Final Paper Outline

1. Abstract
   1. Overview of channeling radiation
      1. Physical properties
      2. Applications
   2. Purpose of PCR code – to simulate channeling radiation spectra in crystal
   3. Discrepancies between PCR and theory
      1. Linewidth underestimated
      2. Photon yield overestimated
   4. Sources of error
      1. Linewidth – only broadening due to coherence length included
      2. Photon yield – unrealistic peak shape (hypothesis for now)
   5. Product – new and improved PCR code with accurate linewidths and photon yields
   6. (Possibility) Brief explanation of A0 experiment
2. Introduction
   1. Physical explanation of channeling radiation
      1. Inter-planar potential
      2. Line-broadening mechanisms
      3. Photon yield derivation
   2. Properties of CR that make it desirable
      1. Highly monochromatic peaks
      2. High intensity
   3. Real-world applications
      1. Medical imaging
      2. Military – vehicle scanning
3. PCR Code
   1. Purpose of PCR code – to simulate planar channeling radiation spectra of relativistic electrons channeled along the planes of a crystal
   2. Inputs
      1. Electron energy
      2. Crystal type
      3. Miller indices of plane
      4. Crystal thickness
      5. Incident angle of electrons with crystal
   3. Outputs (with examples)
      1. Potential
      2. Probability densities
      3. Initial state populations
      4. State populations vs. depth
      5. CR spectrum
   4. Comparison of peak energies with theory and experiment
      1. Plot comparison
      2. Analysis and summary of data
      3. Explanation of our satisfaction
4. Problems with Code
   1. Linewidth
      1. Plot comparison
      2. Analysis and summary of data
      3. Source of error – inclusion of only broadening due to coherence length
      4. Comparison with theory
   2. Photon yield
      1. Plot comparison
      2. Analysis and summary of data
      3. Source of error – use of different peak shape than in theory (not yet confirmed)
      4. Comparison with theory
5. Solutions to Problems
   1. Linewidth
      1. Broadening due to multiple scattering
         1. Explanation of theory
         2. Interesting improvement of Azadegan’s theory
         3. Application in code
         4. Data, plot, and summary of linewidth contribution
      2. Bloch-wave broadening
         1. Explanation of theory
         2. Application in code
         3. Data, plot, and summary of contribution
      3. Other effects (undecided)
      4. Method of combining effects (undecided)
      5. Total application in code
   2. Photon yield (expected)
      1. Summary of theory behind desired line shape
      2. Explanation of line shape in PCR
      3. Method of correction
      4. Data, plot, and summary of improvement
6. Final product
   1. Summary of improvements made to PCR
   2. Full comparison of improved code with theory and experiment
7. (Possible) A0 experiment
   1. Summary of experiment parameters
   2. Schematic of experiment
   3. Explanation of my role
   4. Comparison of data from A0 with new PCR calculations (unlikely, because code will not work at low energies)
8. Discussion (have not thought about yet)
   1. Uses for the new code
   2. Possible improvements in future
9. Acknowledgements
10. Sources cited