

# Coherent X-ray Diffraction for Imaging Strains

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# Outline

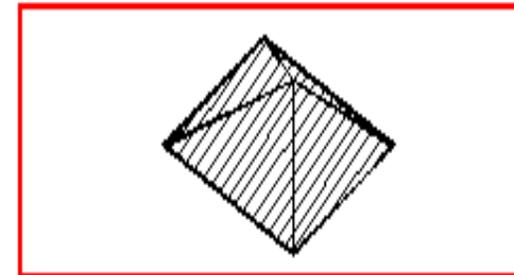
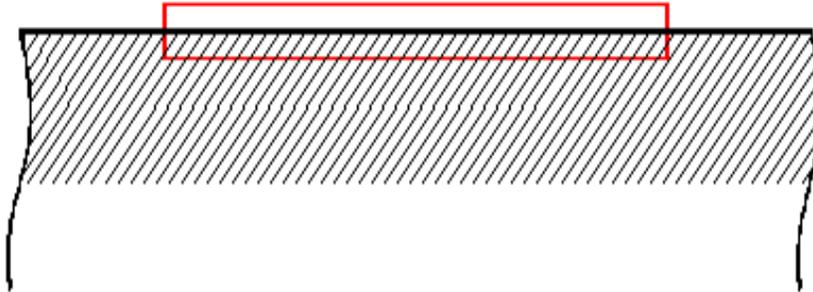
- Goals of Coherent Diffraction
- The **Phase** Problem
- Nanocrystal Shapes
- CXD beamline at Argonne
- Potential Applications

# Goals of Coherent Diffraction

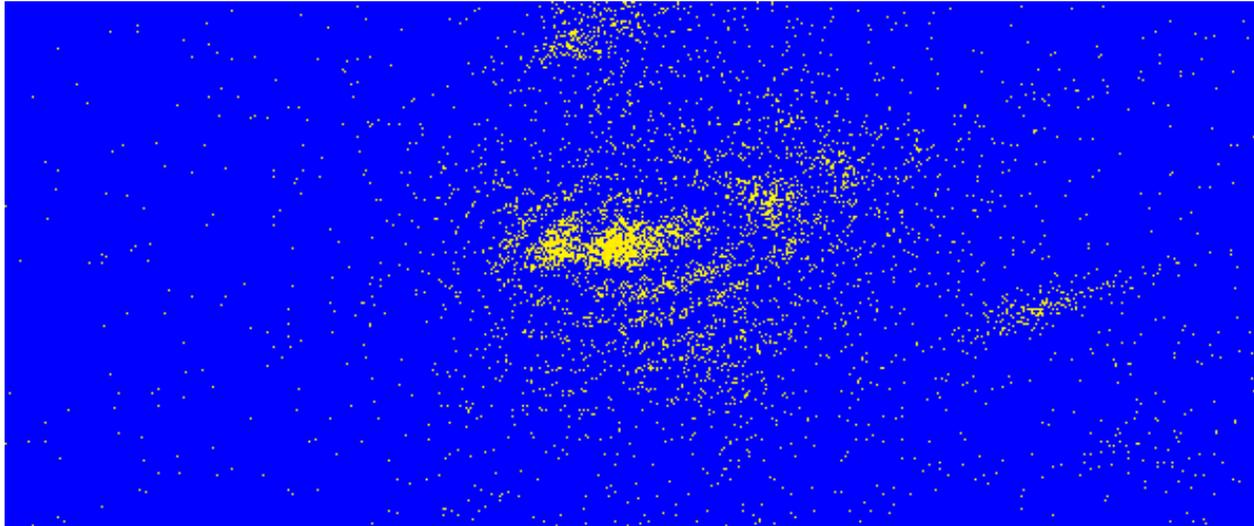
- Thermodynamic fluctuations
  - May be too hard because of beam-induced effects, sample damage
- Probe of structure on **nm** scale
  - 1D, 2D and 3D
  - non-periodic object gives **continuous**  $F(\mathbf{q})$
- **Oversampling** in reciprocal space permits solution of the **phase** problem

# Coherence at the APS

Coherence of	$\xi_{\text{VER}}$	$\xi_{\text{HORIZ}}$	$\xi_{\text{LONG}}$	Flux
Raw Undulator	35 $\mu\text{m}$	9 $\mu\text{m}$	0.004 $\mu\text{m}$	$2 \times 10^{12}$
Si(111) Monochromator	35 $\mu\text{m}$	9 $\mu\text{m}$	1 $\mu\text{m}$	$1 \times 10^{10}$
C(111) Monochromator	35 $\mu\text{m}$	9 $\mu\text{m}$	3 $\mu\text{m}$	$3 \times 10^9$

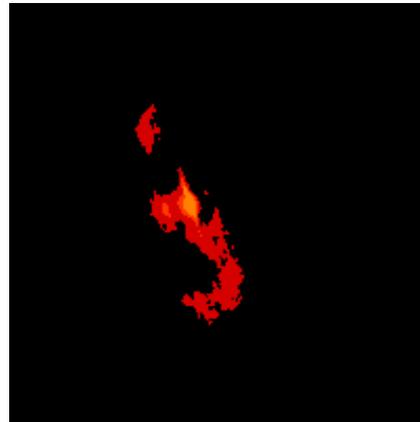


# 3D Diffraction Data 1 micron Au crystal

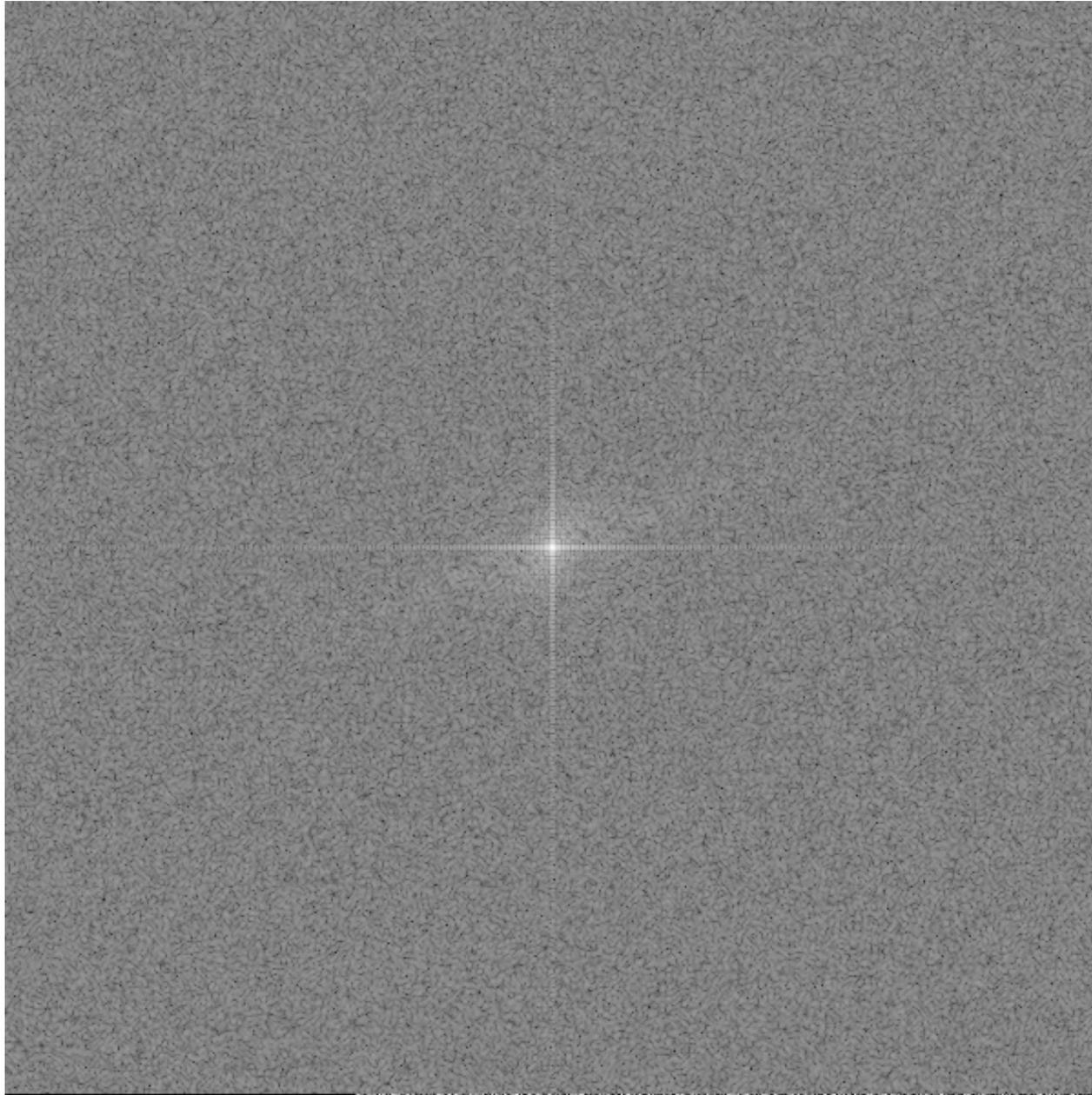


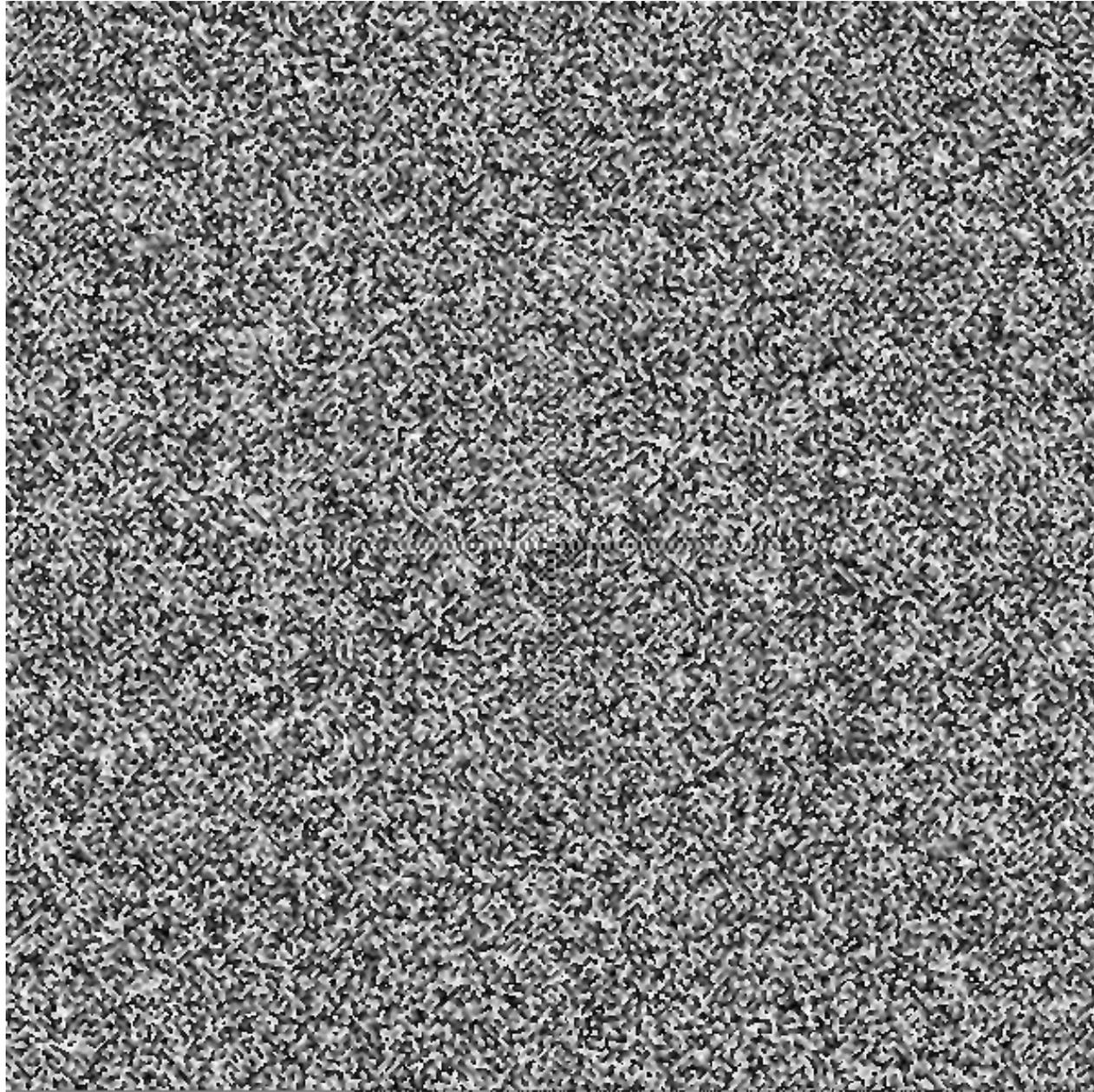
\* Center is Symmetric \*

# 30 frames of 3D reconstruction 1 micron gold crystal

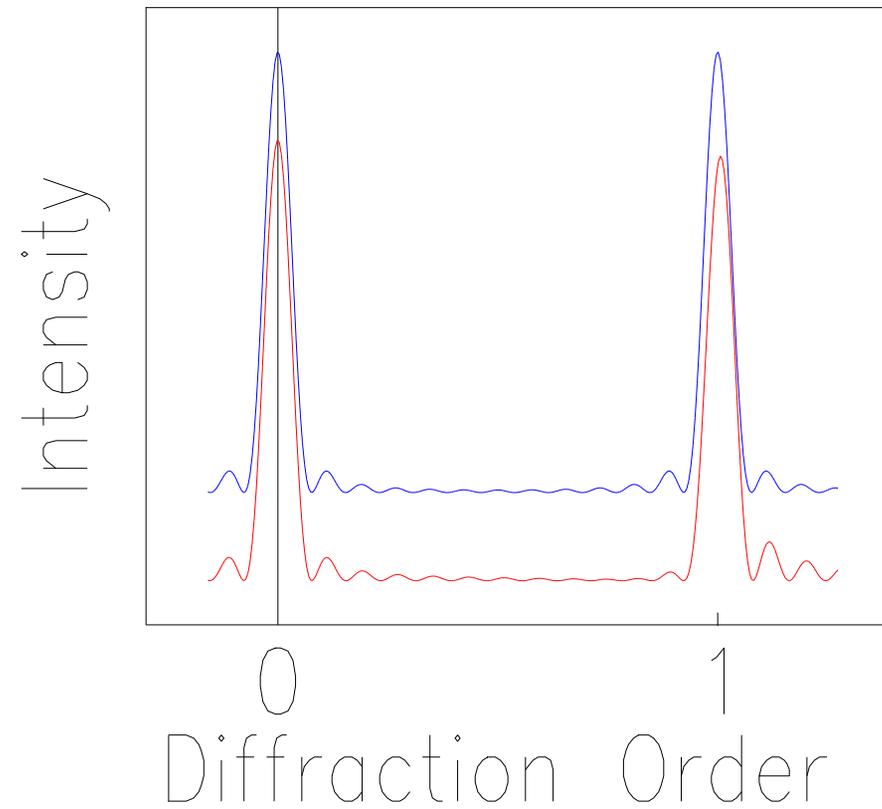
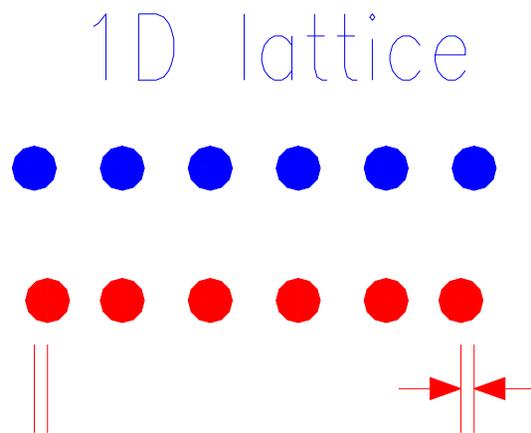


\* CENTER \*





# Imaging of Lattice Strains



# Conclusions

- “Diffuse” scattering acquires fine structure
- Surface/interface morphology
- Shapes of small particles
- CXD facility almost ready
- Potential applications
  - Atomic-scale fluctuations
  - Imaging of strain fields