Protein Crystals on the Nanometer Scale

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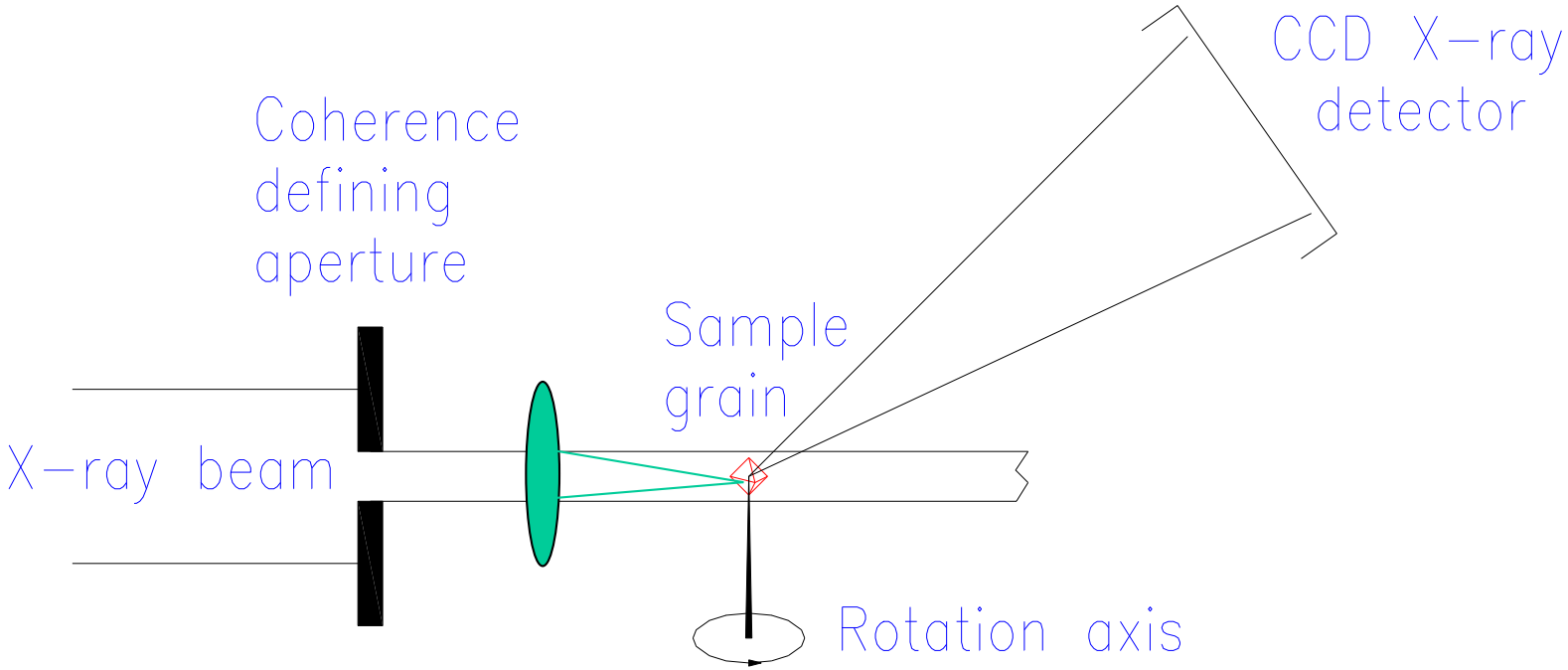
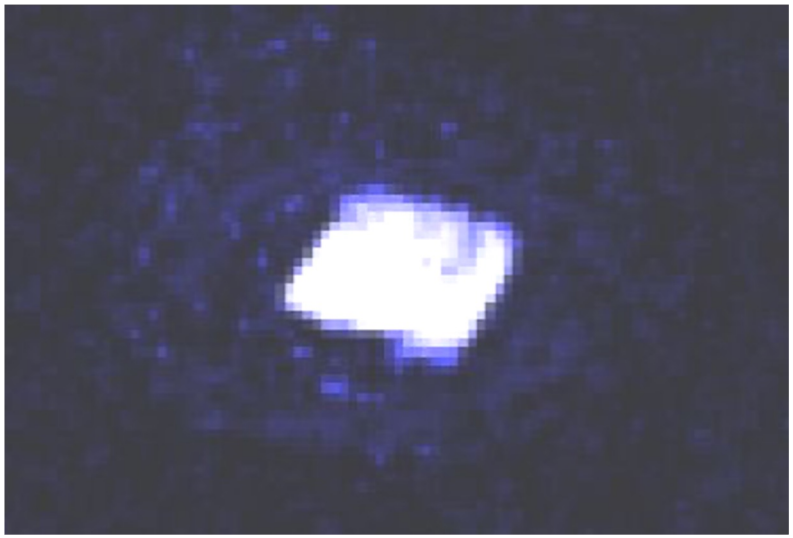
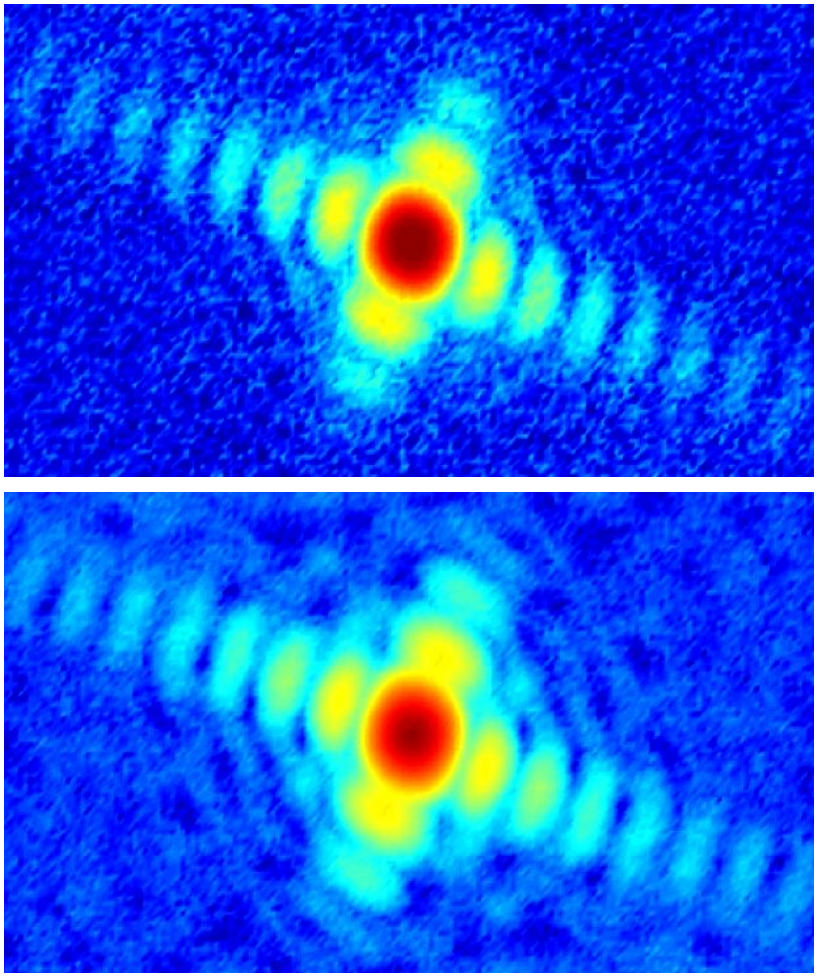
Lensless X-ray Microscope



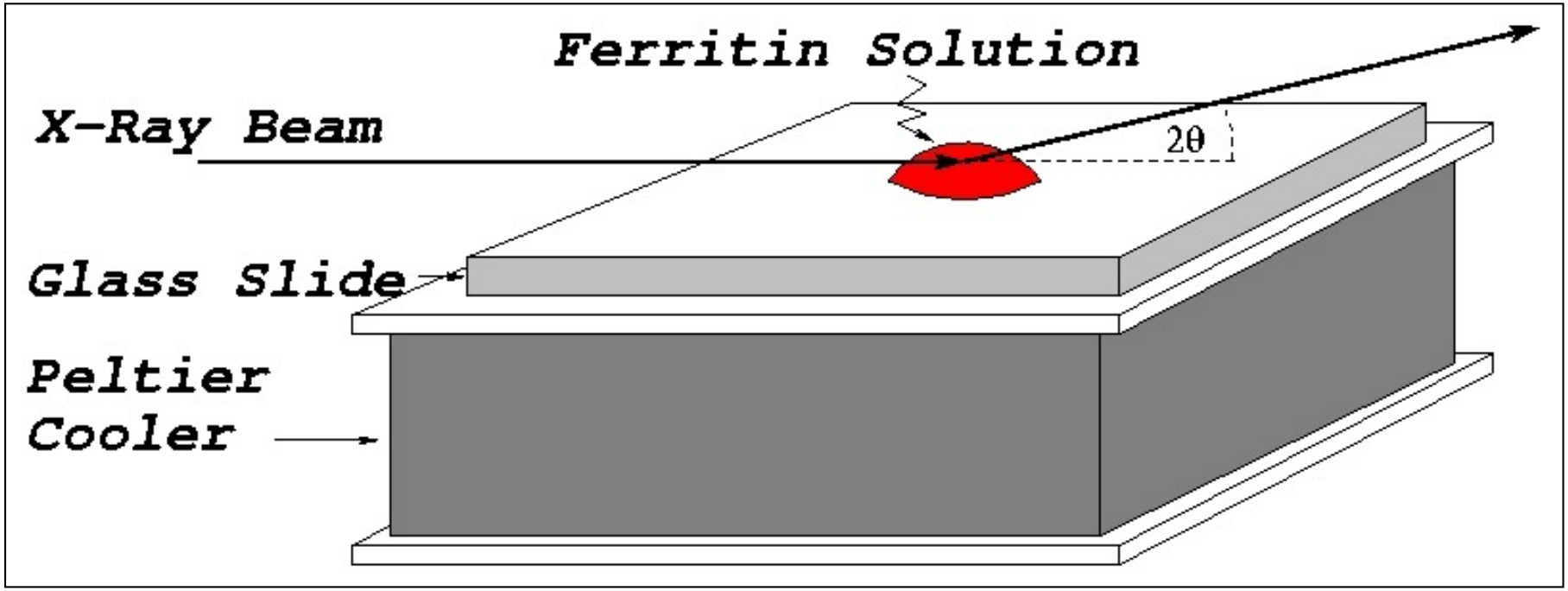
Reconstruction of Ag Nanocrystal



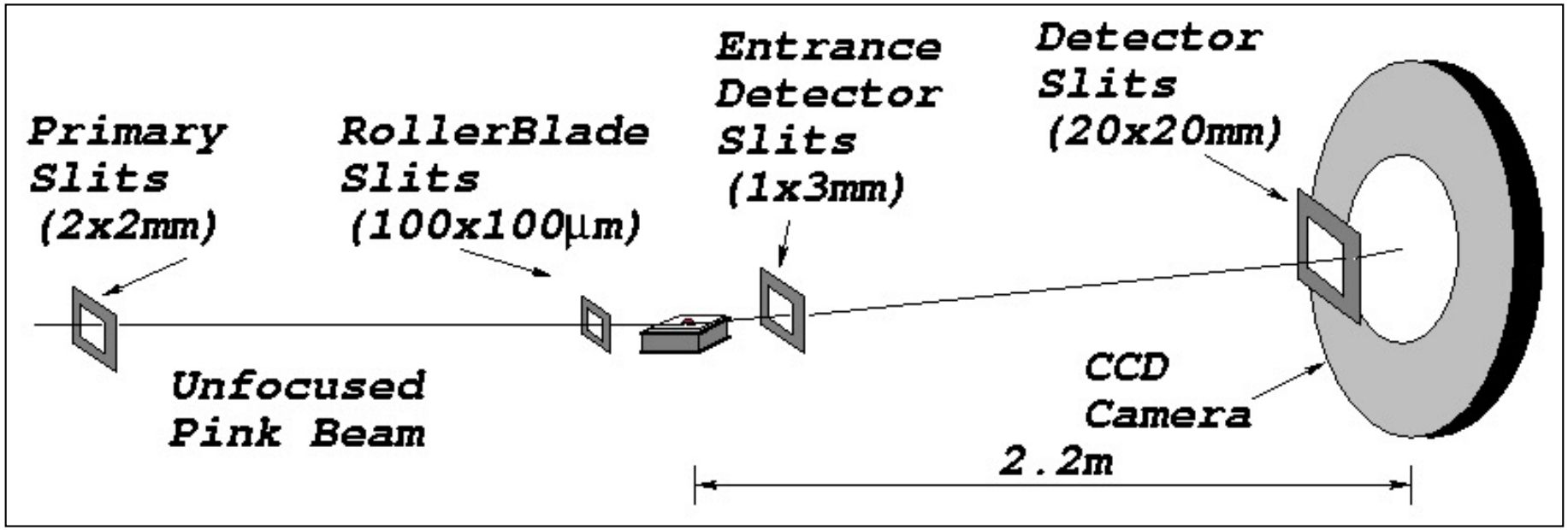
200nm



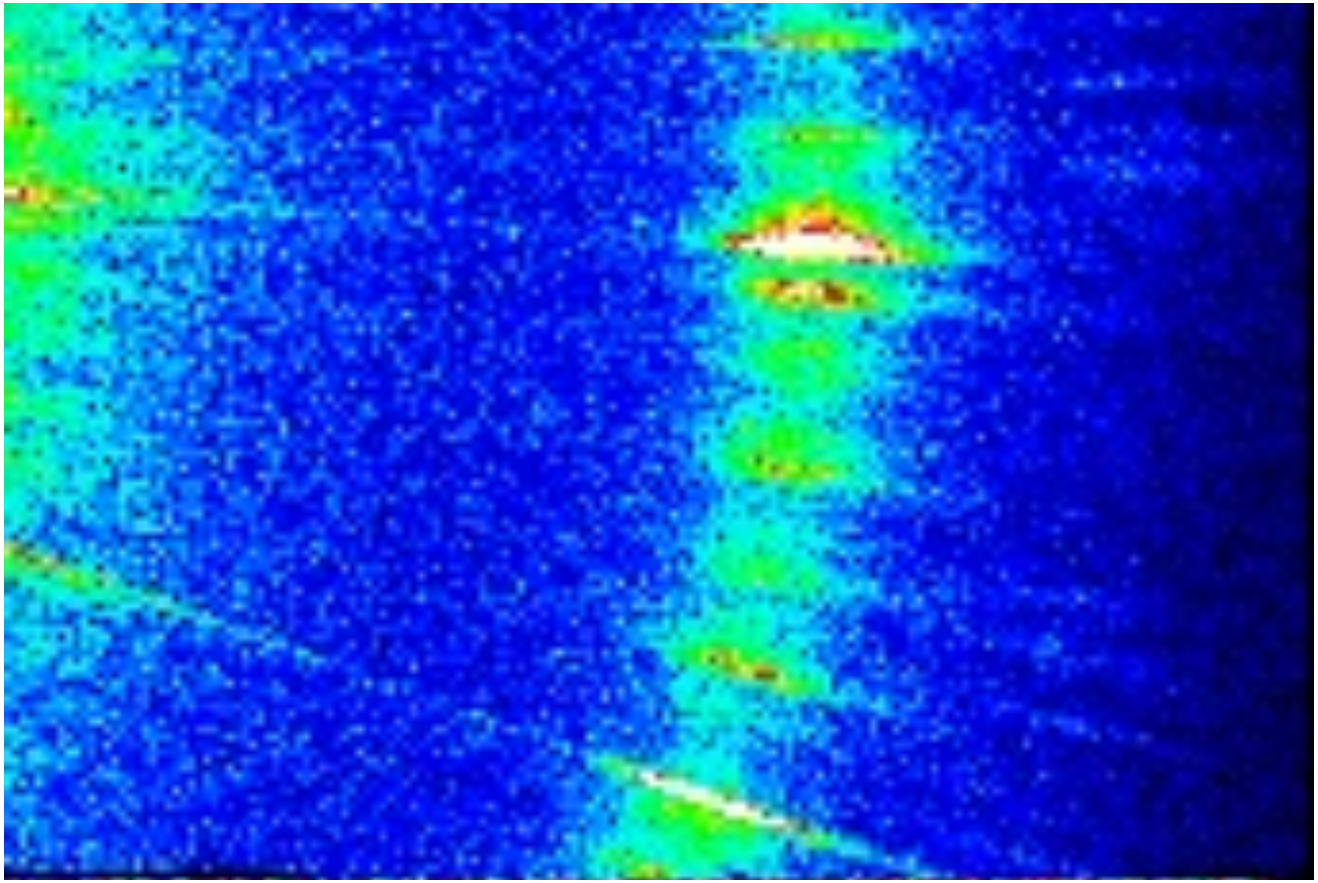
In-situ Study of Crystallization



Experiment at APS Sector 34

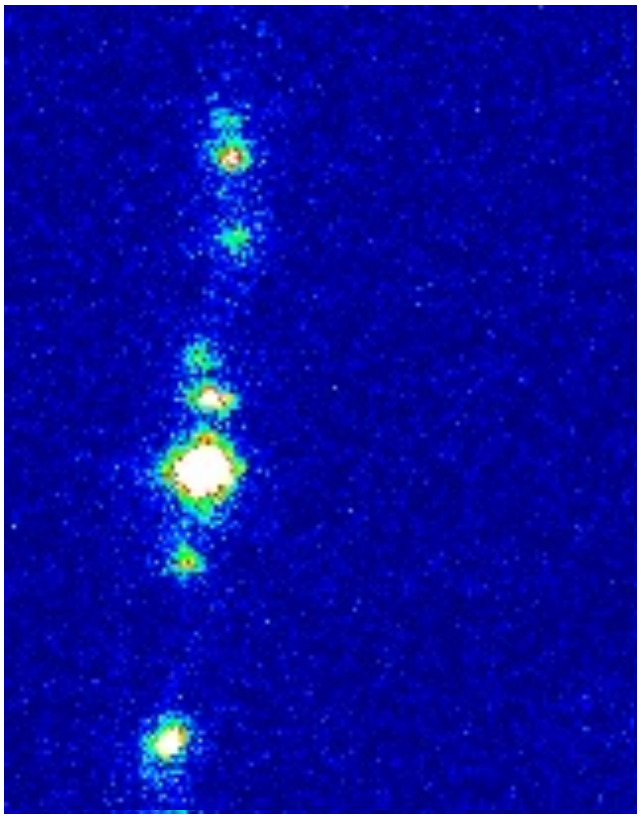


“Pink beam” sees CTRs

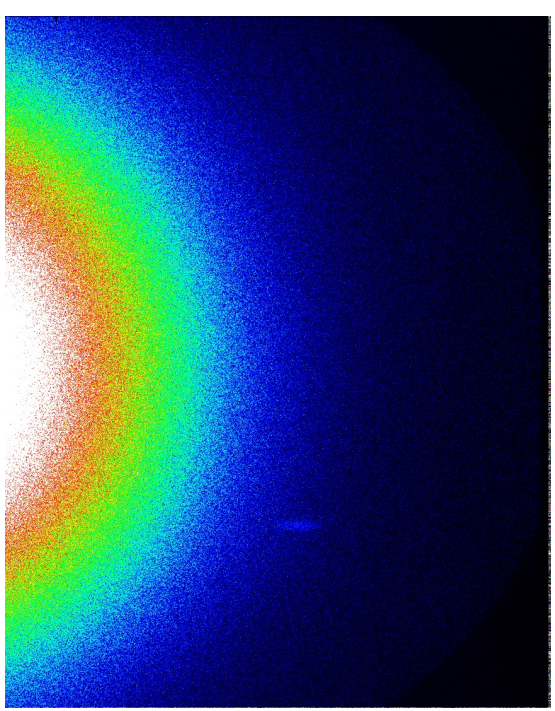


Ferritin (111) Powder Ring

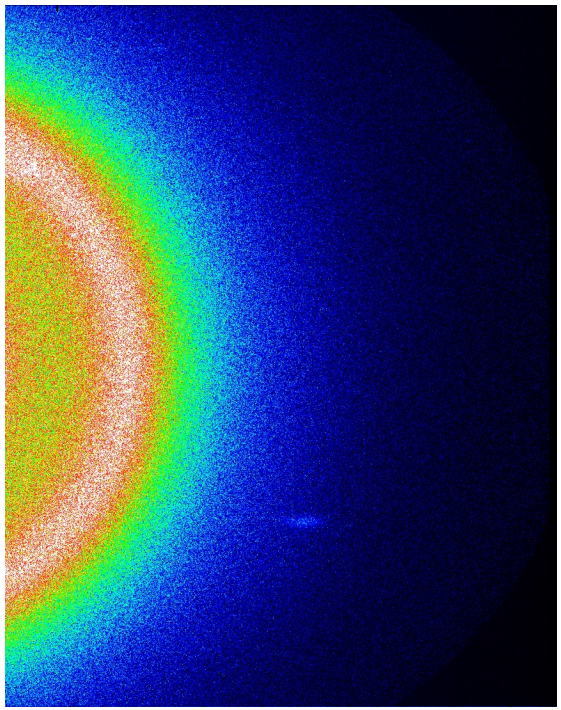
- 50 frames
- 30sec exposure
- 0.3sec playback
- 150x200 pixels of 22.5μm



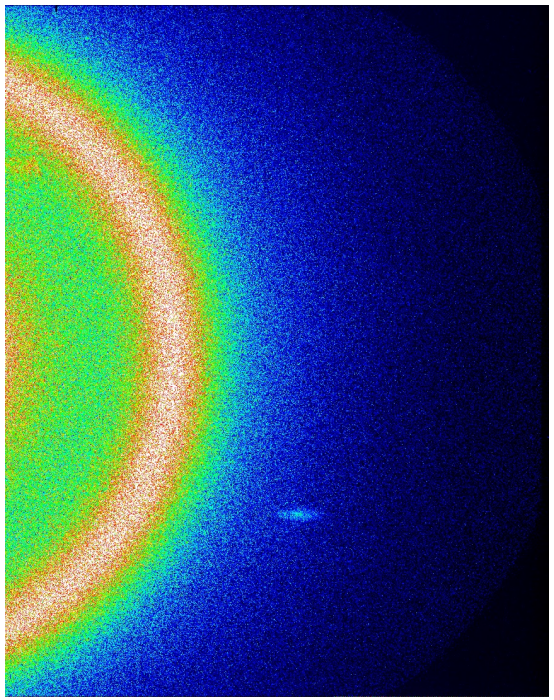
Ferritin Solution upon Freezing



T=13.3

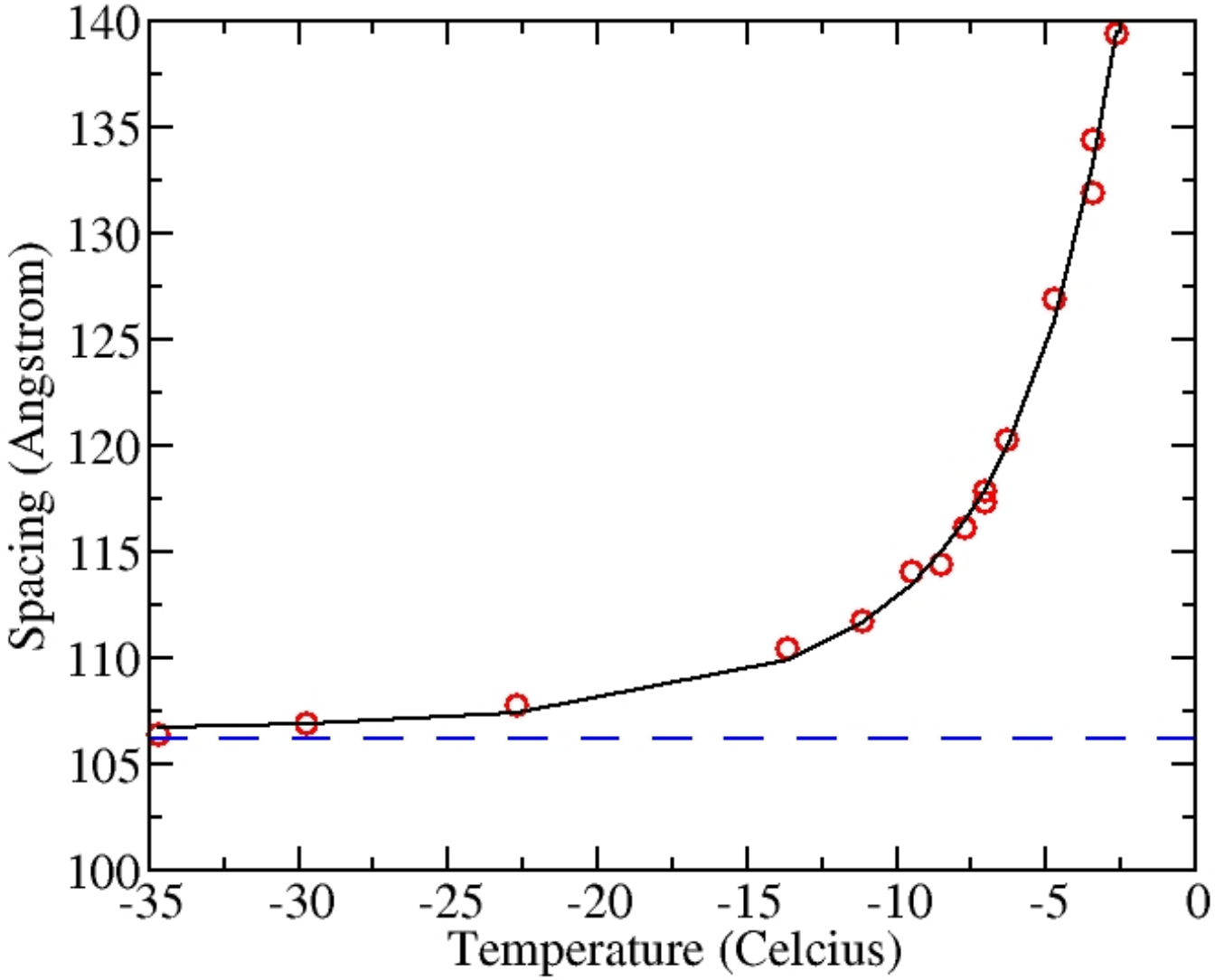


T=-4.7

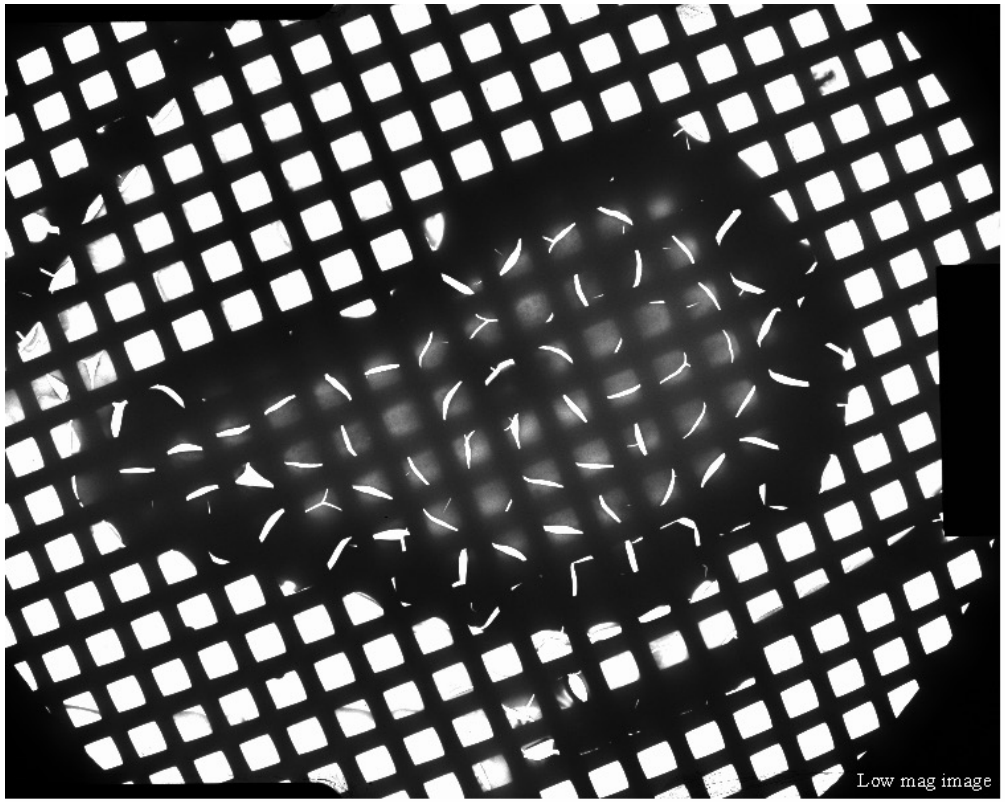


T=-34.7

Temperature Variation of Peak Position

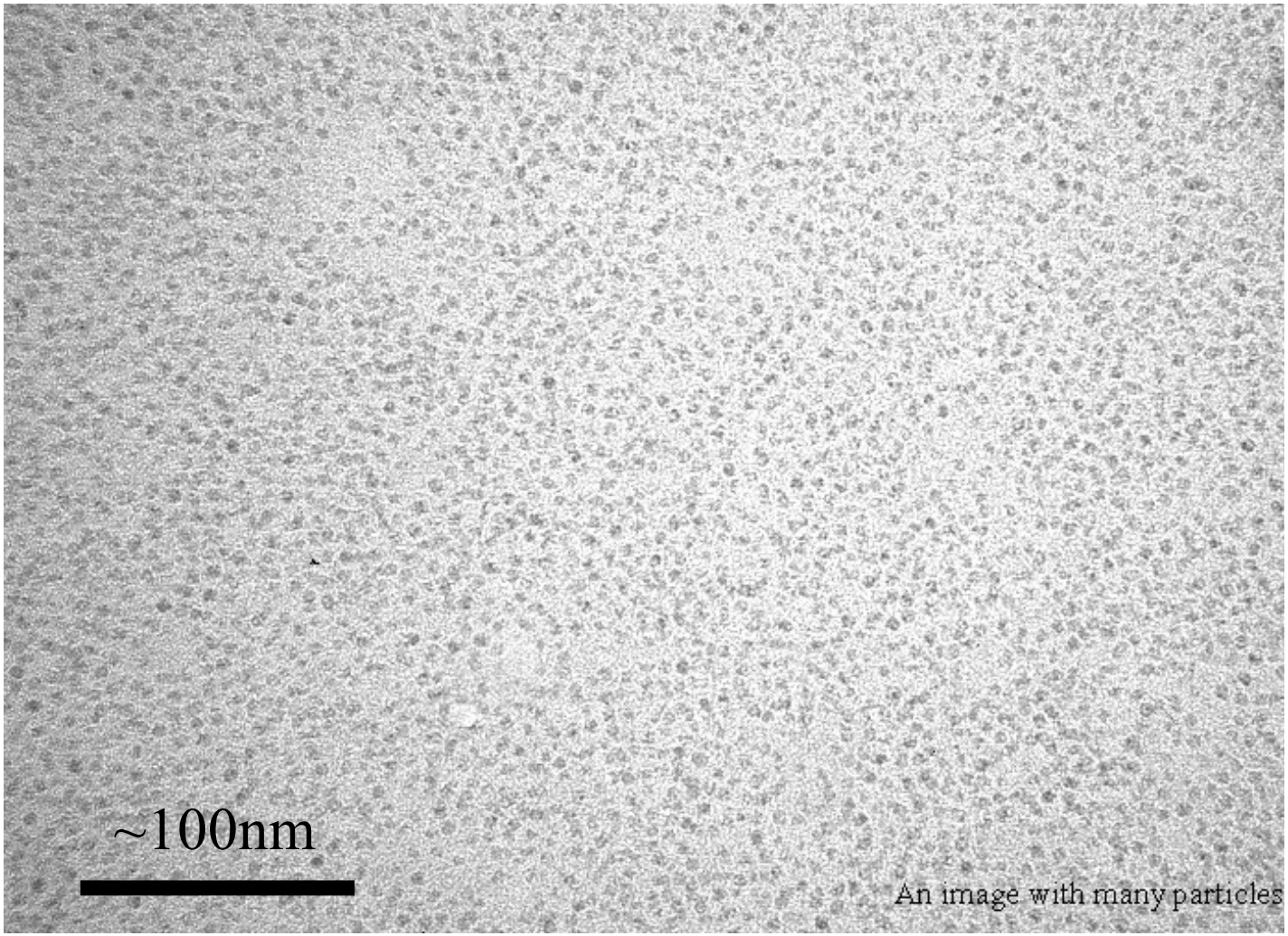


Overview of EM grid

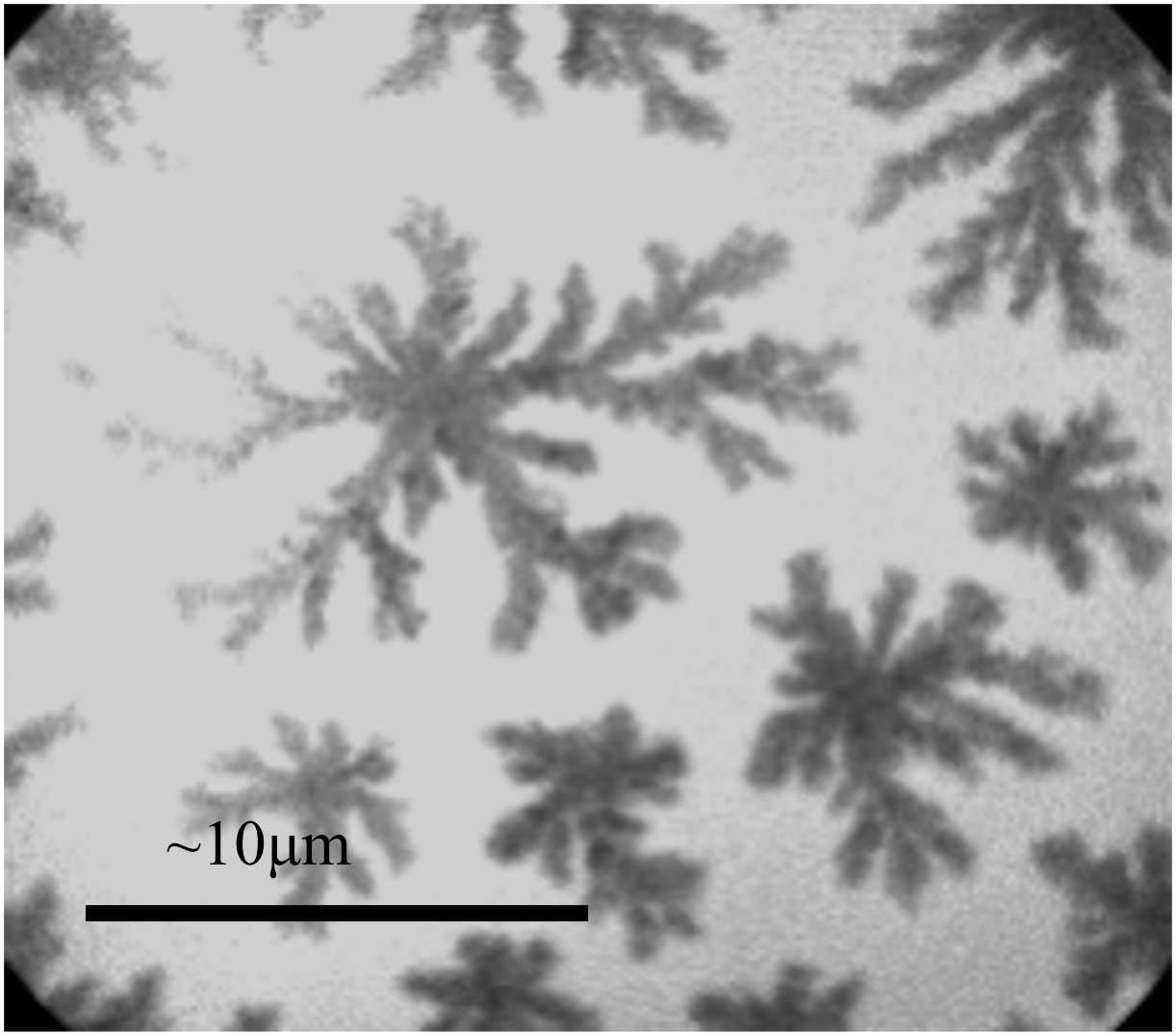


- 3mm diam grid
- a-carbon + "Formvar"
- 10mg/ml Ferritin
- 10mg/ml NaCl
- dipped grid
- dried in air
- no cryo-cooling
  - ▷three regions of different density

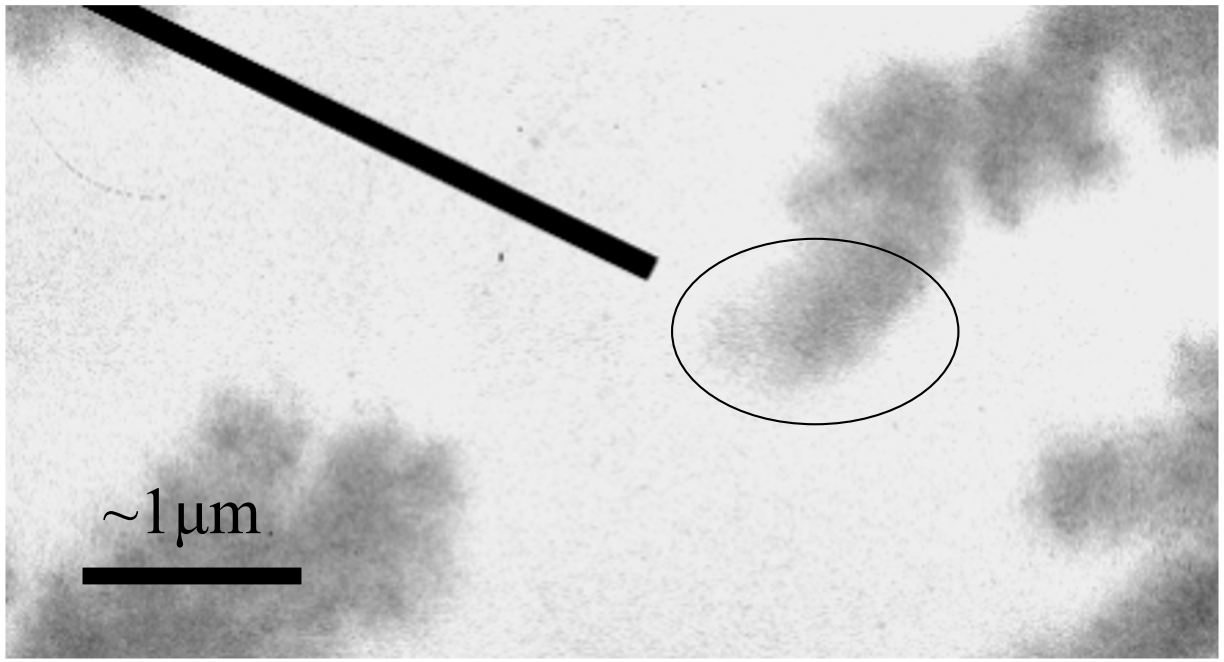
Border Region (low density)



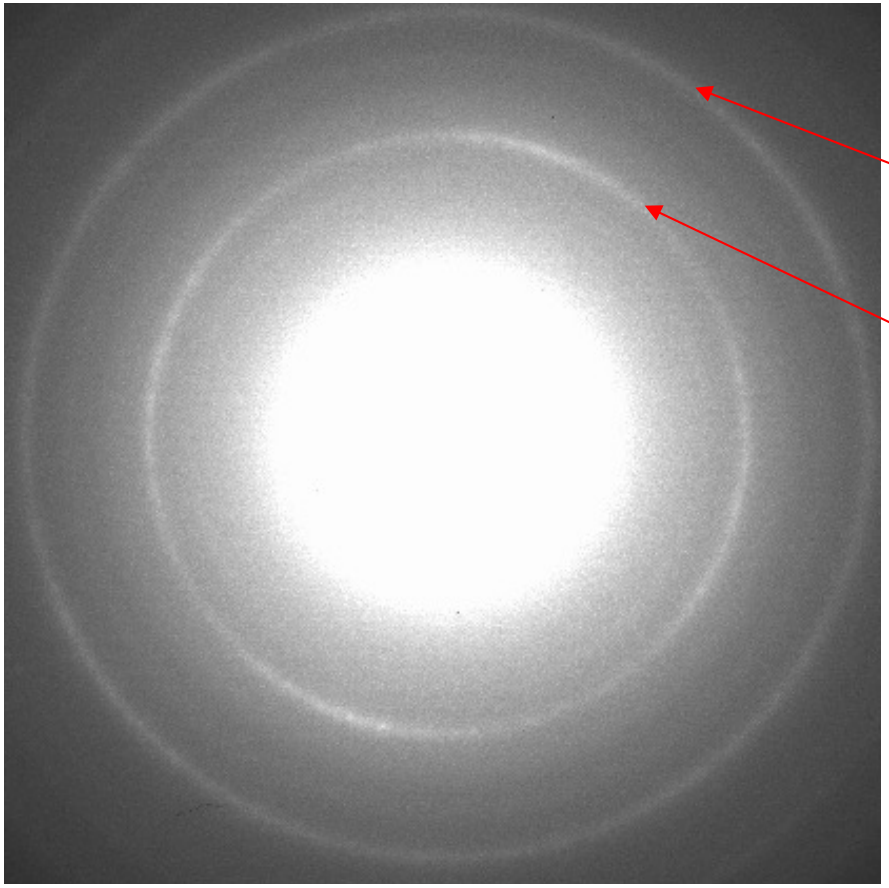
High Density Ring



Select Area around Dendrimer Tip



Selective Area Diffraction



$Q=6.32Å^{-1}$

$Q=4.44Å^{-1}$

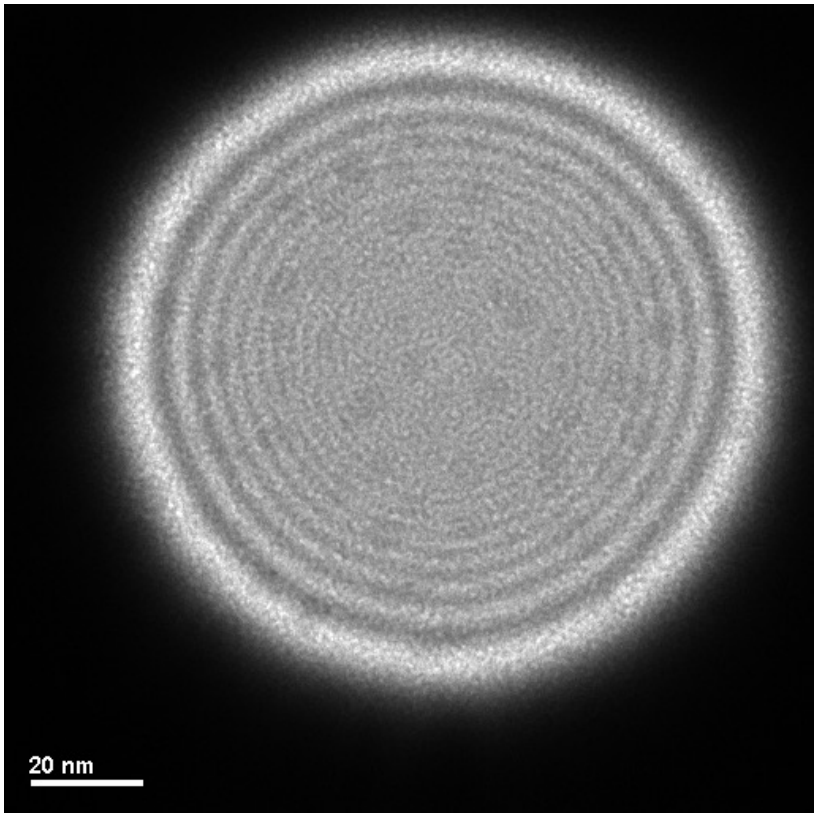
$\lambda = 0.025Å$

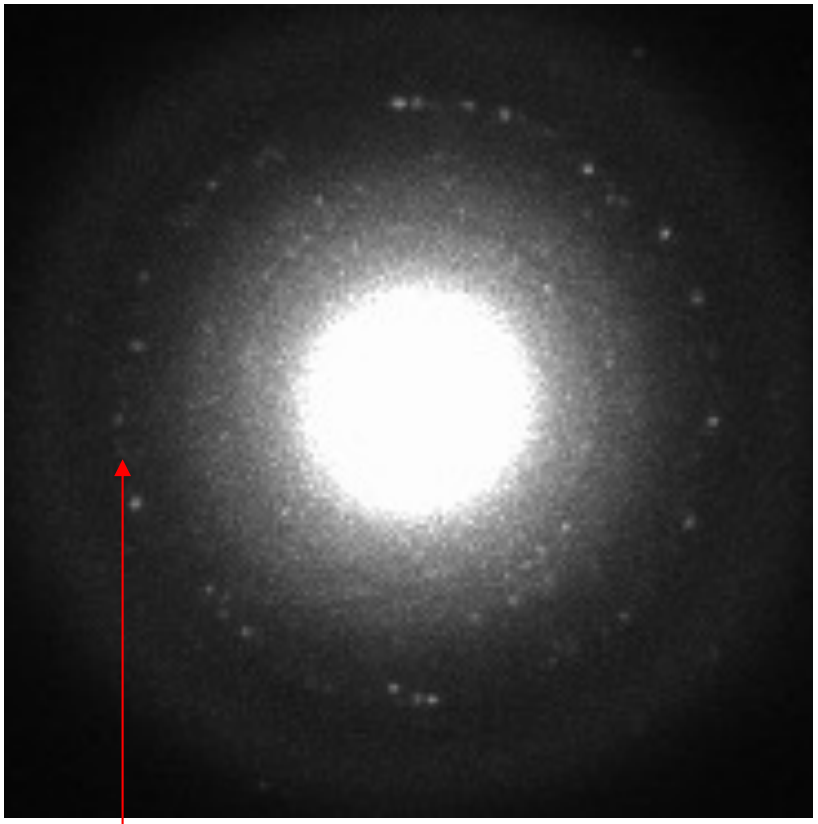
$D = 2.0m$

$R_1=35.4mm$

$R_2=50.4mm$

Diffraction from Border Region

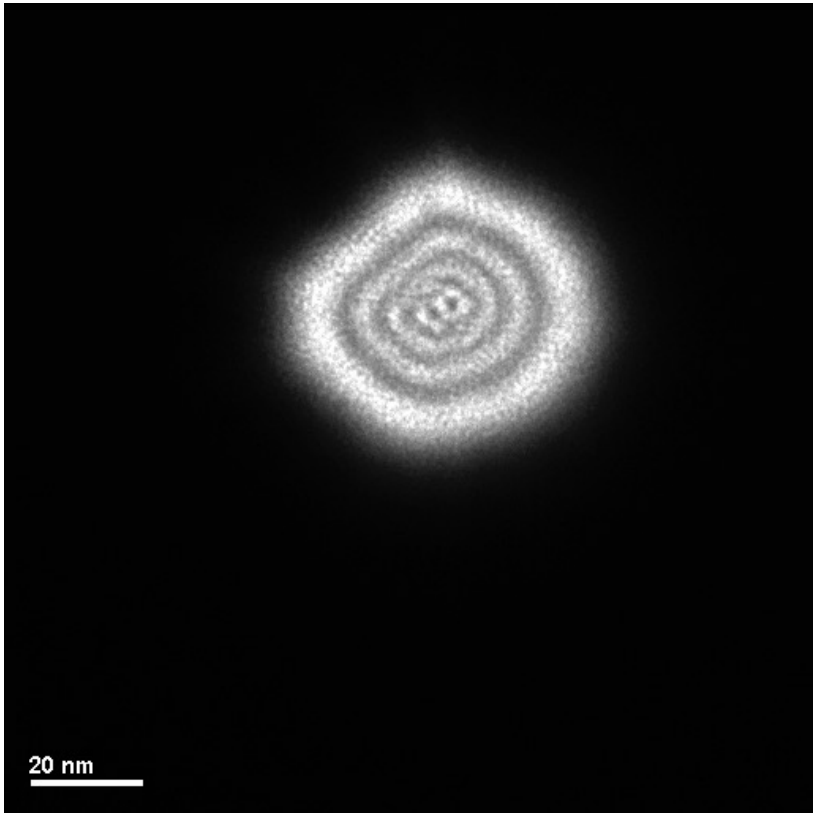


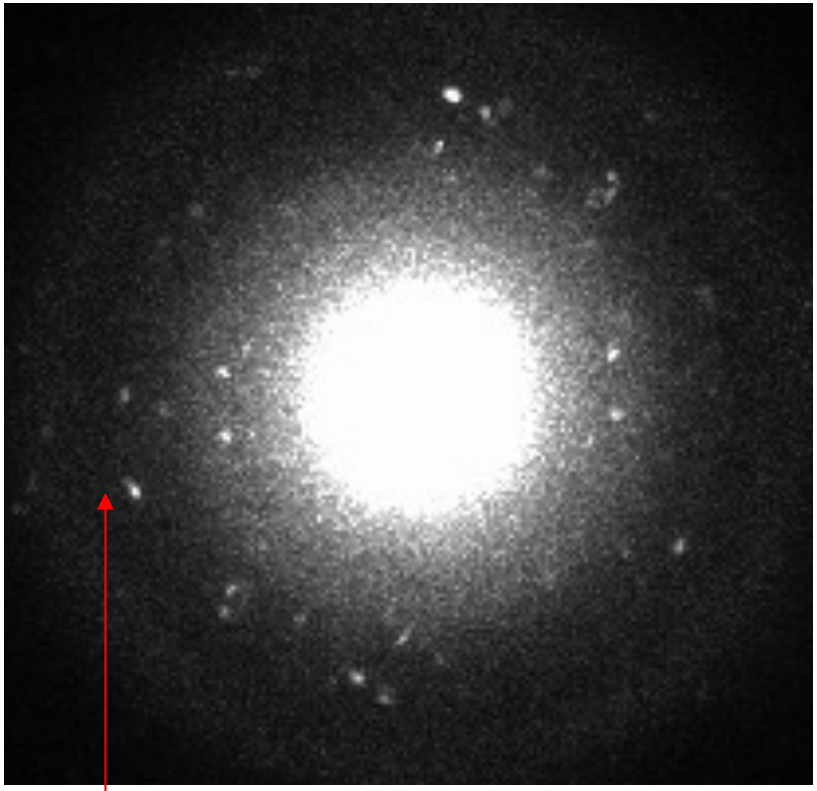


$Q=8.43 Å^{-1}$

Smaller Area Diffraction

Images: picture2 and diffraction4





Q=8.2Å^{-1}

Conclusions

- Coherent X-ray Diffraction works even after focusing optics
- Smallest Ferritin crystals about 3 microns
- Implode upon radiation damage
- Expanded aggregate state upon freezing
- Single molecule diffraction ideas can be tested by electron diffraction