Shapes of Nanocrystals using Coherent X-ray Diffraction

- Ian Robinson
- Ivan Vartanyants
- Mark Pfeifer
- Garth Williams

Department of Physics
University of Illinois

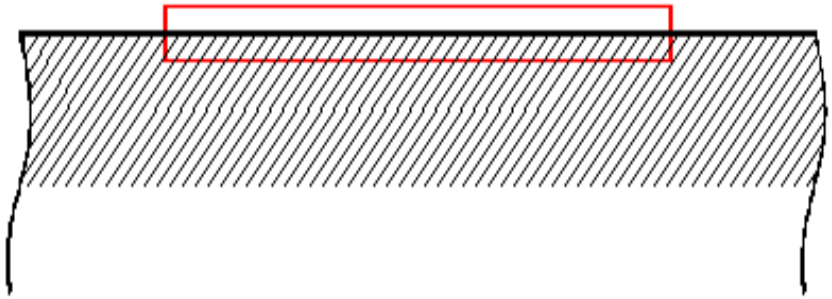
APS March Meeting
18 March 2002, Indianapolis

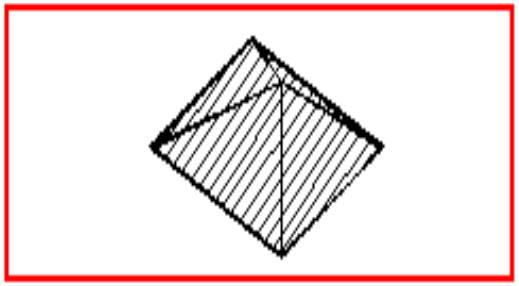
Outline

- Principles of Coherent X-ray Diffraction
- The Phase Problem
- Surface Morphology
- Nanocrystal Shapes
- Applications to Strain Mapping

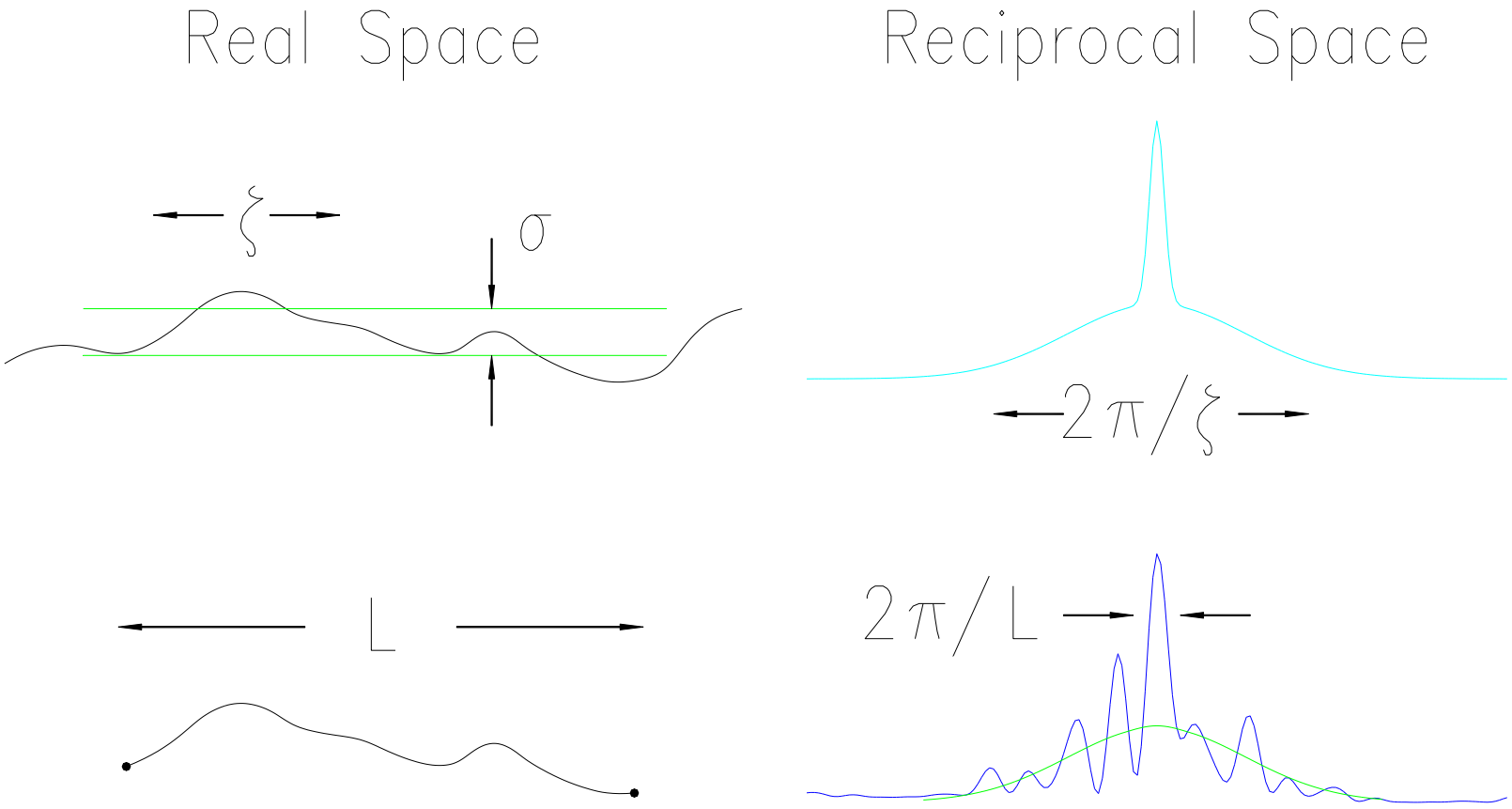
Coherence at the APS

Coherence of	ξ_{VER}	ξ_{HORIZ}	ξ_{LONG}	Flux
Raw Undulator	35μm	9μm	0.004μm	2×10^{12}
Si(111) Monochromator	35μm	9μm	1μm	1×10^{10}
C(111) Monochromator	35μm	9μm	3μm	3×10^{9}





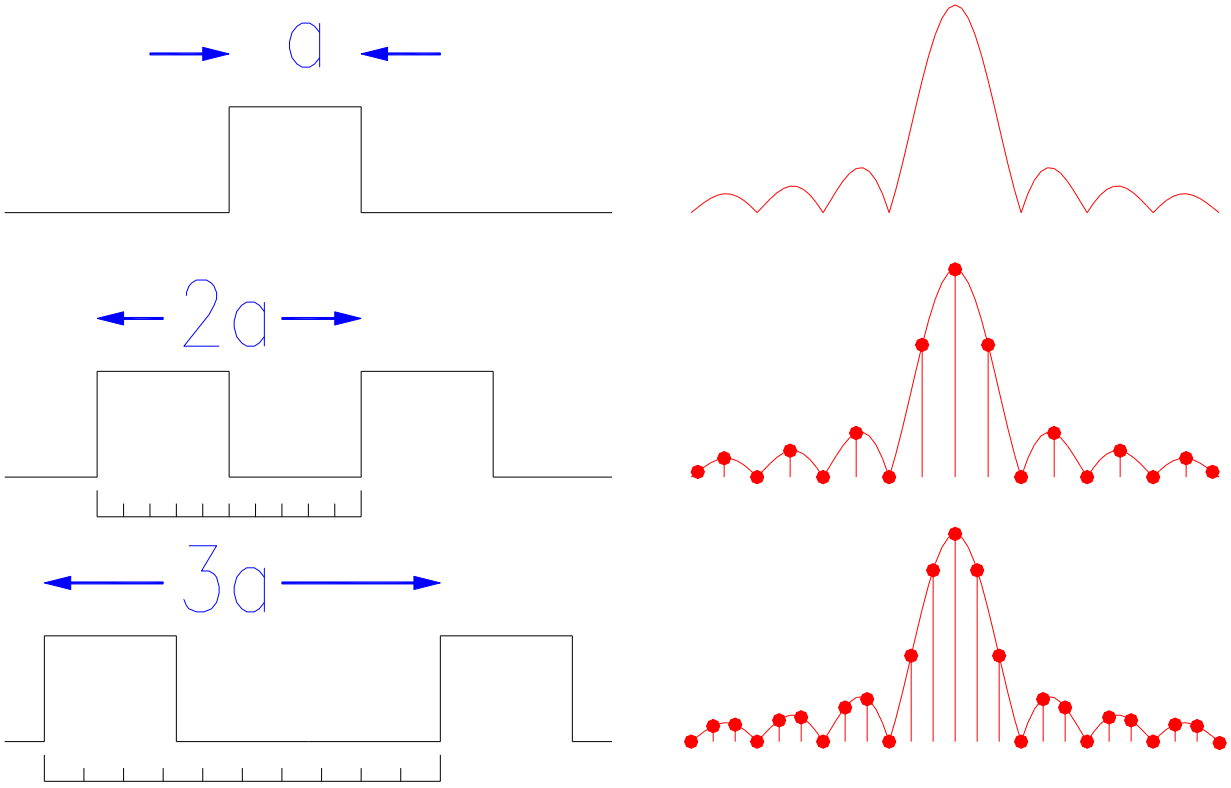
Diffuse Scattering acquires Structure using CXD



Oversampling for Small Crystals

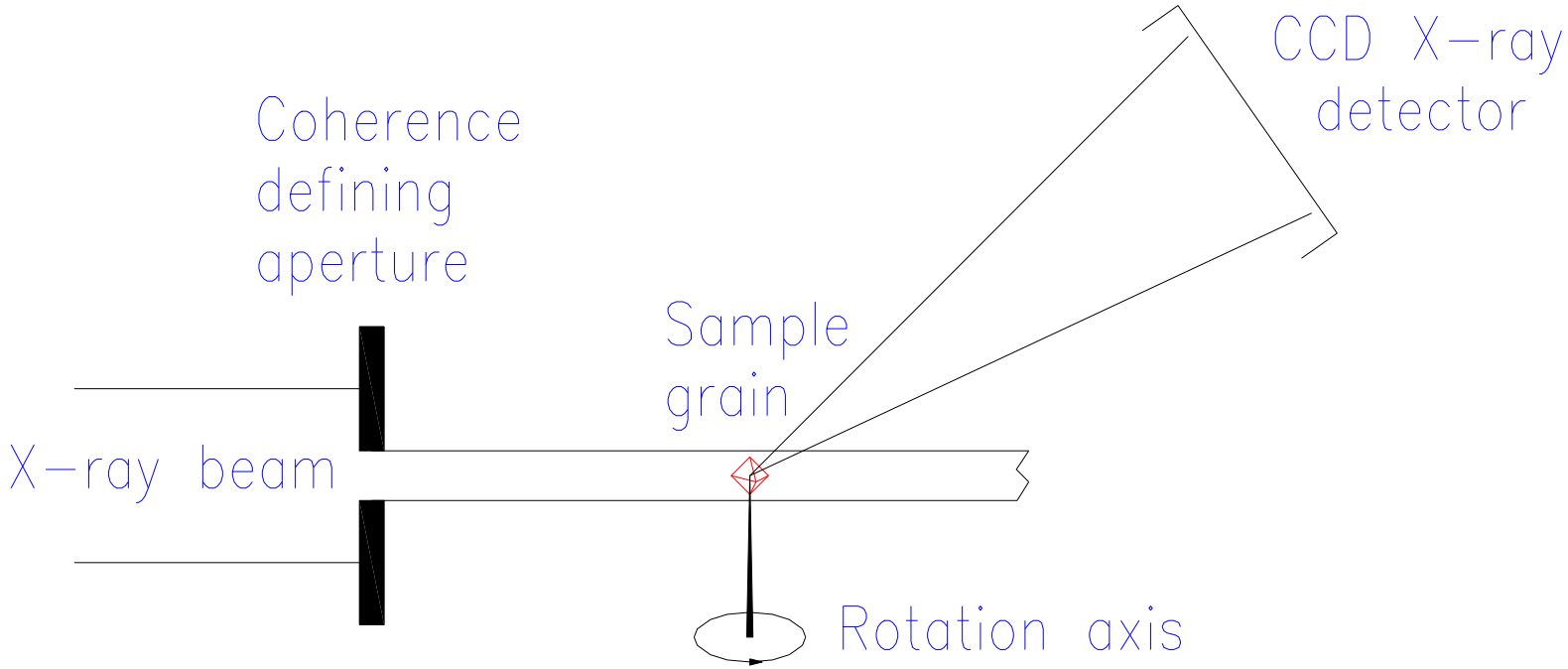
N points in 2a:
N/2 unknowns

N points in 3a:
N/3 unknowns

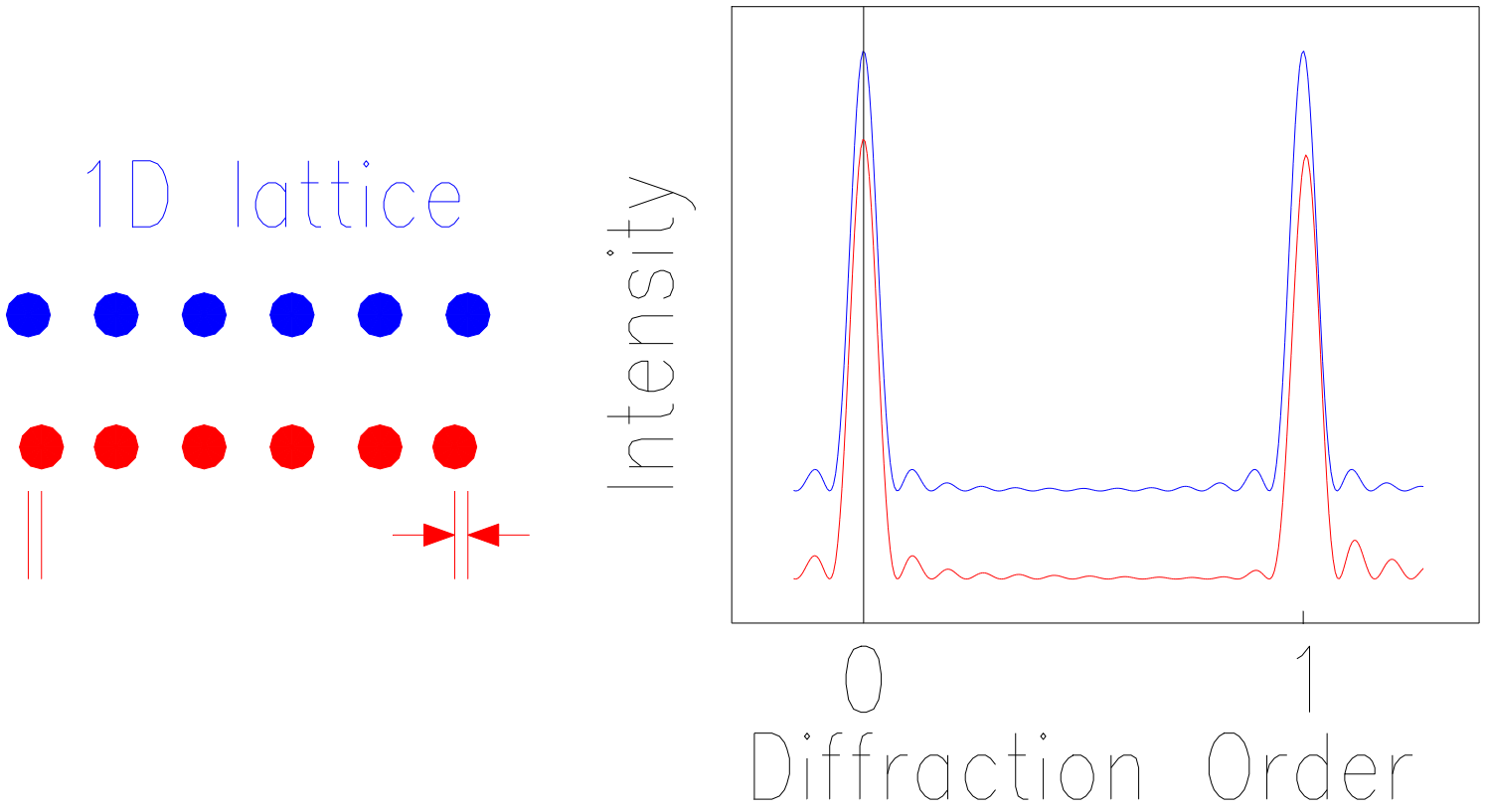


Always N/2 measurements

Lensless X-ray Microscope



Imaging of Lattice Strains



Conclusions

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