

# On-line determination of nanocrystal lattice parameters

*Question:* Is near-automatic on-line measurement of Bravais lattice parameters for an arbitrary nano-crystal possible with a sub-Å microscope? *Answer:* Yes, IF...

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Dr. H. Siriwardane (UM-StL)

Dr. W. James (UMR)

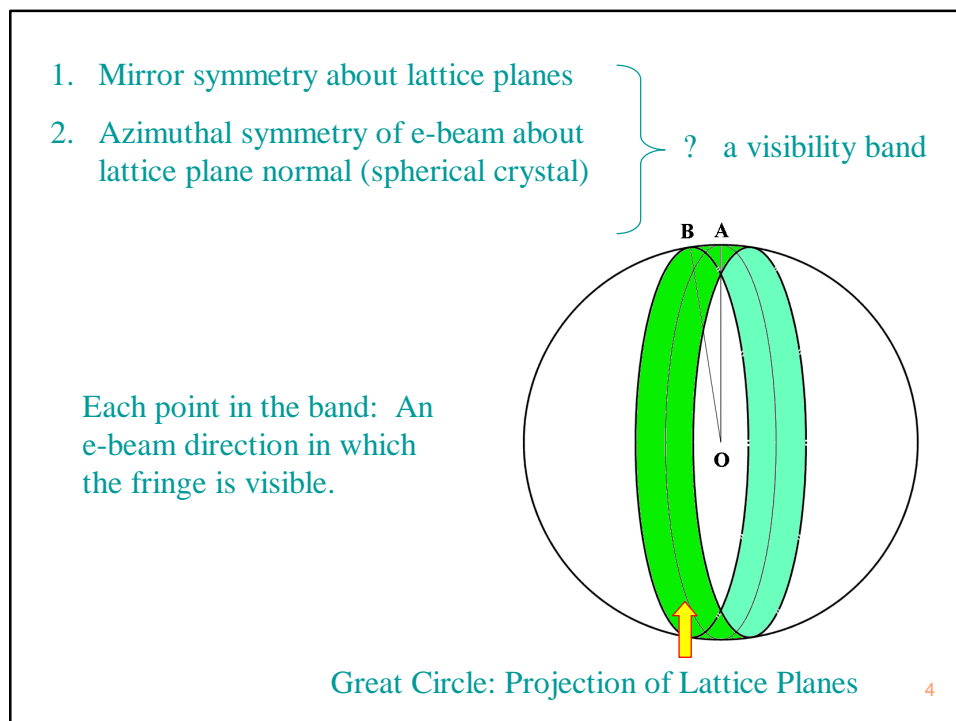
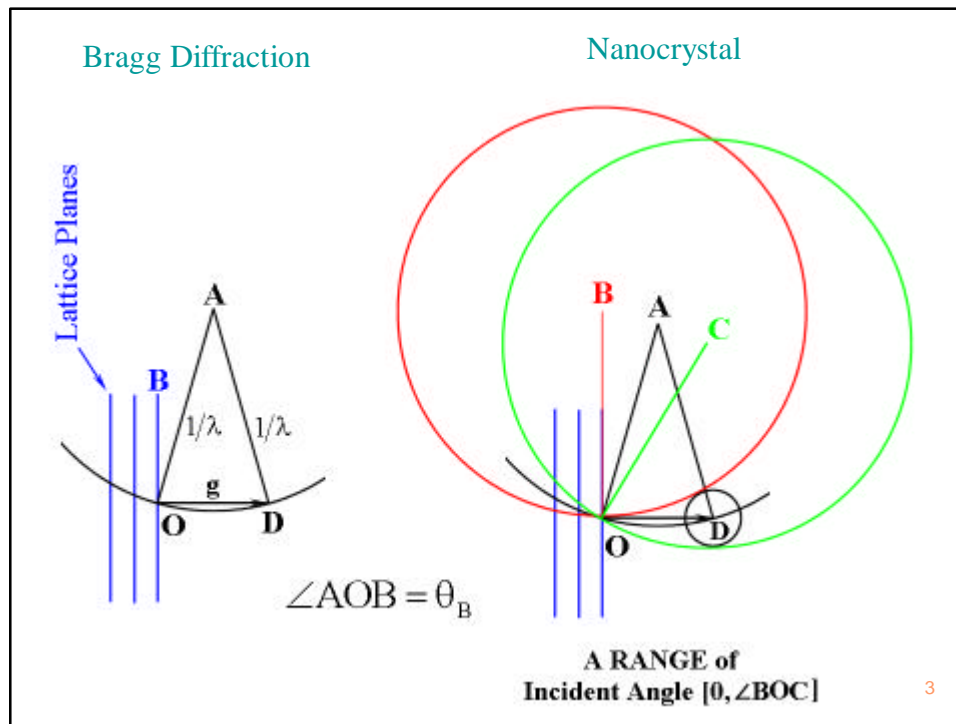
Dr. W. Shih (UMR)

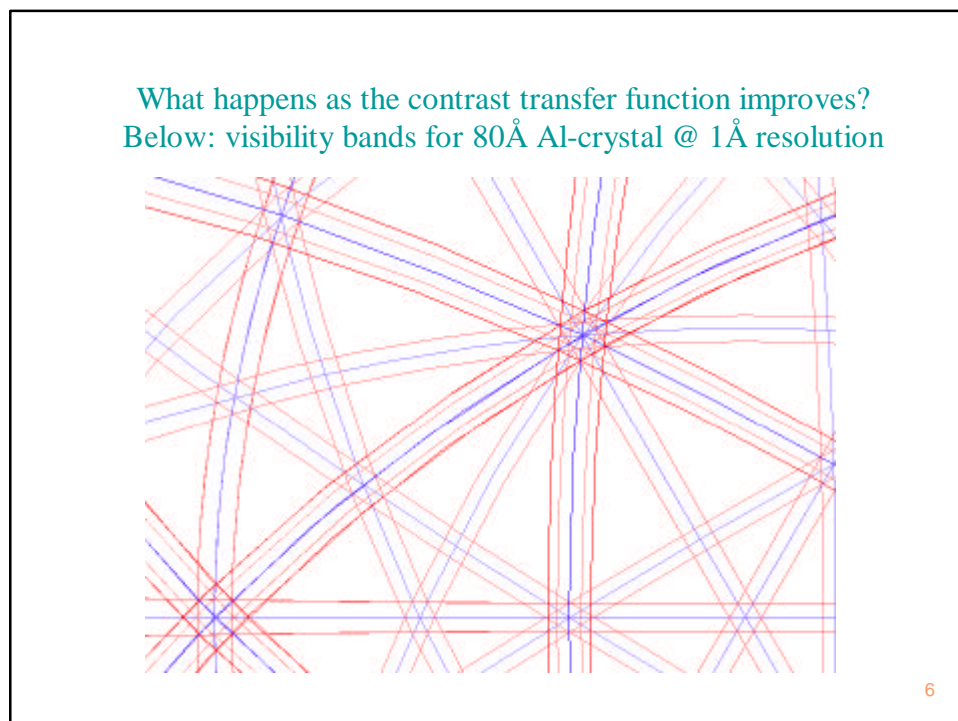
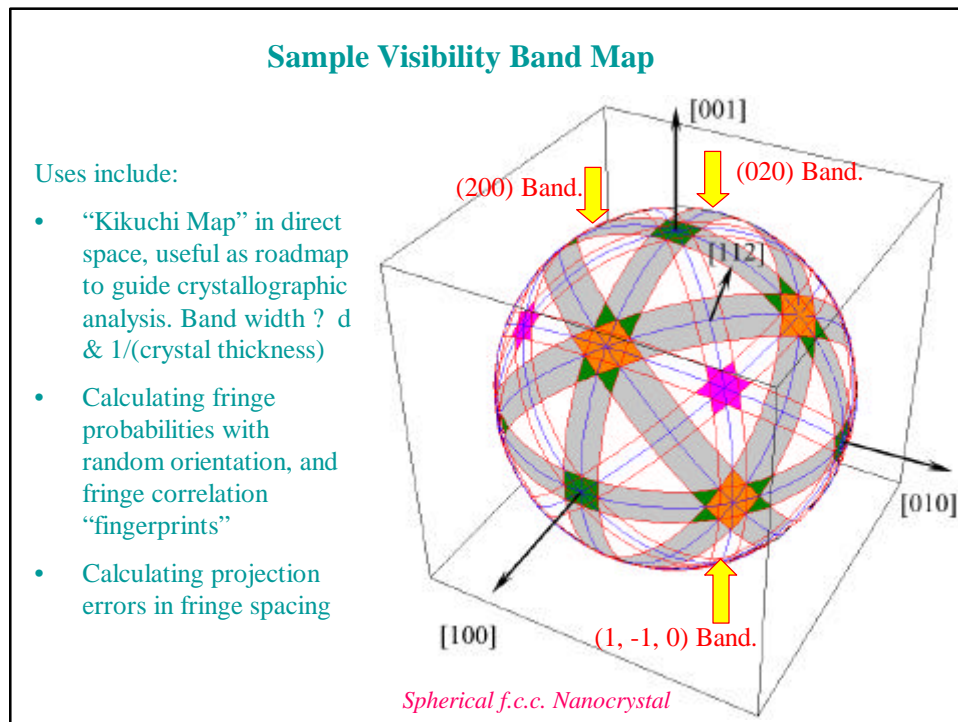
Dr. J. Newkirk (UMR)

Eric Mandell, Jon Bailey (UM-StL)

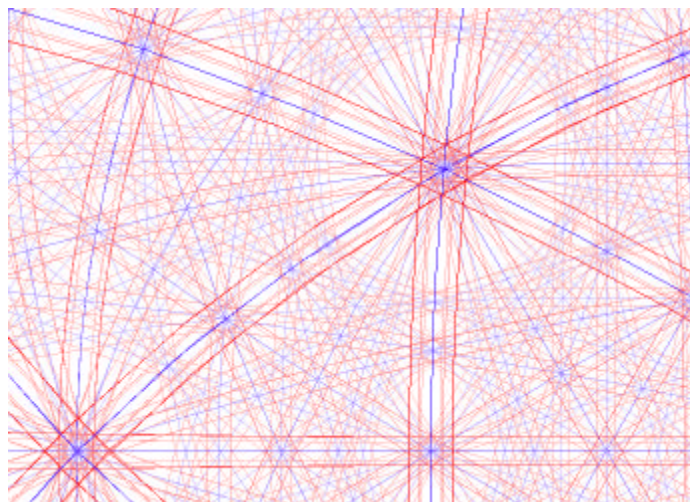
EMS OnLine for Model Drawings  
(<http://cimewww.epfl.ch/CIOL/>)

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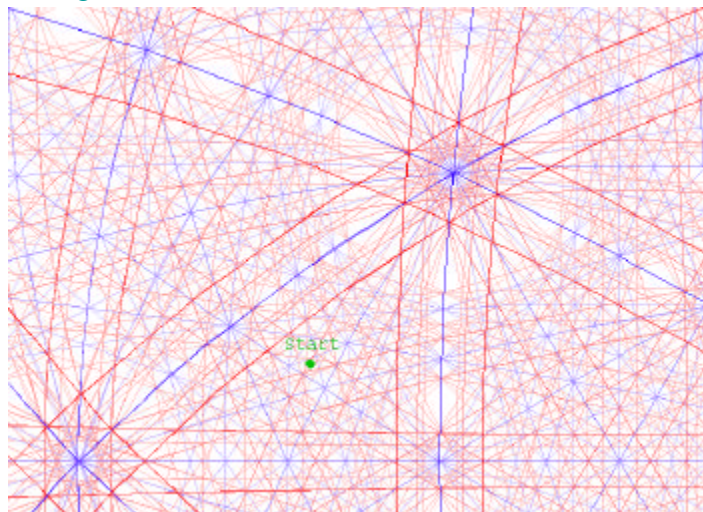


At  $0.6\text{\AA}$  resolution, of course fringes may be seen at most orientations. Now, what if the grain size is even smaller?



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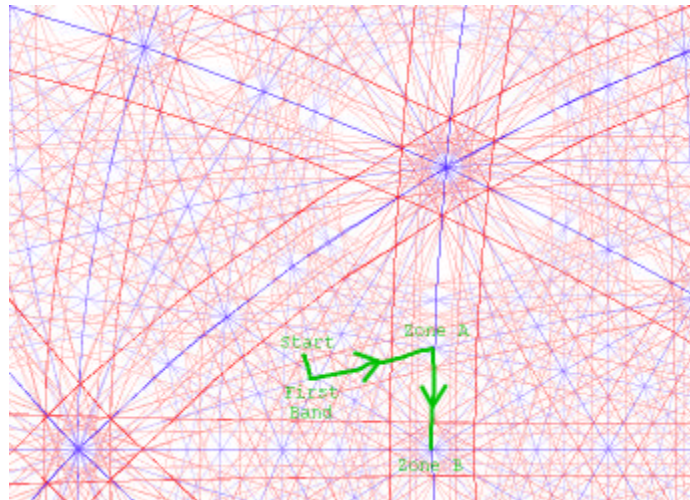
For  $30\text{\AA}$  grains, the visibility bands have widened, so seeing fringes tells us less about orientation. What now?



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*Given fine 2D tilt control, an elegant protocol follows...*

- \* Find “large” spacing.
- \* Maximize it.
- \* Tilt along it to 1<sup>st</sup> cross fringe set A.
- \* Maximize cross fringe.
- \* Tilt along it to 2<sup>nd</sup> cross fringe set B.
- \* Etc. to C, D, over full tilt range...



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## Discussion/Summary

- ⌘ Three non-coplanar spacings yields a subset of, & often the full, 3D reciprocal lattice.
- ⌘ N spacings from N-1 zones over the available tilt range yields/minimizes errors as described in *Ultramicroscopy* 6 (1981) 227-236.
- ⌘ TEAM design request: develop fine (e.g. 0.1 degree) automated double-axis tilt control.
- ⌘ For more, cf. *Ultramicroscopy* 94 (2003) 245-262, and arXiv:cond-mat/0212281.

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