Thoughts on Scattering in a Magnetic Field

13 Tesla magnet at X21

Keimer and Birgeneau, 13 Tesla magnets:

- long (~15 year) history at NSLS (X20A, X22B, and X21)
- exciting research ranging from spin-Peierls compounds ($CuGeO_3$) to CMR manganites to multiferroics
- low-temperature (1.8 K) capability and large angular range (~70 degrees with $\omega = 0$) for scattering
- but there are some drawbacks . . .

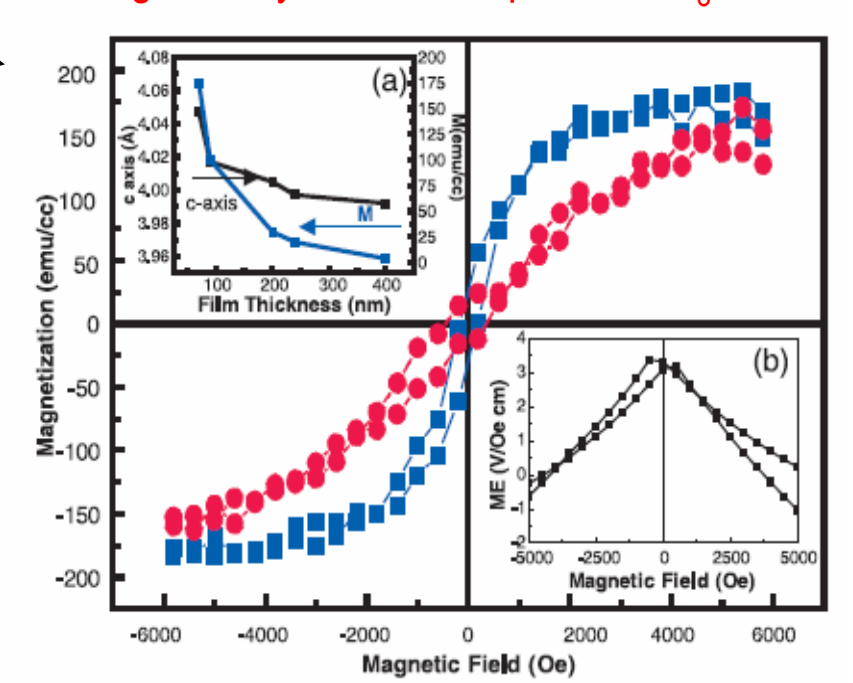
“Issues” with the 13 Tesla Magnets

- liquid cryogens
- horizontal scattering plane
- no independent sample motion
- high background
- overall complexity (cooldowns, sample insertion, quenches, general irritability)
- and sometimes you just don’t need 13 Tesla:

Applied Materials

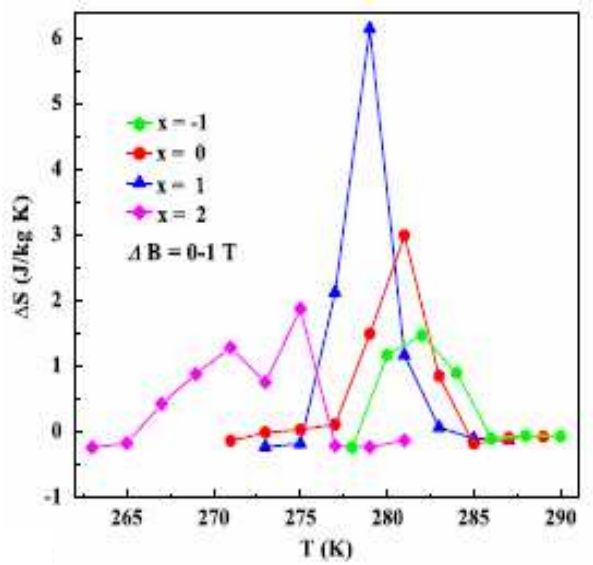
- magnetostrictives
- magnetoelectrics
- magnetoresistives
- magnetocalorics

Magnetic Hysteresis Loop of $BiFeO_3$ Film



from J. Wang *et al., Science* **299**, 1719 (2003)

1 T Entropy Change in $Ni_{50-x}Mn_{38+x}Sb_{12}$ Alloys



from W.J. Feng *et al., J. Phys. D: Appl. Phys.* **42**, 125003 (2009)

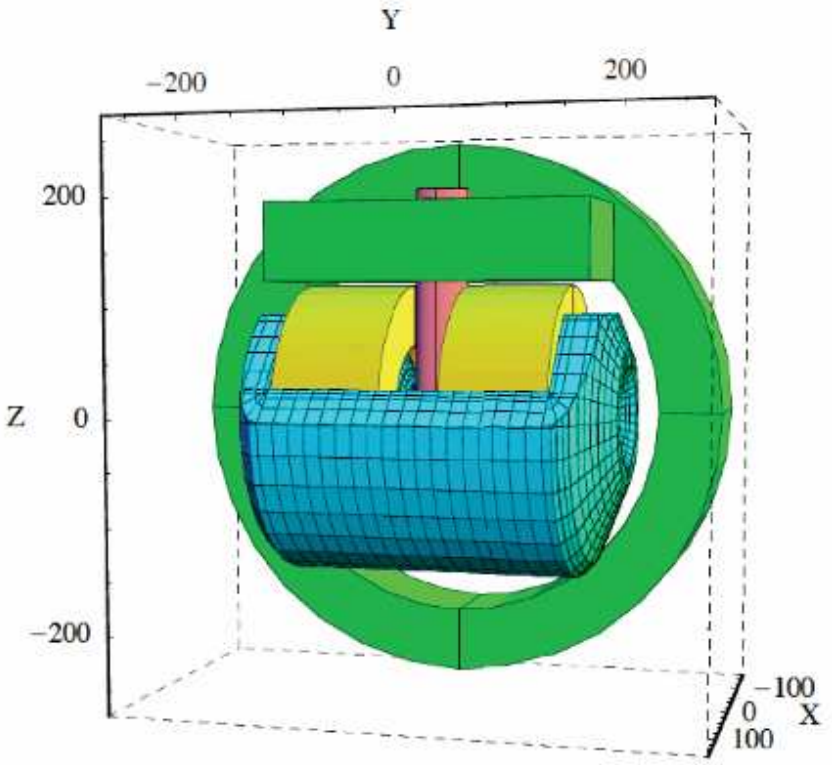
NSLS ~1 Tesla Magnet Project

George Rakowsky, NSLS/BNL,

18 June 2009

Diffractometer Dipole Design

(For reference only)



Conceptual design by George Rakowsky (NSLS) with engineering support by Martin Woodle (contractor for NSLS)

- vertical scattering geometry
- two mounting positions
- ~5 cm air gap to accommodate a variety of sample environments
- independent sample motion
- no liquid cryogens