

Searching for Helimagnets within ternary crystal structures

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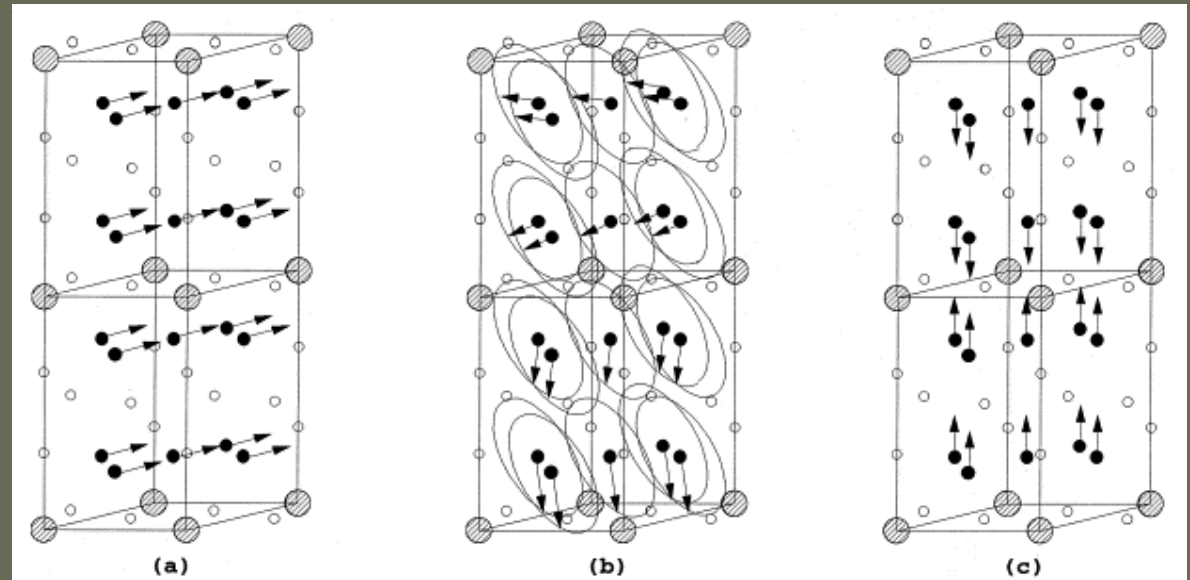
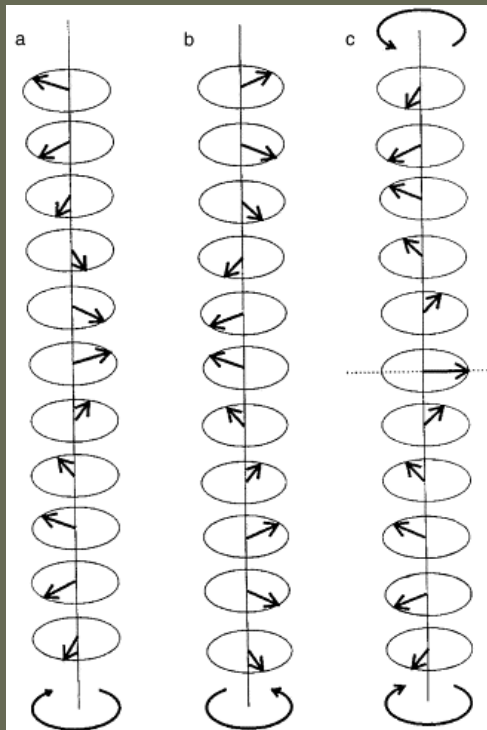
Dr. David Young

La-SiGMA REU 2012

Summer Goals

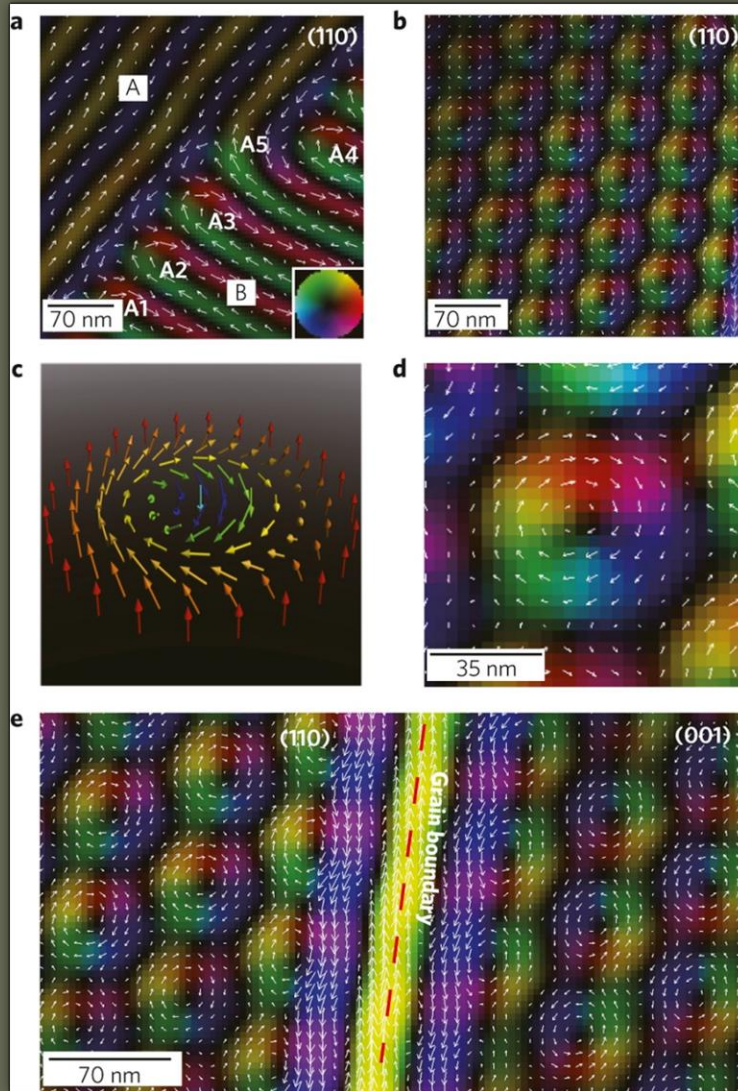
- Develop a rudimentary understanding of helimagnetic materials
- Synthesize prospective compounds
- Determine the phase purity of samples using X-Ray Diffraction
- Measure magnetic characteristics of the sample at varying temperatures

What are helimagnets?



Skyrmions

Magnetic Vortex



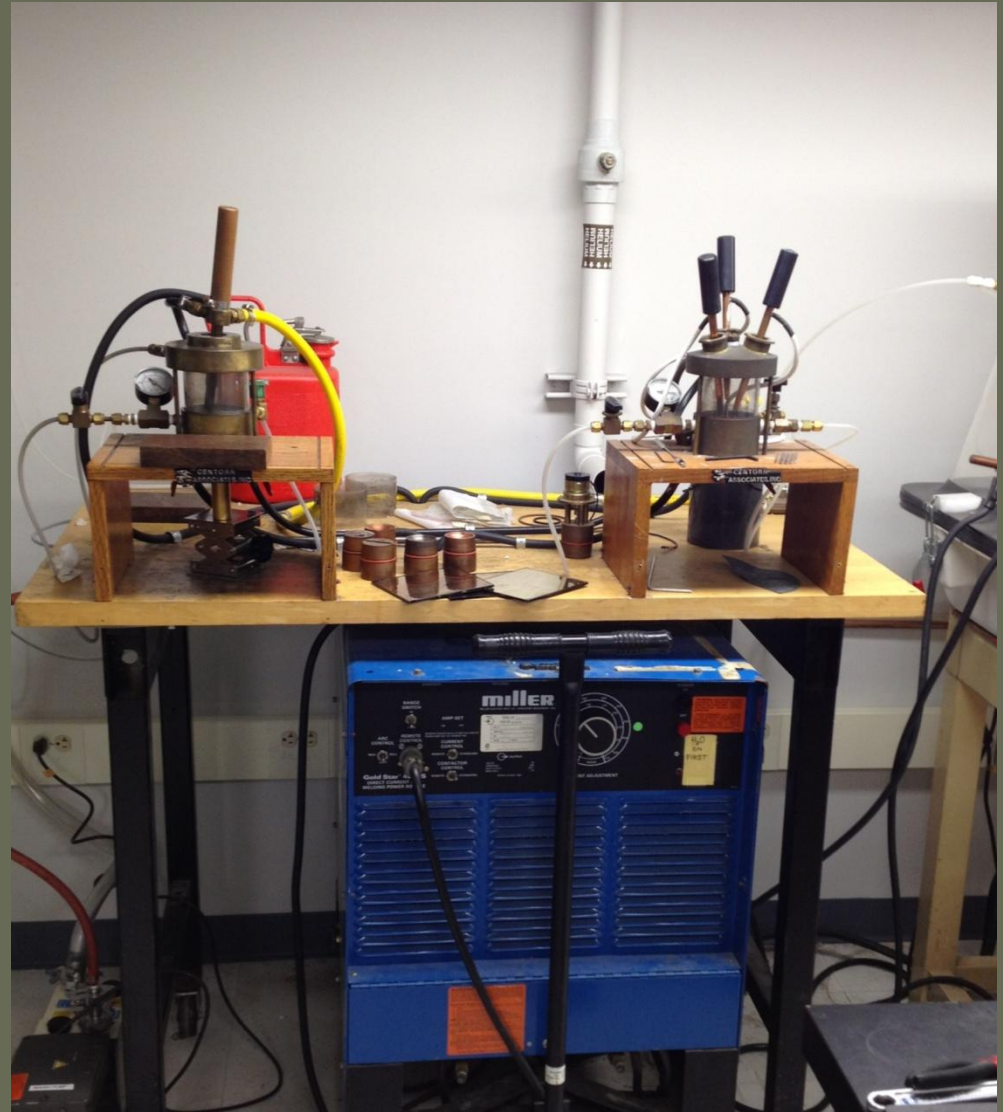
Synthesis



Arc Melter

-Uses an electric potential to create a plasma arc inside a sealed chamber to melt and combine materials

- Quick and Easy process that can be problematic for some materials



Vaporization
and loss of
Manganese

NbMnSi



Radio Frequency Induction

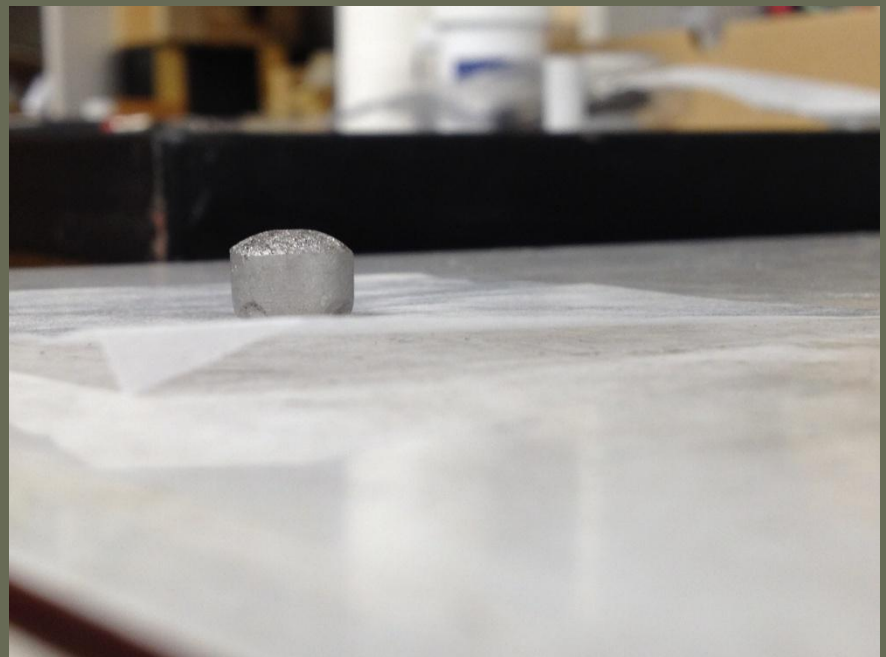
-Utilizes a high frequency A/C power supply to create oscillating magnetic fields inducing eddy currents and resistance inside conducting materials within the work coil

-RF induction is easier to control

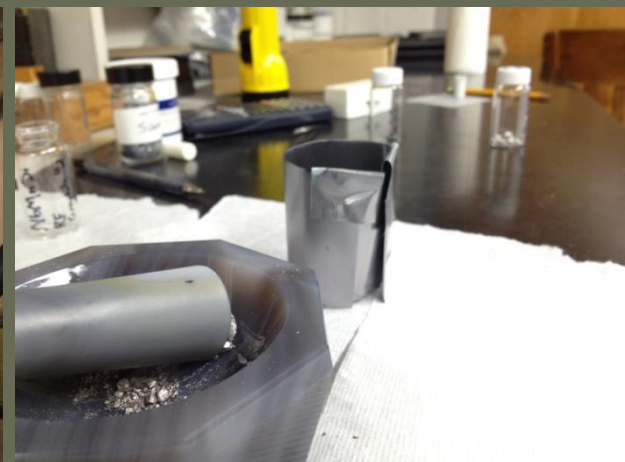


Volume vs. Surface Area

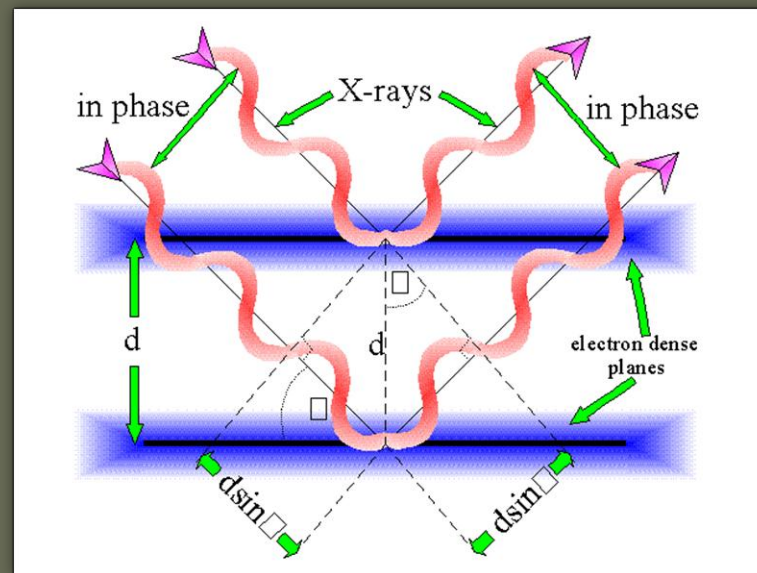
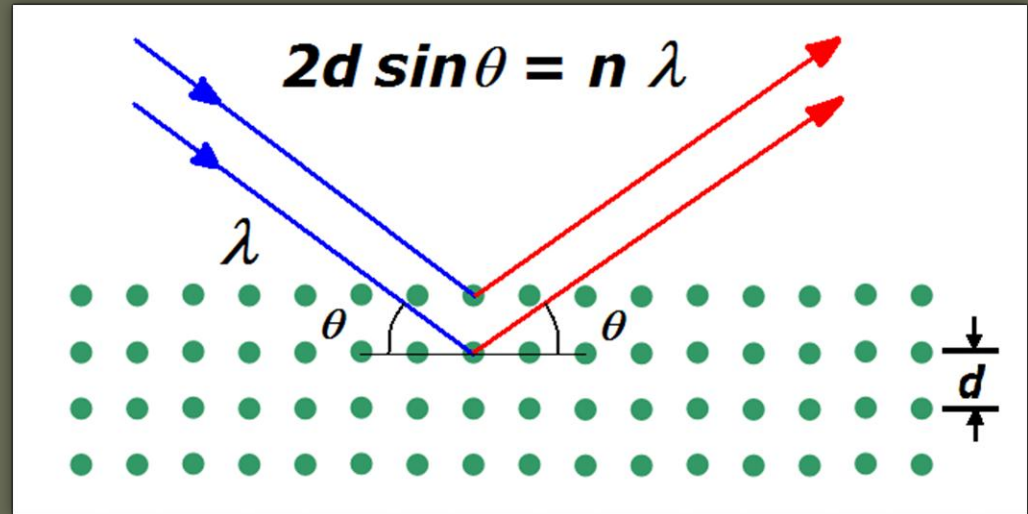
- A spherical shape can be associated with a single phase homogeneous sample



Sample prep for X-ray diffraction



Bragg's Law



SQUID

superconducting
quantum interference
device



Utilizes temperatures as 2 K and varying magnetic fields to apply a voltage or current to test a materials response

Summary

- - Helimagnetic Ordering and Skyrmions
- - Arc Melting and RF Induction Furnace
- - X-Ray Diffraction and Bragg's Law
- - SQUID magnetometer