# *Quantifying Interface Disruption by X-ray Resonant Scattering*

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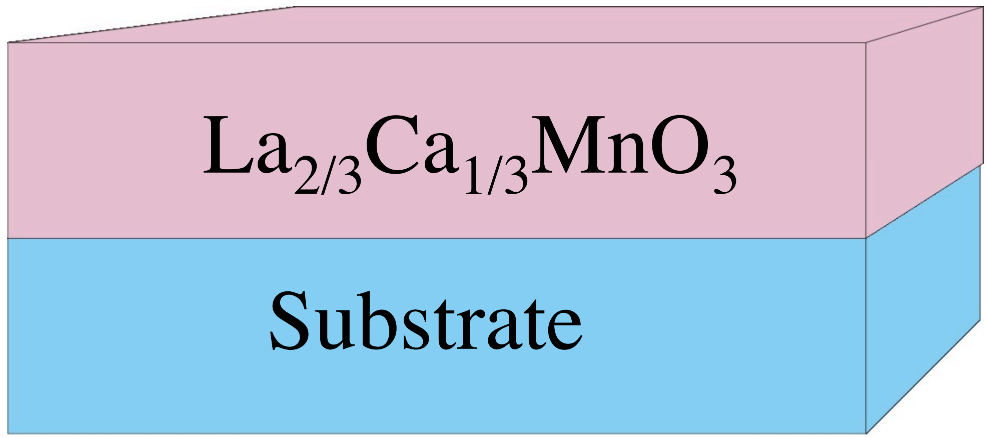
# *Stress Induced Interface Disruption*
## *substrate lattice mismatch*

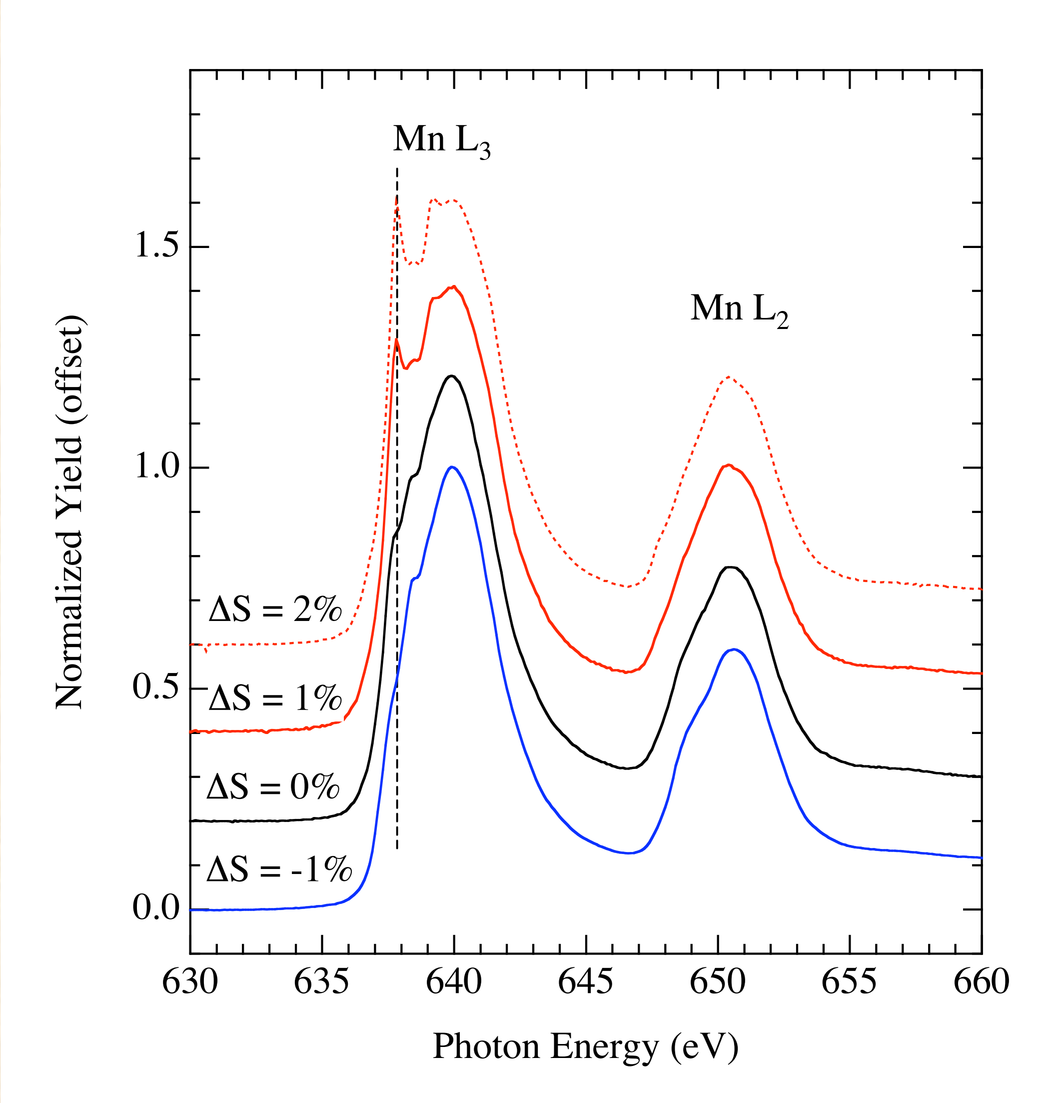



$SrTiO_3$(100) - 0.98% Tensile

$NdGaO_3$(100) + 0.08% Unstressed

$LaAlO_3$(100) + 1.81% Compressive

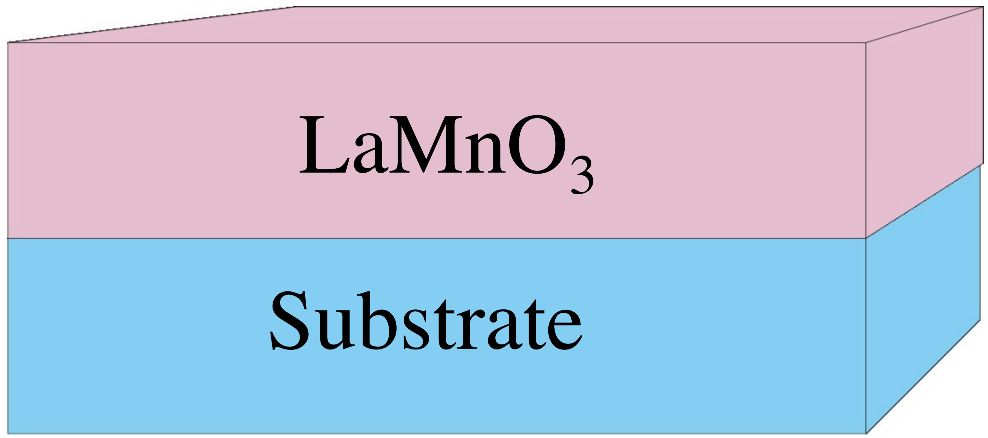
# Interface Stress (LCMO)




XAS Variation in Mn $L_{2,3}$ edge for $La_{2/3}Ca_{1/3}MnO_3$ with interfacial stress ΔS.

Stress created by **selecting substrate** to create a lattice mismatch.

# *Stress Induced Interface Disruption substrate lattice mismatch*

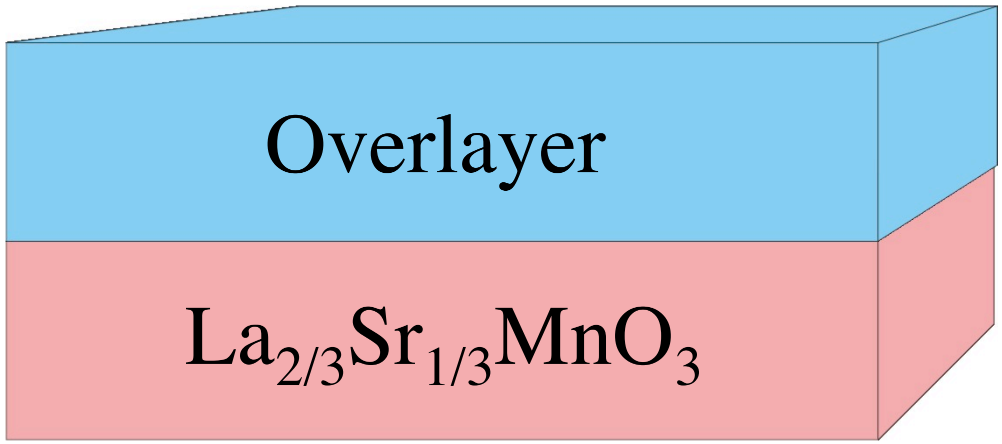



$SrTiO_3$(100) - 0.0015%

$LaMnO_3$
formaion

J. Dvorak, et al., JAP (04)

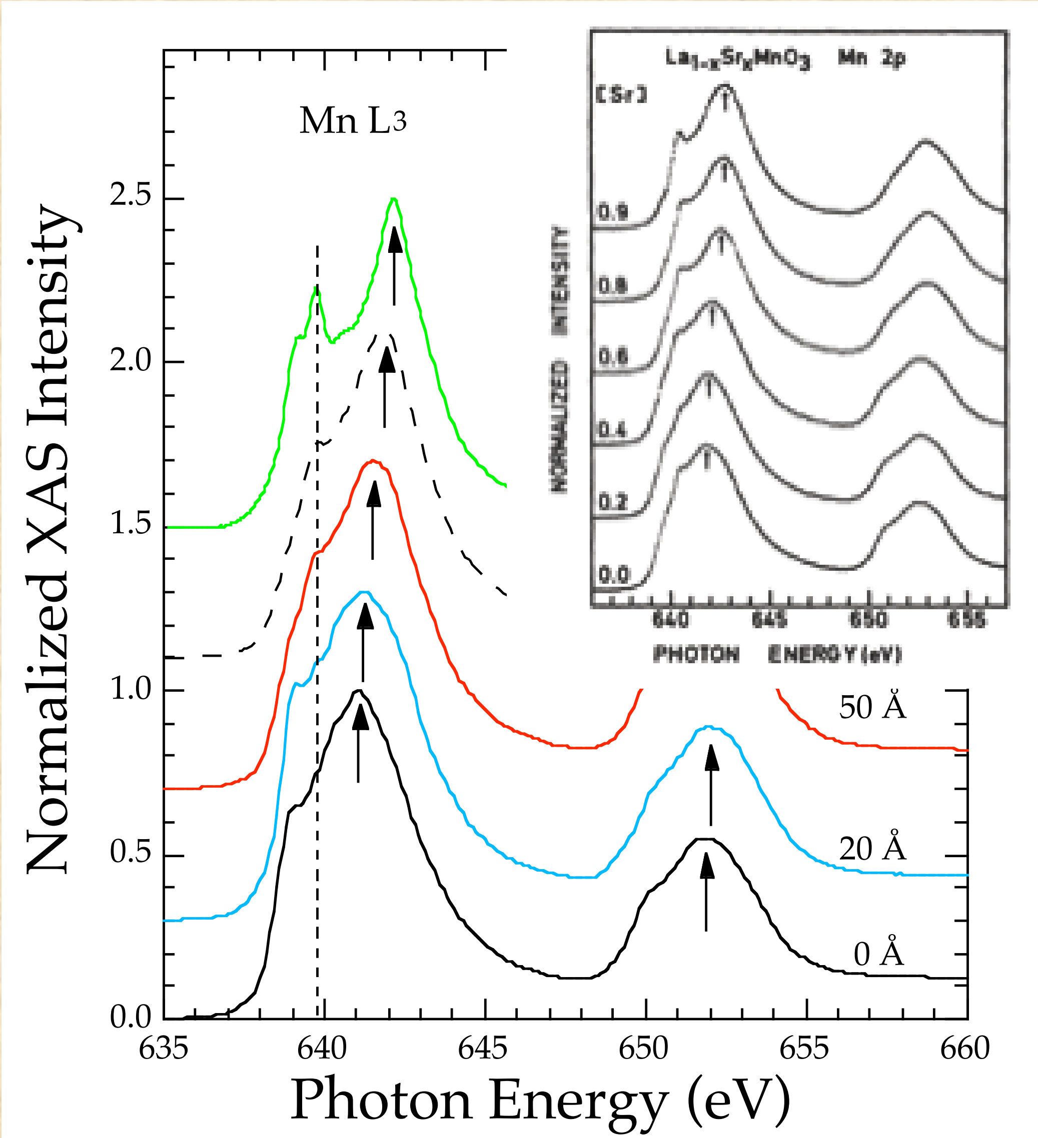
# *Stress Induced Interface Disruption*
## *overlayer lattice mismatch*




YBCO + 2.3%
10 Å to 100 Å thickness

Controlled strain

# Interface Stress (LSMO)

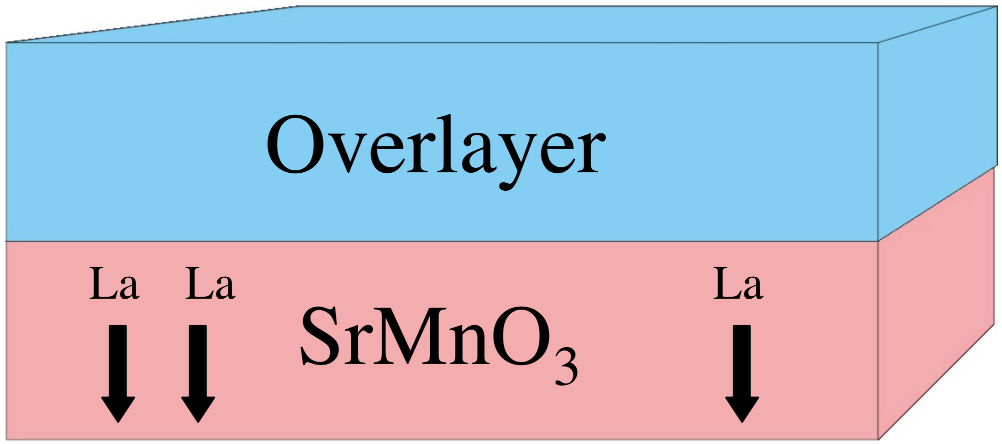



XAS Variation in Mn $L_{2,3}$ edge for $La_{2/3}Sr_{1/3}MnO_3$ with overlayer stress.

Stress created by **changing thickness of an overlayer** with a lattice mismatch.

Abbate et al., PRB 46, 4511 (1992)

# *Stress Induced Interface Disruption overlayer lattice mismatch*

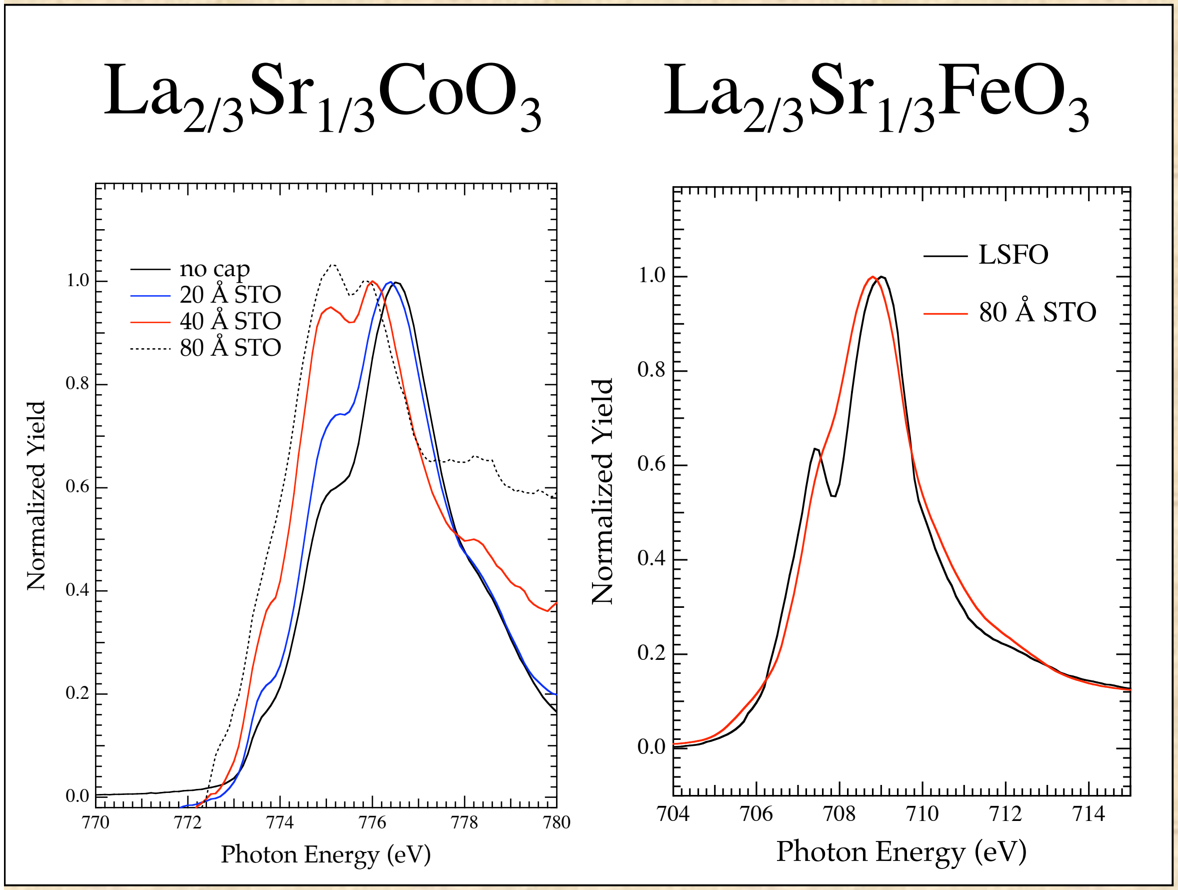


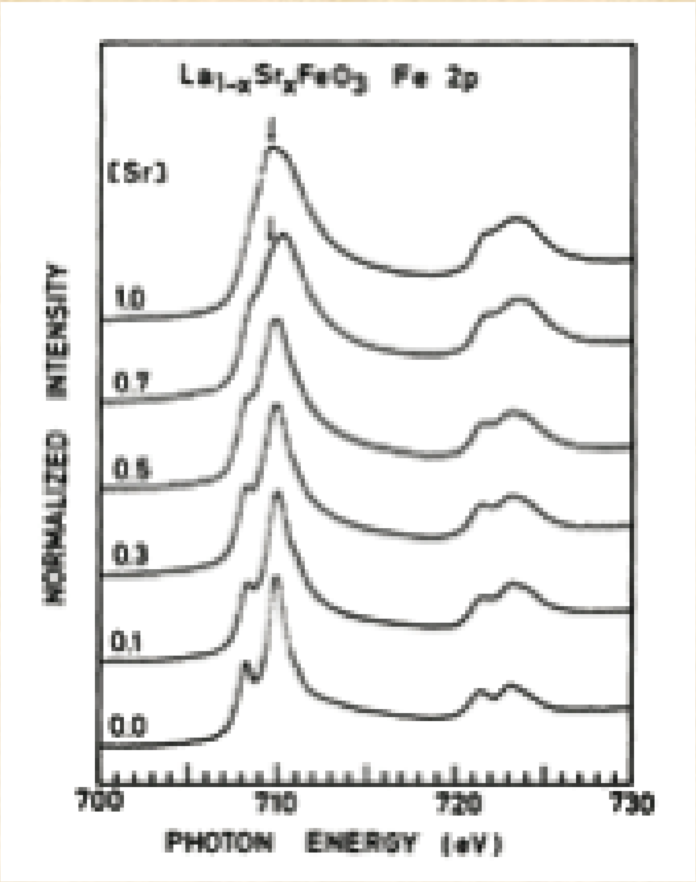

YBCO - 0.3%

La removed from interface

S. Stadler, et al., APL (99)

# Interface Stress (LSCO & LSFO)




Abbate et al., PRB 46, 4511 (1992)

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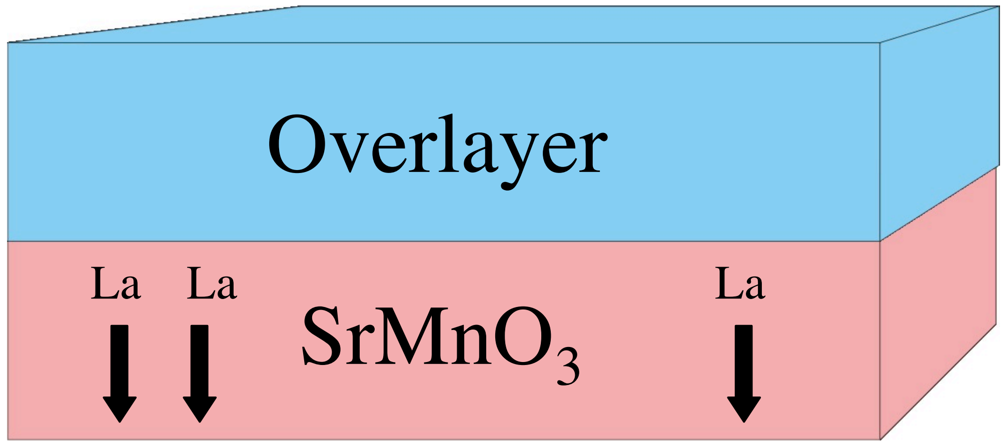
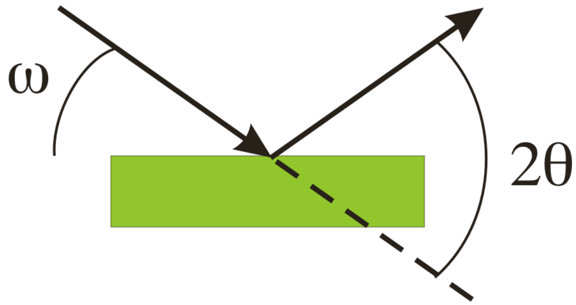
# *Quantify Interface Disruption?*

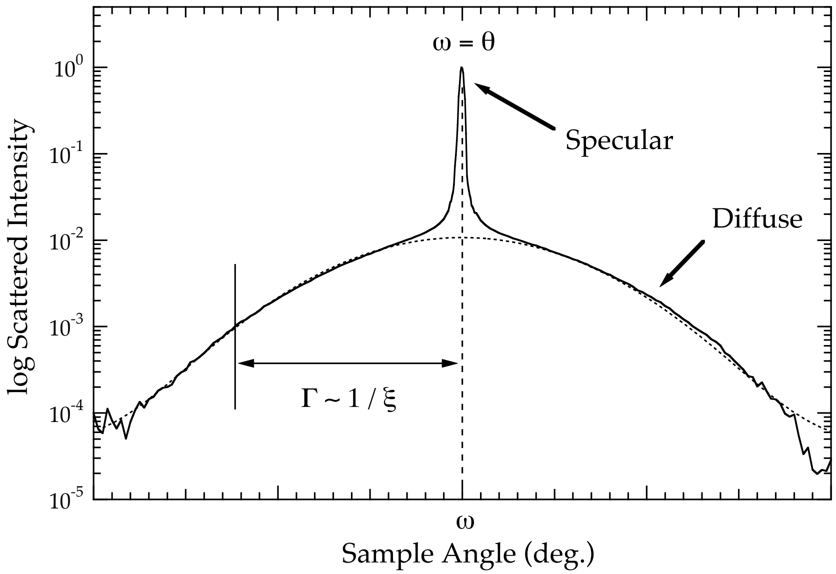



Diffuse X-ray Resonant Scattering
to determine interface distribution

# Diffuse X-ray Resonant Scattering (XRS)



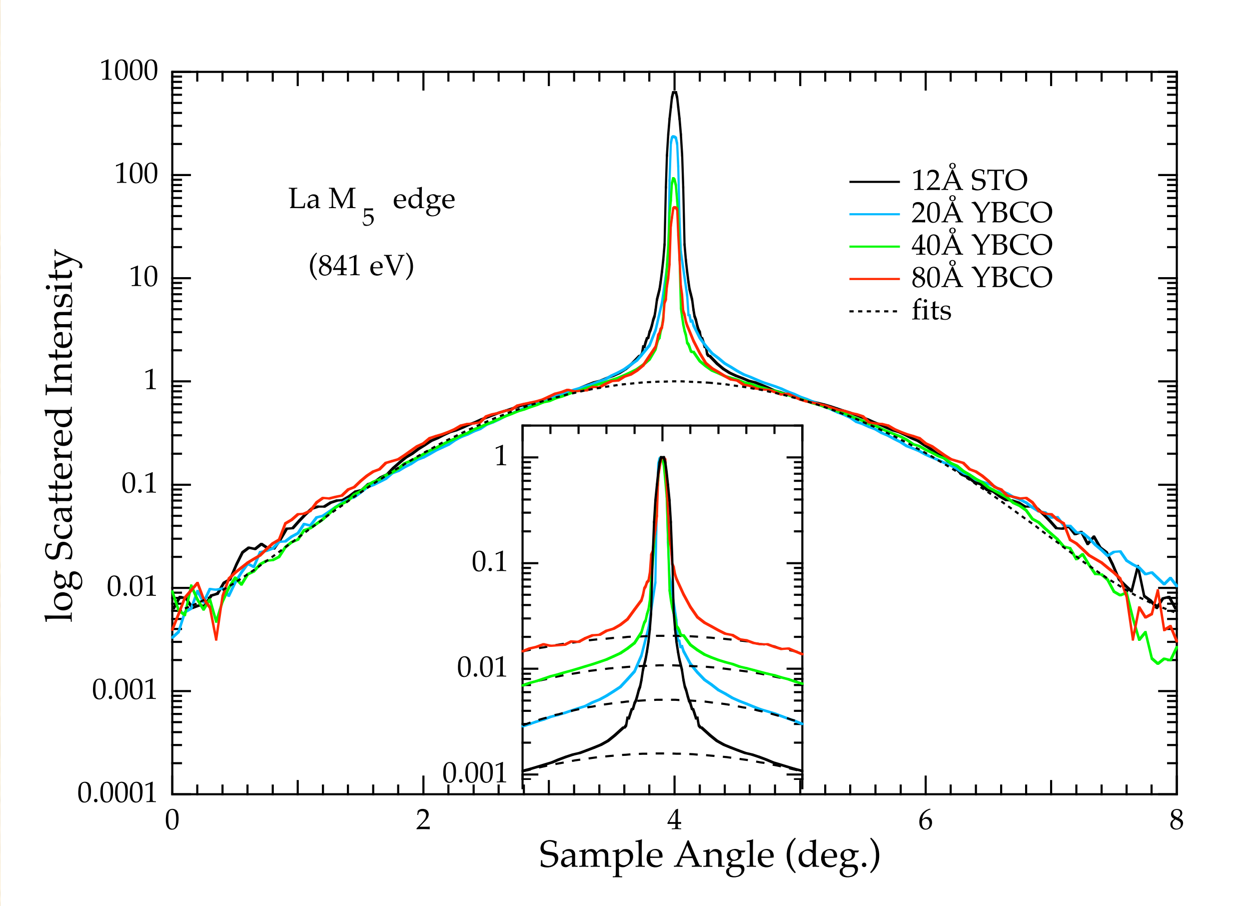

Specular $\omega = \theta$




Specular vs. Diffuse Int. ➡ Perp. Roughness ($\sigma$)

Width of Diffuse ➡ In-plane Corr. Length ($\xi$)

# La Distribution in LSMO from Diffuse Scans



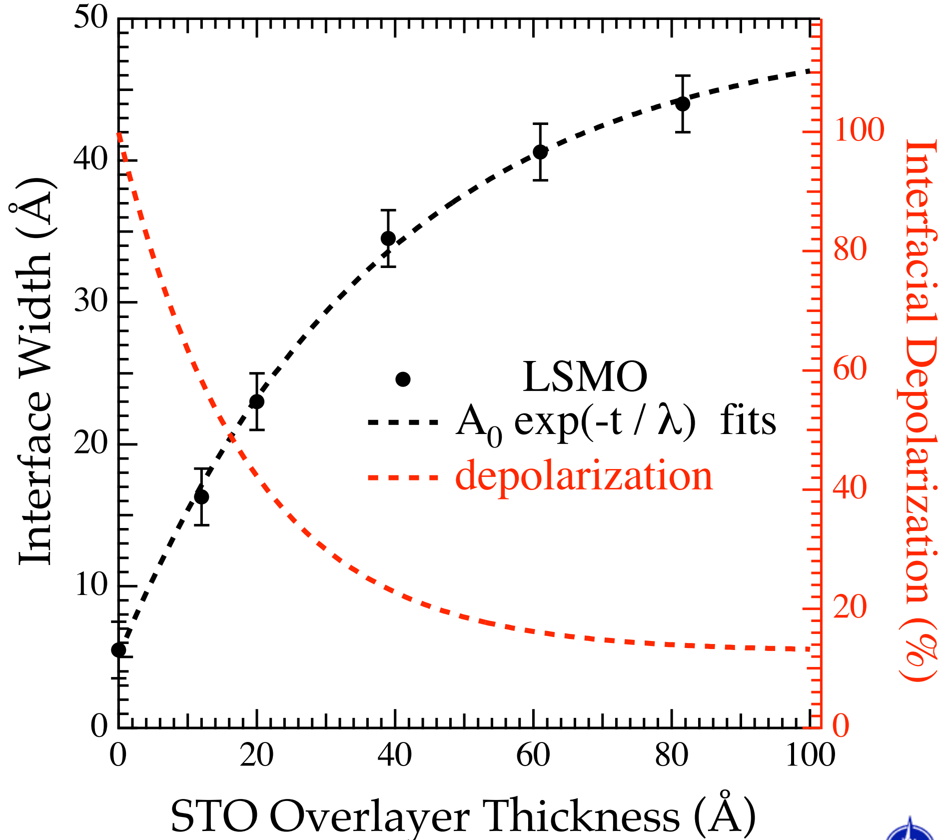

Width of diffuse peak is unchanged.

Specular vs. diffuse intensity changes. Increased perpendicular roughness of La distribution.

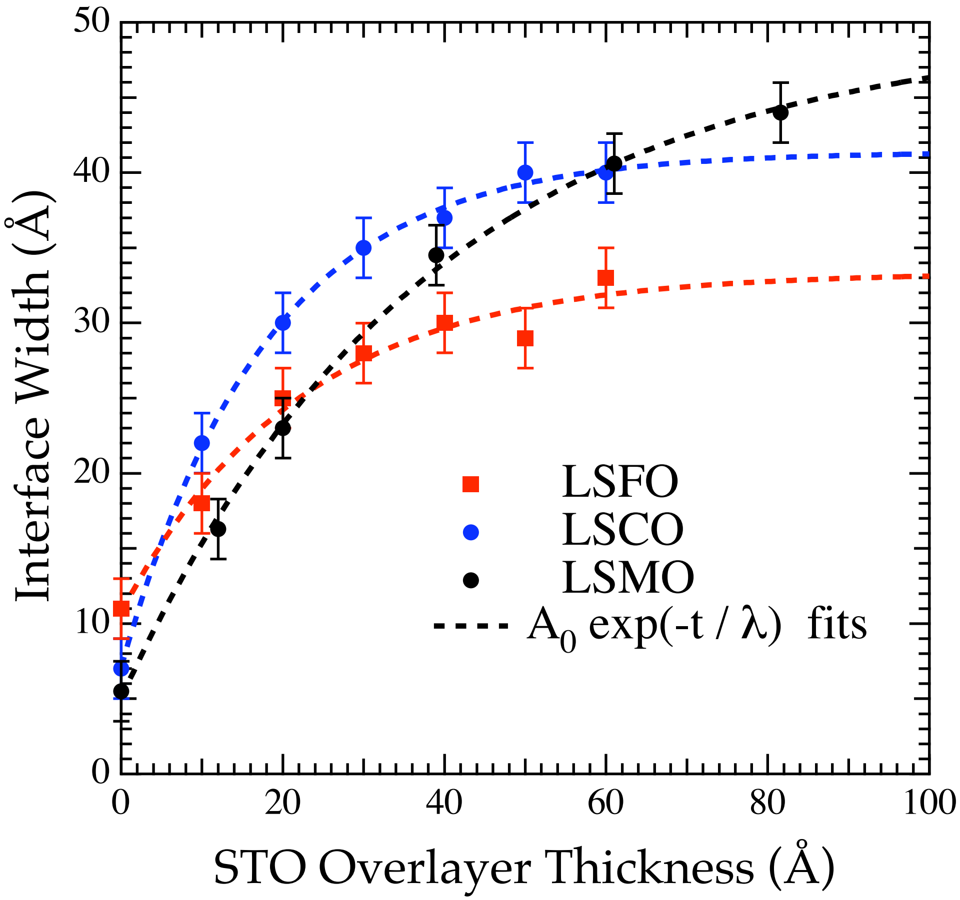
# La Distribution in LSMO from Diffuse Scans

Interface width

$$\frac{I_S}{I_S + I_D} = e^{-(q_z \sigma_c)}$$



# La Distribution in $La_{2/3}Sr_{1/3}TMO_3$ from XRS diffuse scans




Increasing Mismatch

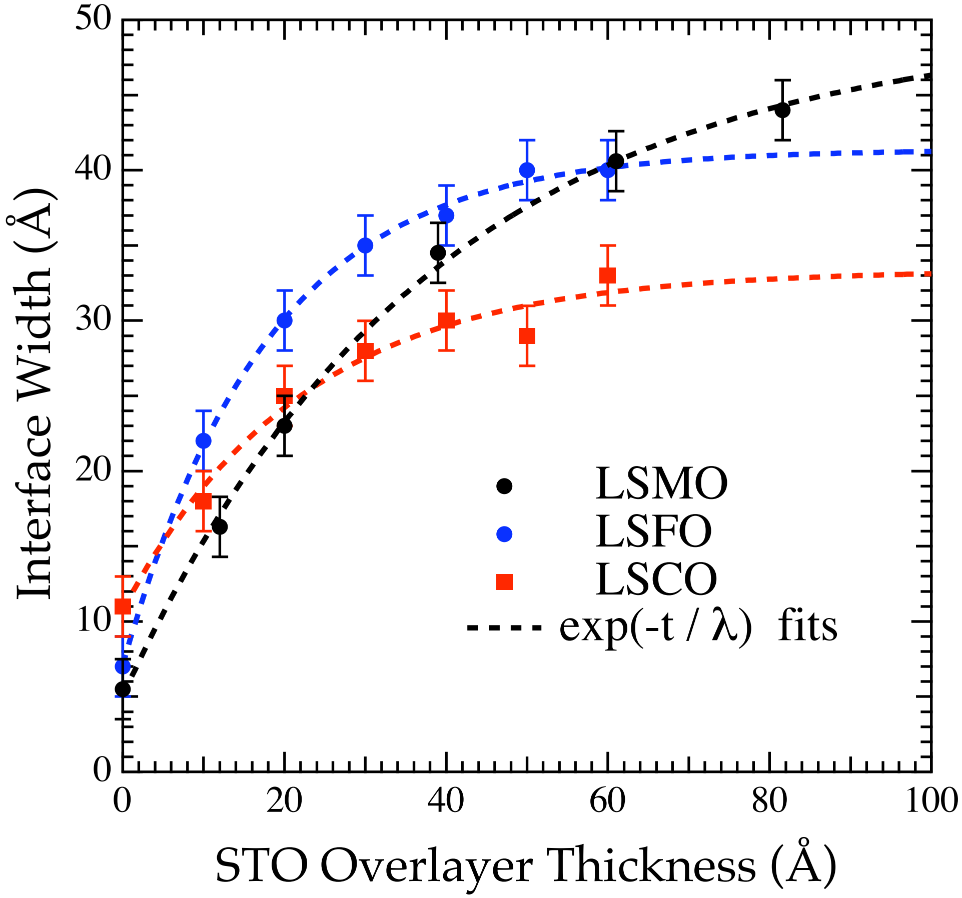
$A_0$ from fits

LSFO - 33.4 Å

LSCO - 41.3 Å

LSMO - 49.5 Å

# La Distribution in $La_{2/3}Sr_{1/3}TMO_3$ from XRS diffuse scans




λ from fits

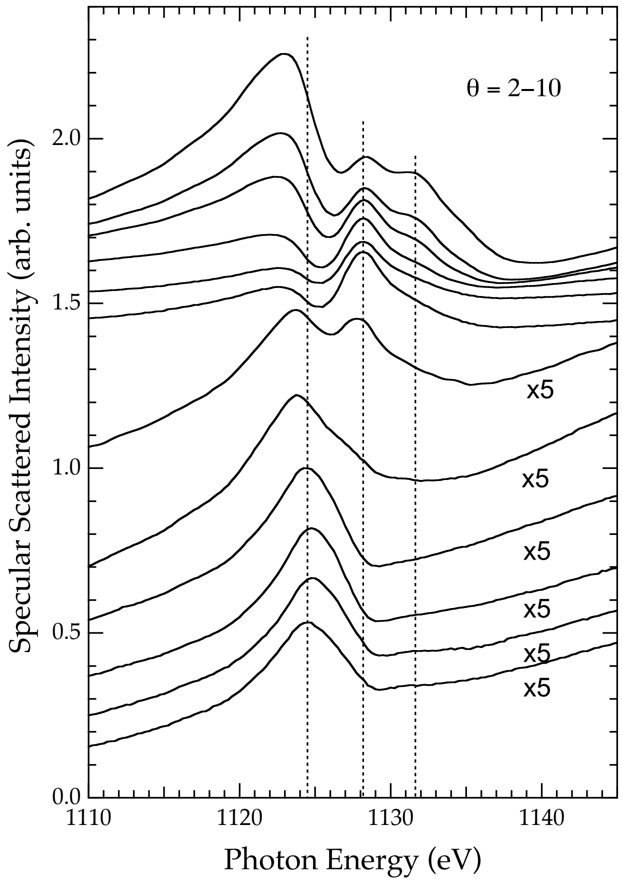
LSCO - 17.9 Å

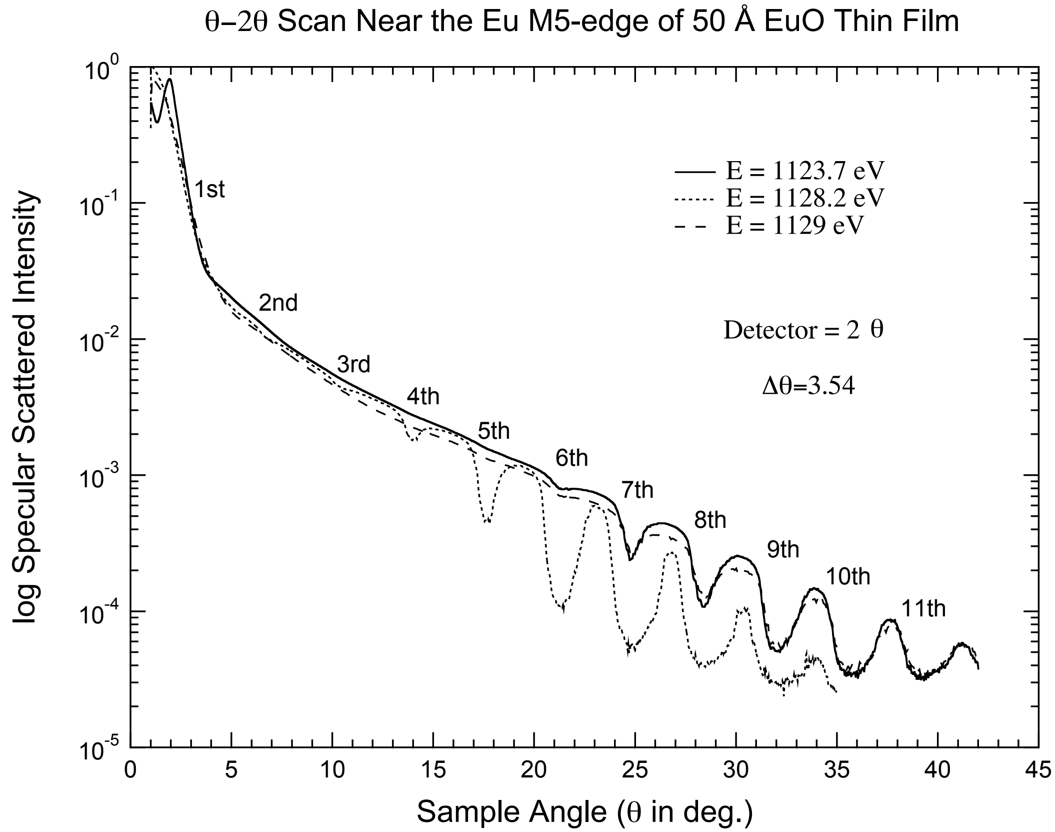
LSFO - 22.2 Å

LSMO - 38.5 Å

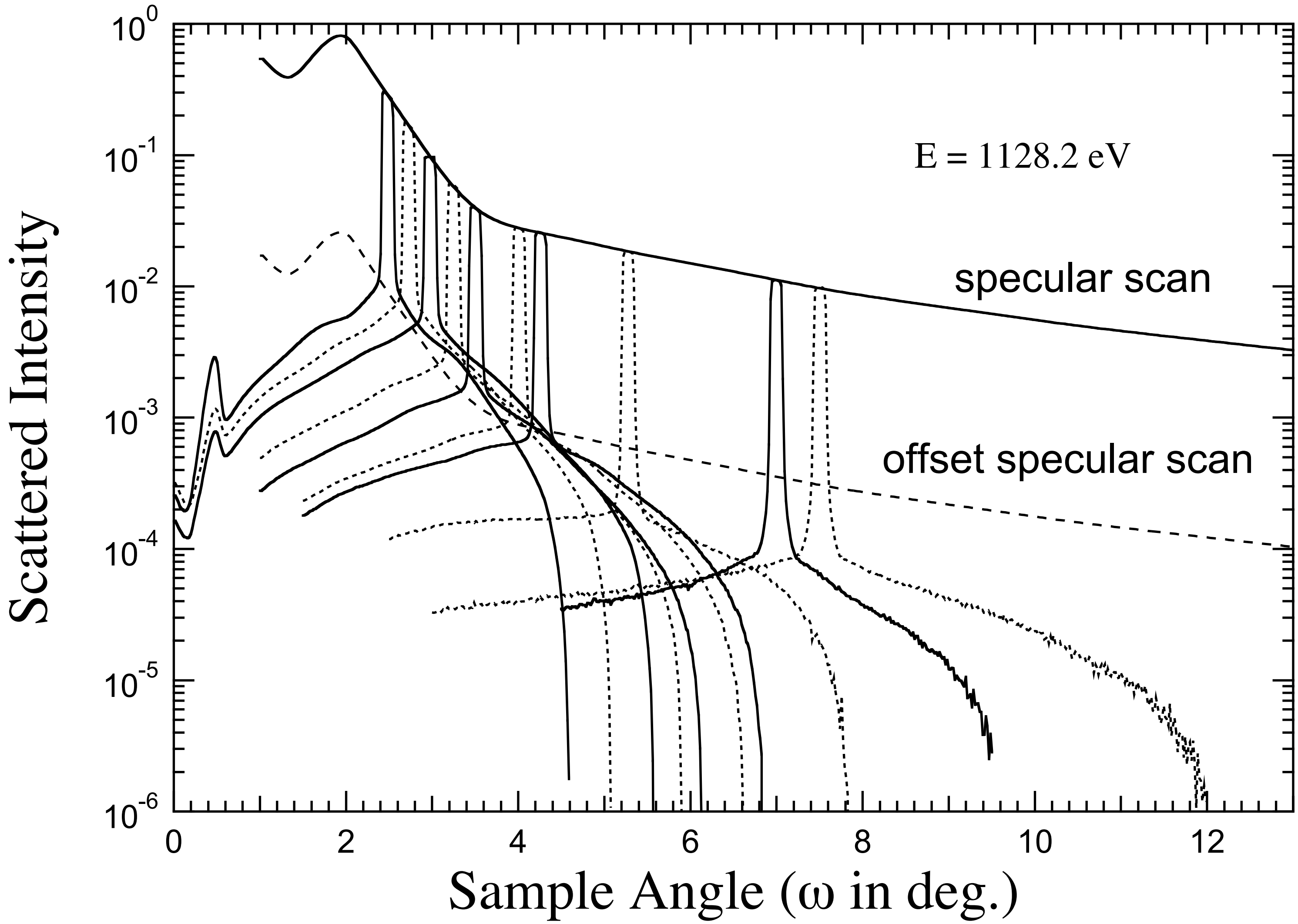
Increasing Stiffness?

# XRS from EuO at the Eu $M_5$-edge



# ω – 2θ Scan near the Eu $M_5$-edge for EuO Thin Film



VOLUME 82, NUMBER 13 PHYSICAL REVIEW LETTERS 29 MARCH 1999

**Observation of Antiparallel Magnetic Order in Weakly Coupled Co/Cu Multilayers**

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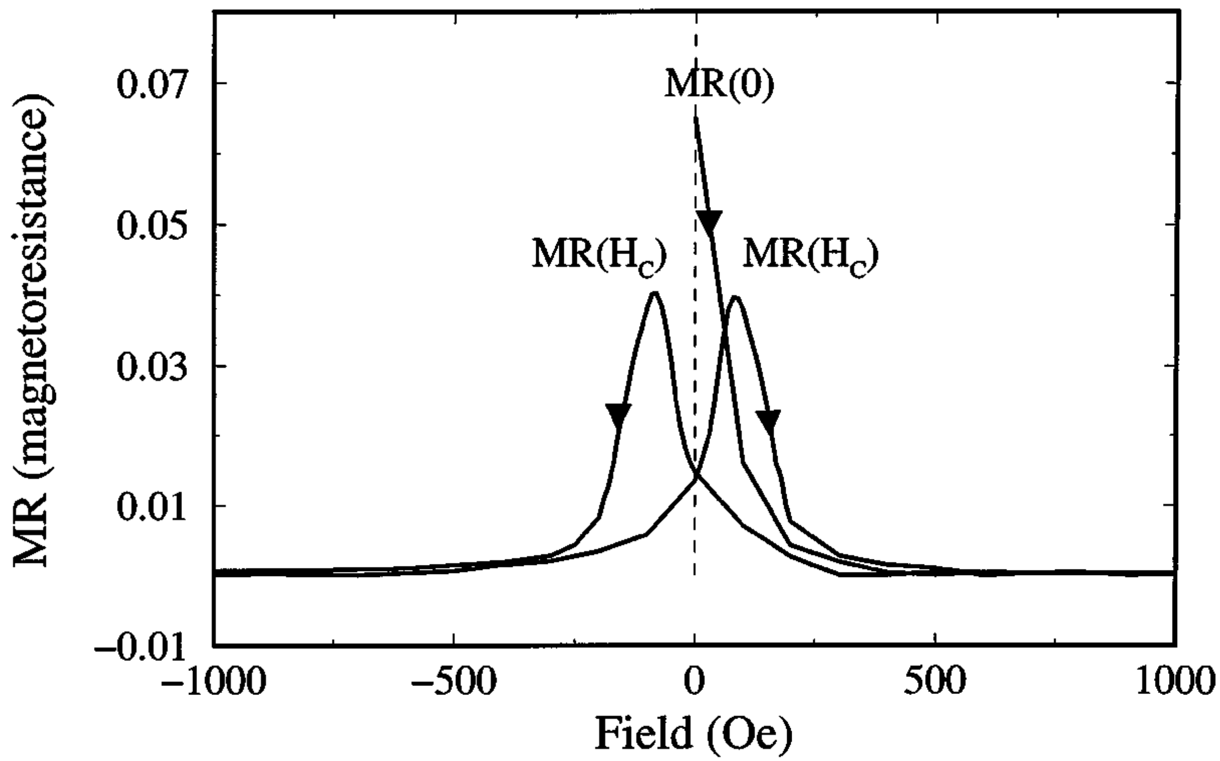
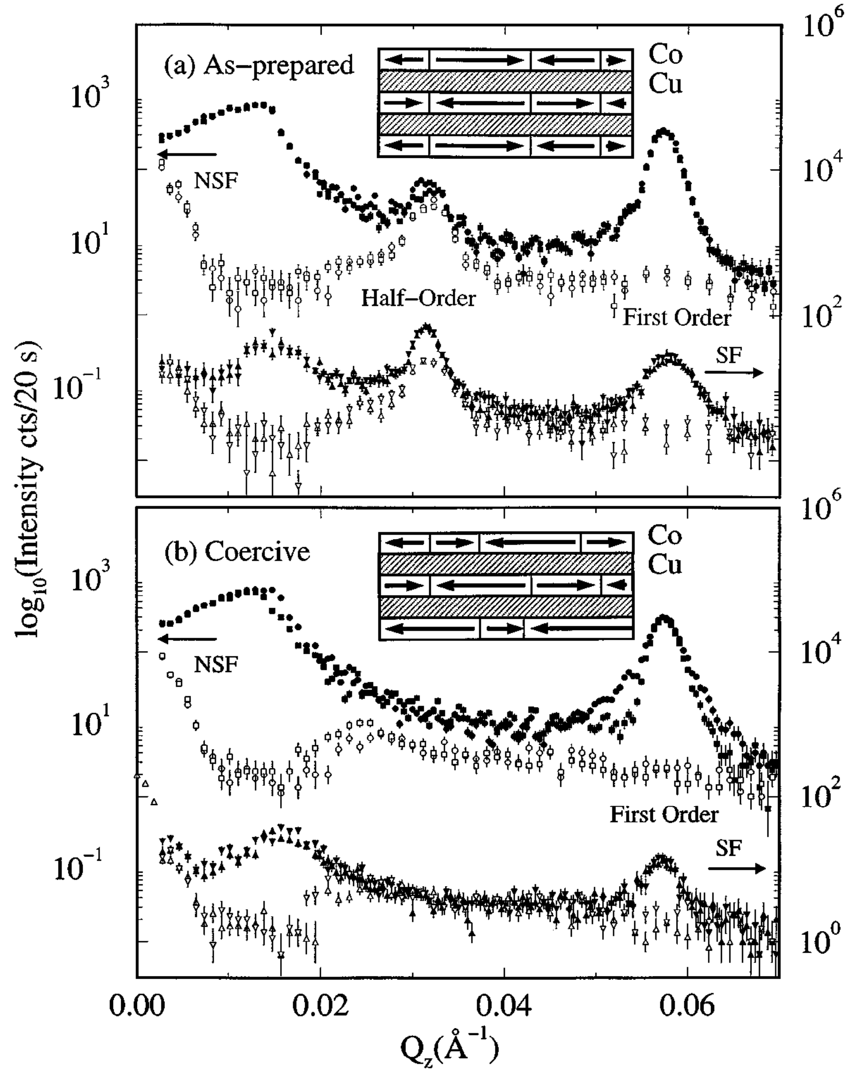
$[Co\ (60Å)/Cu\ (60Å)]_{20}$

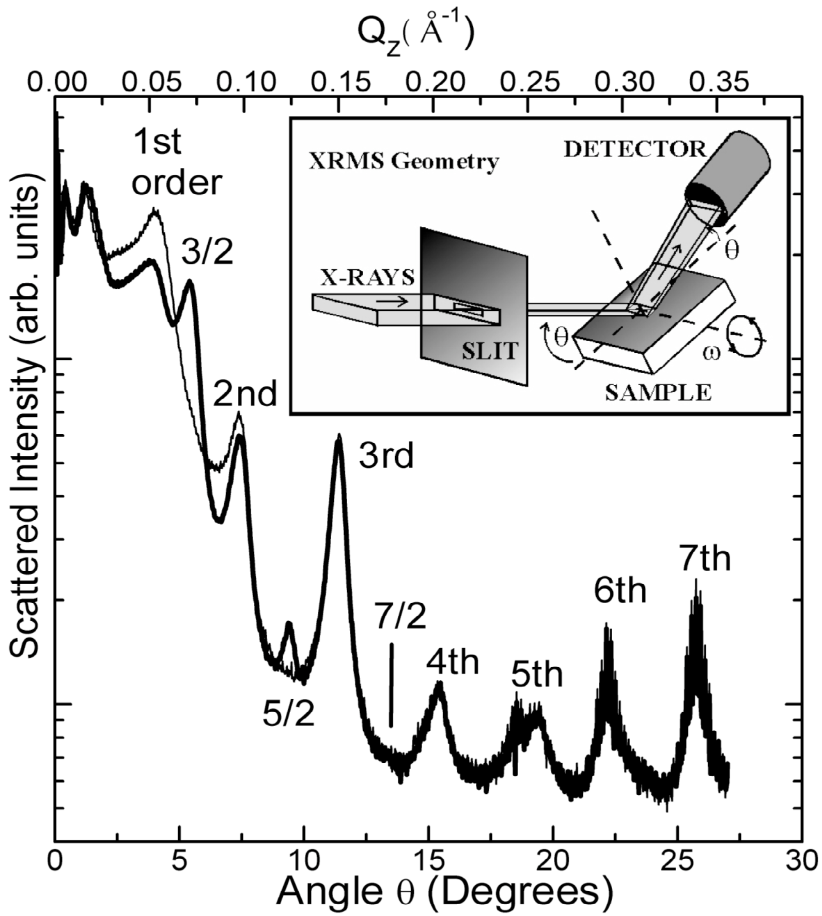


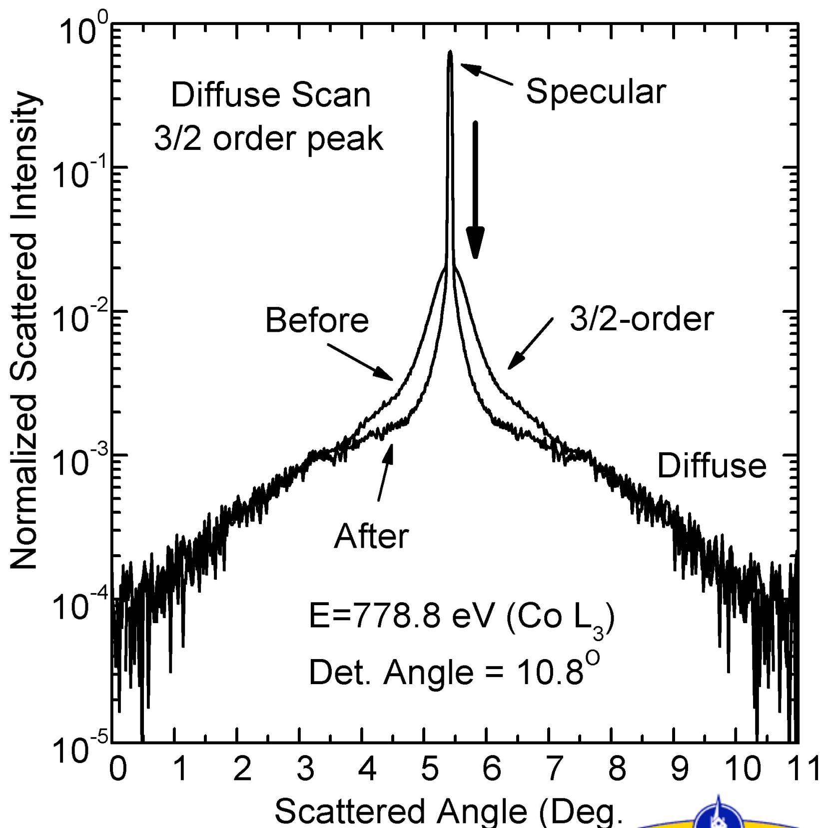
Co layers were magnetically anti-correlated in subsequent layers.

This correlation was lost with the first field application.



# Diffuse X-ray Resonant Magnetic Scattering (XRMS) of a Co/Cu Multilayer

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# Acknowledgements

## Post-doctoral Fellow

Joe Dvorak

## PLD Samples

V. Venkatesan - Univ. of MD
Shane Stadler - S. Ill. Univ

## Graduate Students

Alex Lussier
Johnathon Holroyd
Keith Gilmore
Ezana Negusse
Damon Resnick
Adam McClure
Venessa Pool

Supported by ONR, NSF
NSLS supported by DOE

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