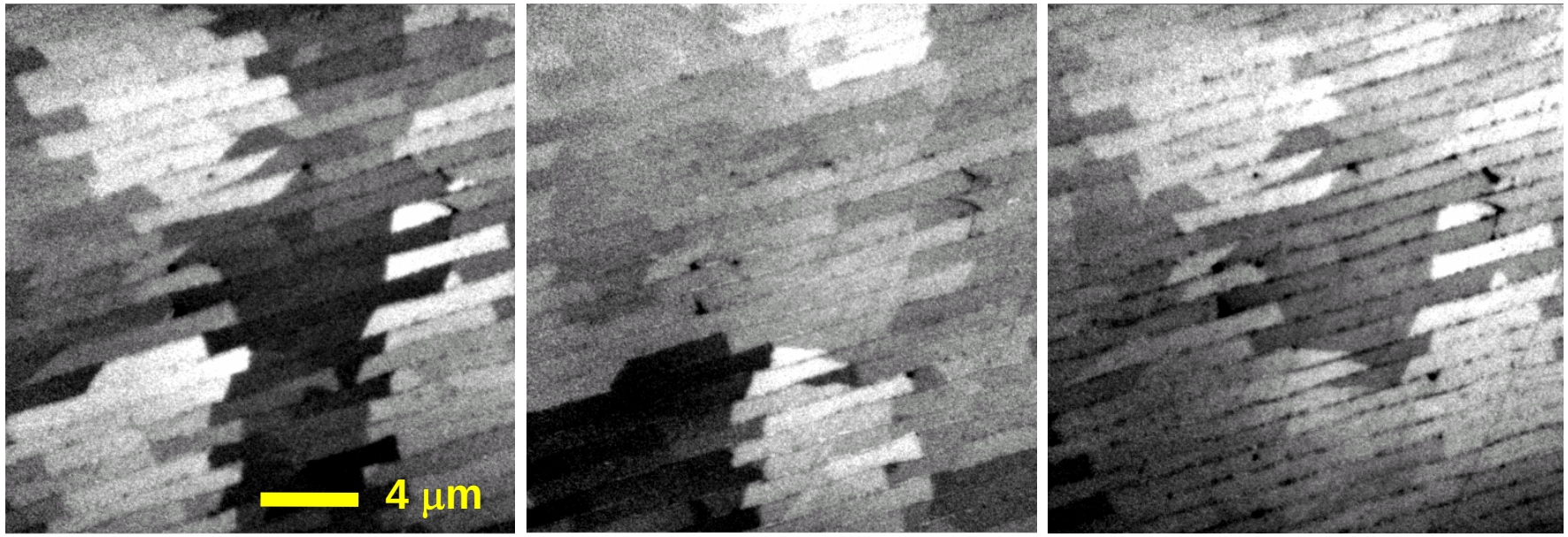



ALS- BL 7
w/Jinghua Guo and Jiau Wiern

RA Metzler, D Zhou.....J. Guo, J. Wiern.....SN Coppersmith, PUPA Gilbert. submitted.

# XLD Imaging Using an EPU

X-ray linear dichroism images at horizontal, vertical and diagonal polarization of cross-sections of nacre –mother-of-pearl




Rebecca Metzler, Dong Zhou, Mike Abrecht, Sue Coppersmith, and Pupa Gilbert

# Magnetic Imaging of the Surface of Manganite Films: Exploring Surface Phase Separation

T. A. Tyson, M. A. Deleon (NJIT), C. Duborudieu (CNRS), A. Scholl and A. Doran (ALS)

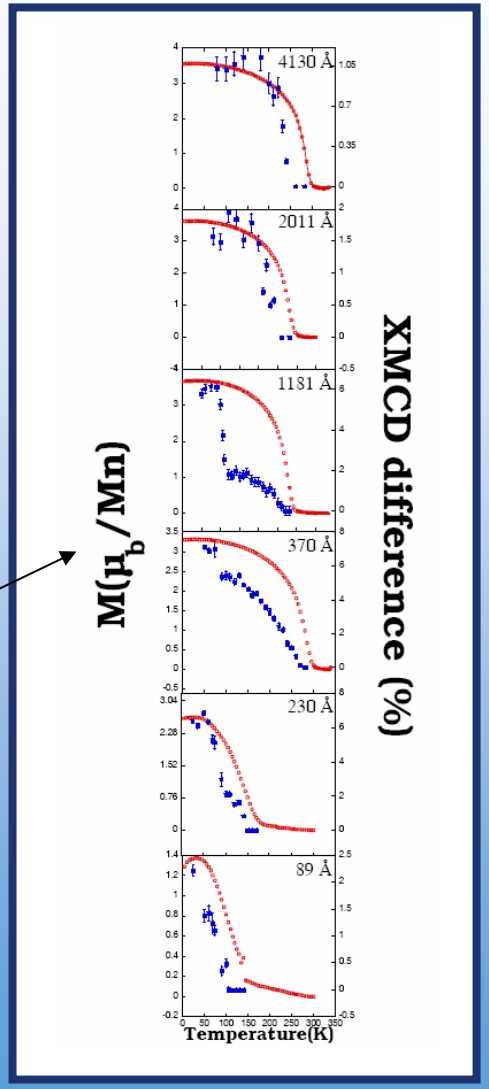
- Motivation
- Manganites exhibit strong electron-spin-lattice coupling. In bulk samples, strain/pressure has been found to increase the insulator to metal transitions. Pressures beyond ~3 GPa leads to re-entrant low-temperature insulating behavior (Chen, Tyson *et al*.)
- Theoretical analysis has shown that Tc is extremely sensitive to biaxial strain – Tc reduction is quadratic in the JT distortion (Millis *et al*.). This suggest that strain can be used to probe the spin lattice coupling.

- In films samples, compression/tensile strain can be used to tune the magnetic anisotropy
- Low magnetization has been observed at the surface of manganite films
- To understand the effect of strain on the magnetic properties of manganites a range of films with thickness varying from 2.5 to 413 nm are being studied

- This research was funded by NSF DMR-0512196, NSF INT-0233316, and CNRS/NSF project No. 14550.

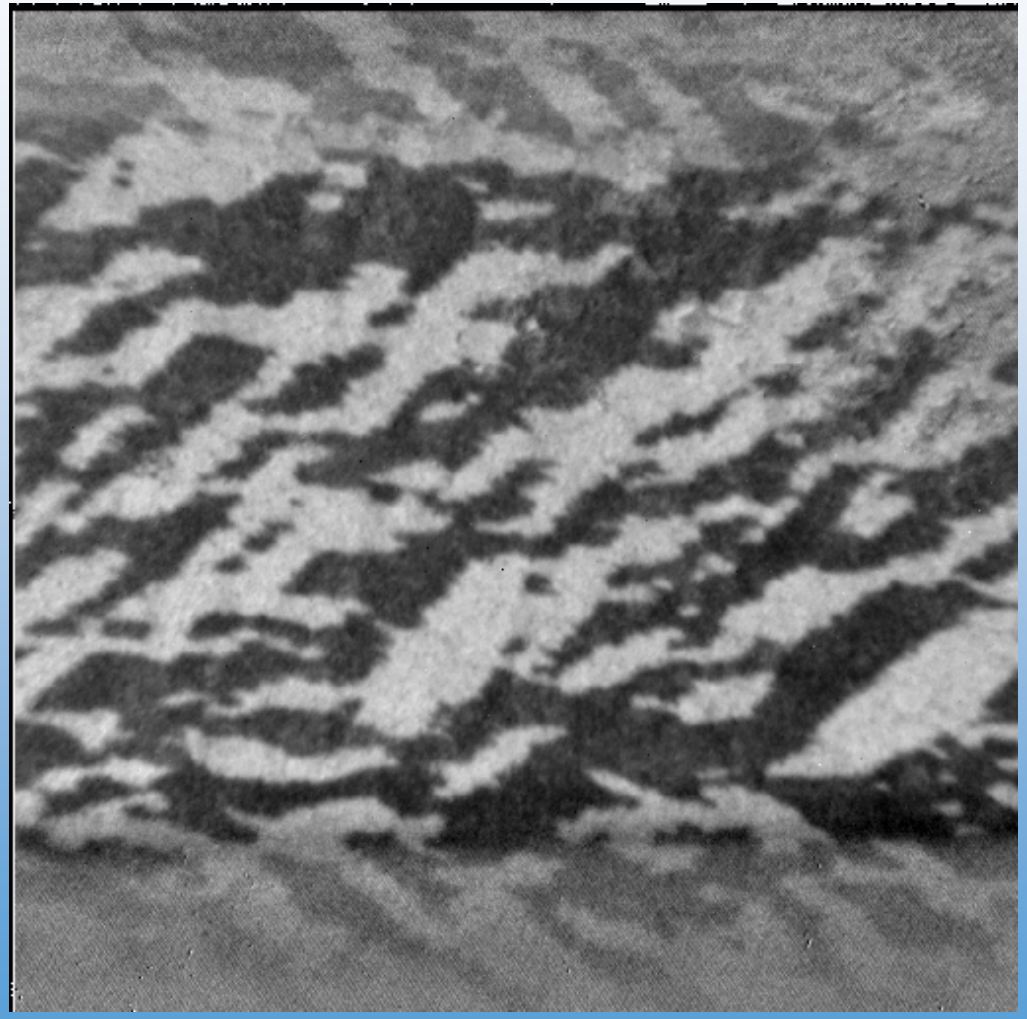
# Temperature Dependence of Magnetic Moment in $La_{0.8}MnO_3$

- $La_xMnO_3$ is chemically simple
- Possesses the same magnetic, structural and transport properties of the classic $La_{1-x}Ca_xMnO_3$ (LCMO) system
- Theoretical bulk magnetization (left, red curves) is achieved at low temperature thick films
- Low surface magnetization (blue dots) observed by XMCD with large beams (U4B NSLS experiments)
- Bulk XMCD (dots) measurements reveal two phase behavior in 118nm (1181 Å) film. Position sensitive chemical analysis of film surface is needed.



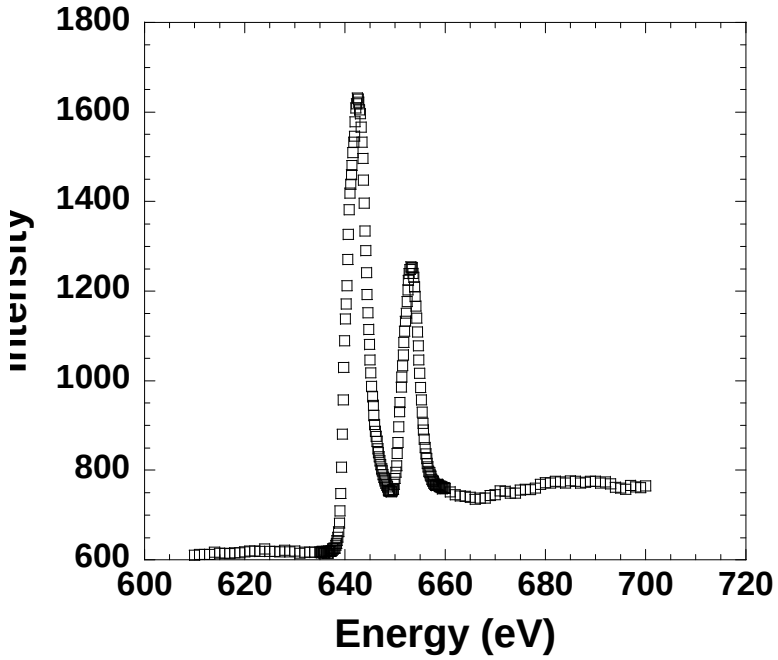
# Magnetic Circular Dichroism Imaging Using an EPU

Magnetic Domains (Mn (L3/L2) ) of 413nm La0.8MnO3 Film at 140K



# Local Spectroscopy at Low Temperature

## Mn L3/L2 Edge at 140K- Full Image Spectrum




## O K-edge Edge at 140K- Full Image Spectrum