Effective Lab Oral Report – Spring 2020

David Hertzog, Eugene V Colla, Alexey Bezryadin
University of Illinois at Urbana-Champaign

DKDP

We will present some of my slides and many Phys 403 student slides as examples. We can talk about why they are well constructed examples.

Covid19 online version

(All remarks about real slides are in these red boxes)

An eye-catching feature on slide 1

This is a technical presentation, so you must develop it as a logical sequence

- ☑ ⬜ **What was the goal?**
  - ⬜ **What physics did you address?**
  - ⬜ **What technology?**
  - ⬜ **Define your special vocabulary here**
- ☑ ⬜ **What did you actually do?**
  - ⬜ **Apparatus / Procedures / Raw Data**
- ☒ ⬜ **What are your results?**
  - ⬜ **Polished graphs, proofs, numerical findings**
  - ⬜ **Principal difficulties and uncertainties**
- ☒ ⬜ **Conclusions**

Sentence title tells what the slide is about … the rest of the slide supports the assertion

Fonts matter

Arial

Comic Sans

Times

Courier

In case of online it is not important - computer monitors have much better resolution that screen projectors

Font size and slide background choice

Optical Pumping - 32 bold (Title)

**Tunneling   18-20 (Body text)**

Courtesy to Wikipedia   14 (comments)

Font size and slide background choice

Optical Pumping   - 32 bold (Title)

Tunneling   18-20 (Body text)

Courtesy to Wikipedia   14 (comments)

Too dark!

Font size and slide background choice

Optical Pumping - 32 bold (Title)

Tunneling   18-20 (Body text)

Courtesy to Wikipedia   14 (comments)

Make contrast between text and backgrtound

Presentation components and grading scale.

CRITERIA	Max. Score
The whole day attendance	5
Title was sent to instructor on time	3
First slide has appropriate title, name, affiliation, date	3
Scientific background, goal and motivation were clearly and correctly presented	20
Research activities were clearly and correctly presented	20
Results were clearly and correctly presented	20
Technical aspects: good balance of text and figures, good quality figures, appropriate citations, correct spelling, correct number of significant digits, etc.	20
Time management: good balance between Introduction-Procedure-Results-Analysis	3
Spoke clearly, at a good pace, loud enough, etc.	3
Finished on time and answered questions clearly and correctly	3
Final Totals (100)	100

Title

OPTICAL STUDY OF FERROELECTRIC POTASSIUM DIDEUTERIUM PHOSPHATE (DKDP)
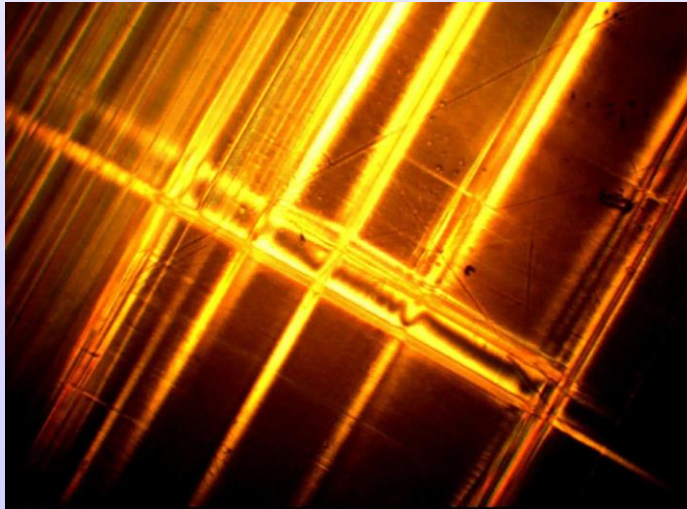
Author name

Student name
2/19/13

Date

Physics 403, Fall 2013
University of Illinois at Urbana-Champaign

Affiliation

Phase transition of Helium 4

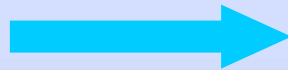- **Below T_λ = 2.17 K, helium exists in mixture of superfluid and normal liquid helium.**

Physics 403 Summer 2020
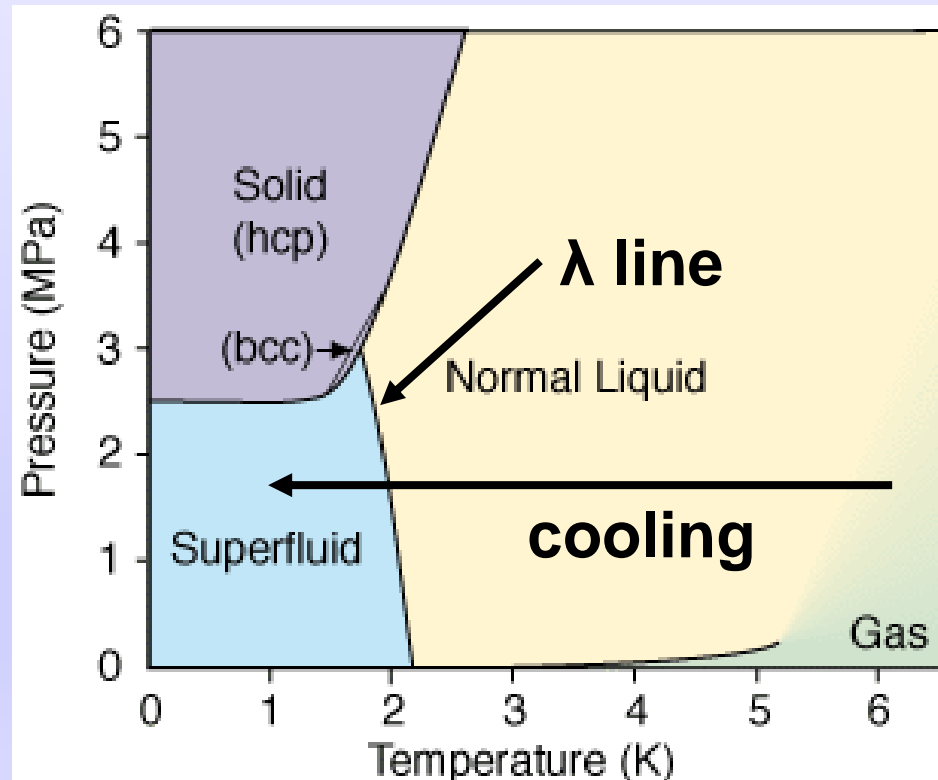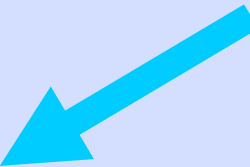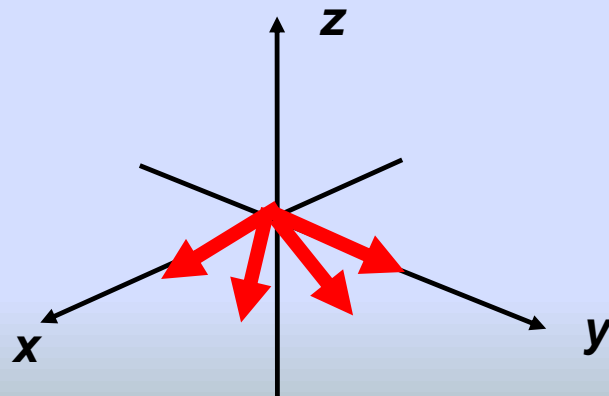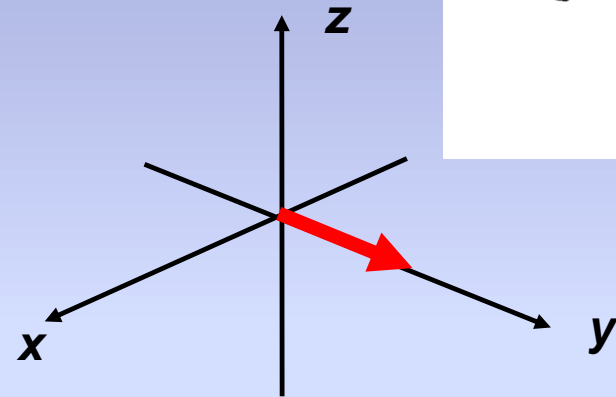
What happen if they are struck by pulses ?

A pulse or a series of pulses is used to change the net magnetization of system. Pulsed NMR!

z

90⁰ Pulse

x

y

z

x

y

z

x

y

?

$$M(t) = M_0 e^{\frac{-t}{T_2}}$$

B = 0

B = B$_0$

M$_z$ = -1/2

ΔE

M$_z$ = +1/2

Energy

U = - μ·B

μ

ω

ω

μ
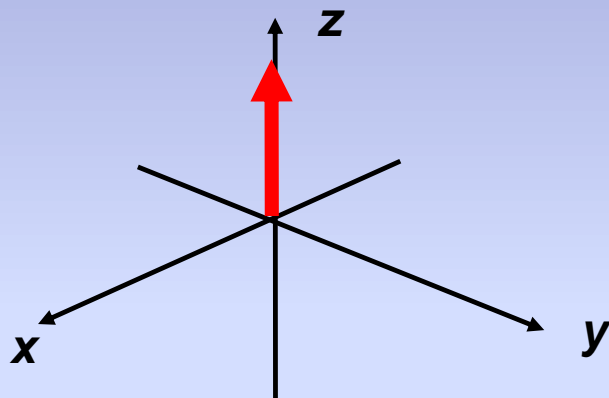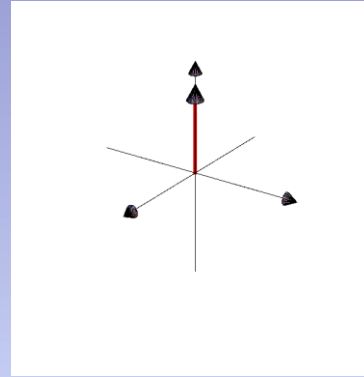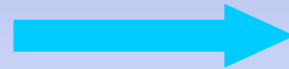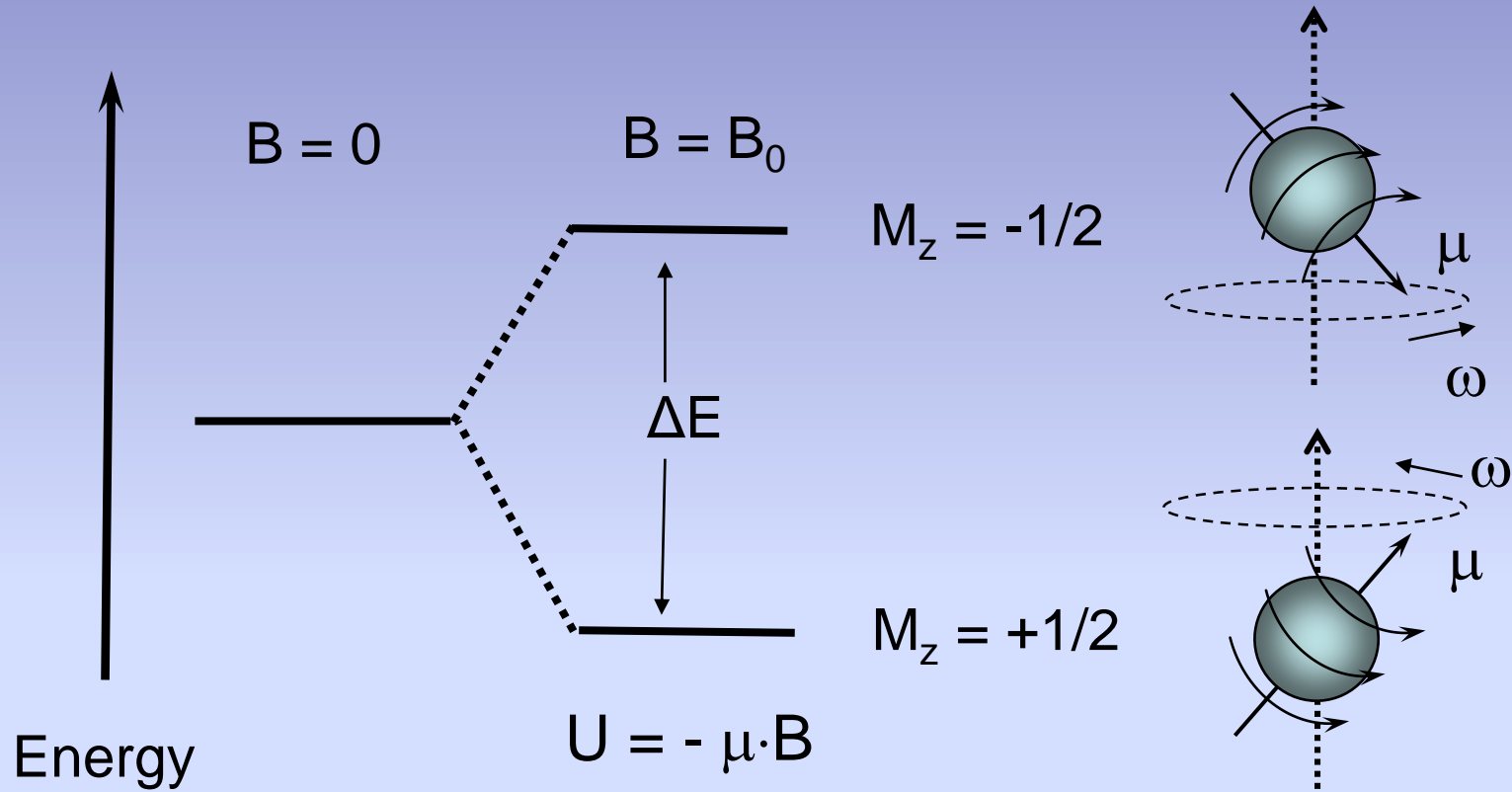
(Courtesy of Bishop. K)
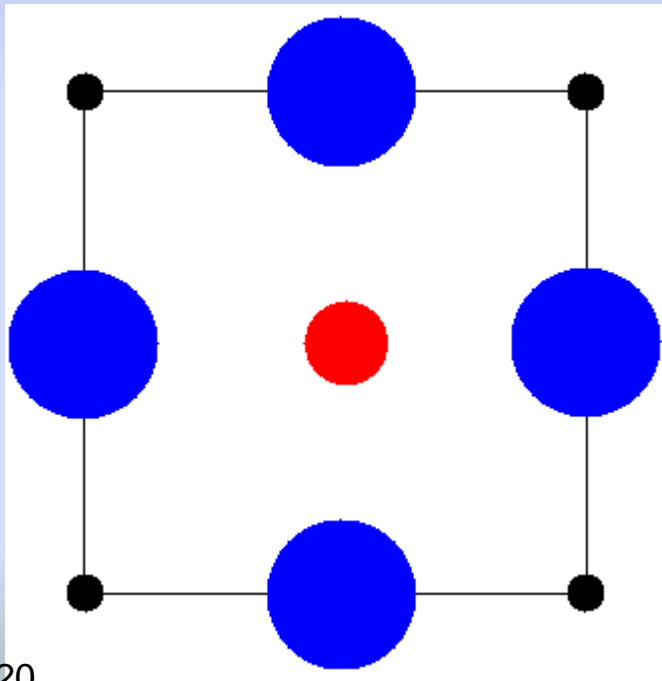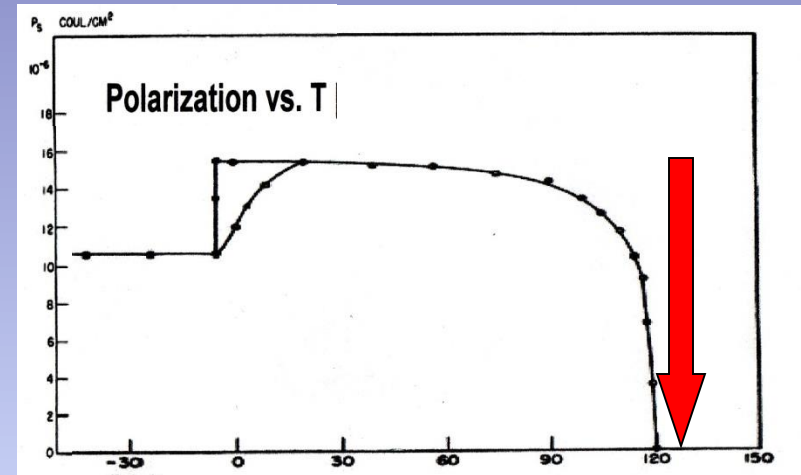
$$\Delta E = \gamma \cdot \hbar \cdot B_0 = \hbar \omega_0 \longrightarrow$$ *Larmor frequency!*
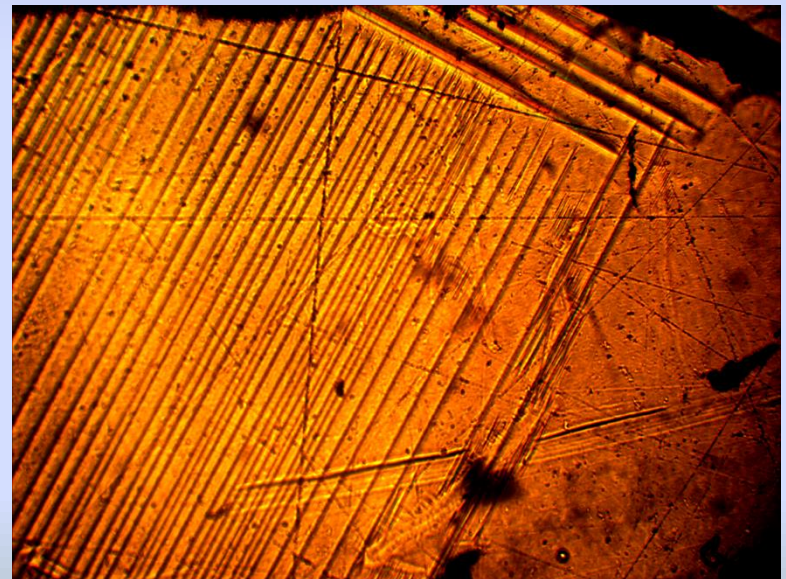
Phase Transition in BaTiO₃
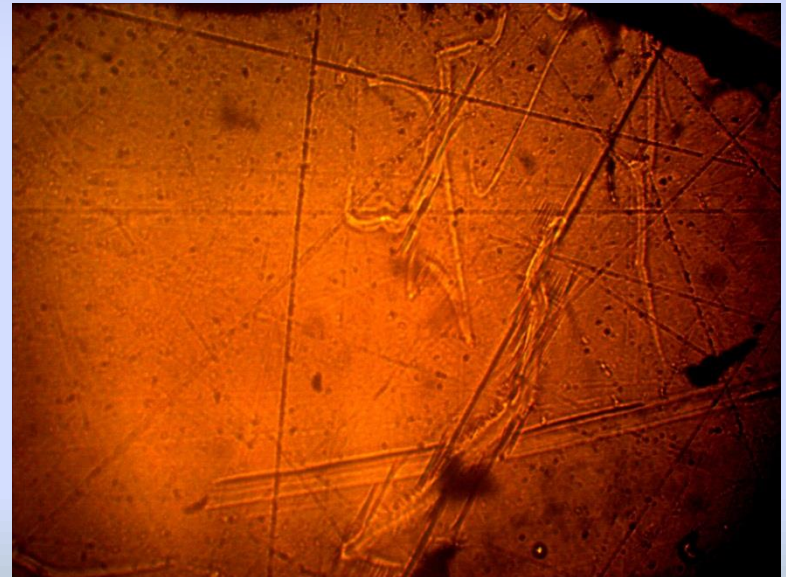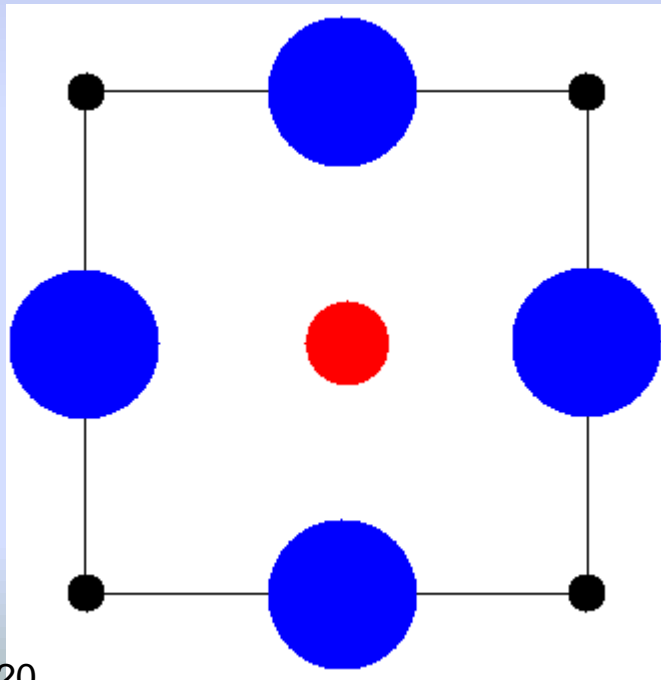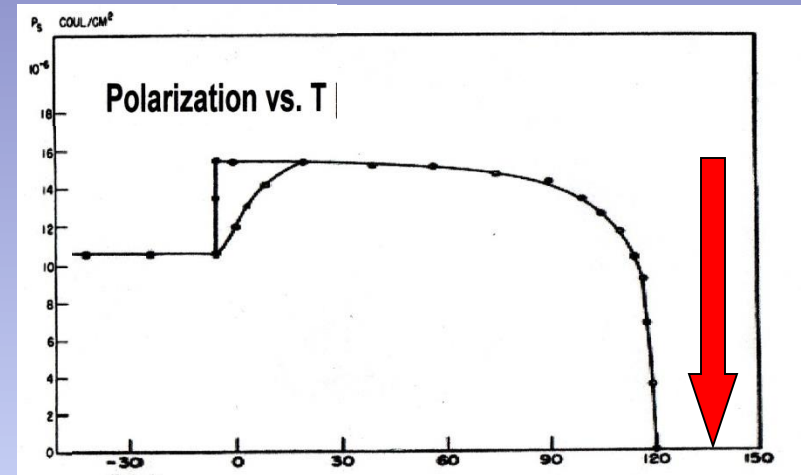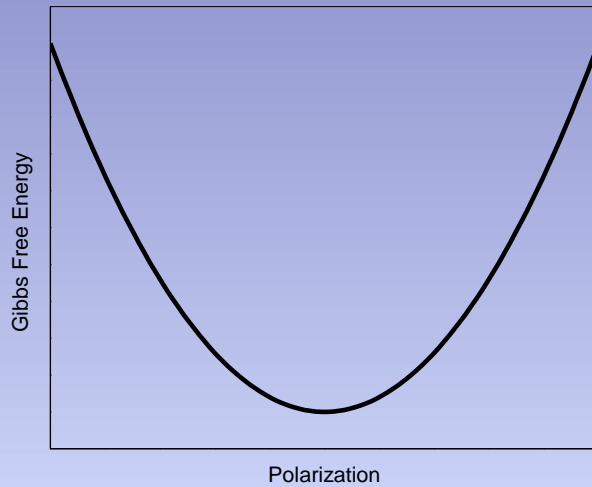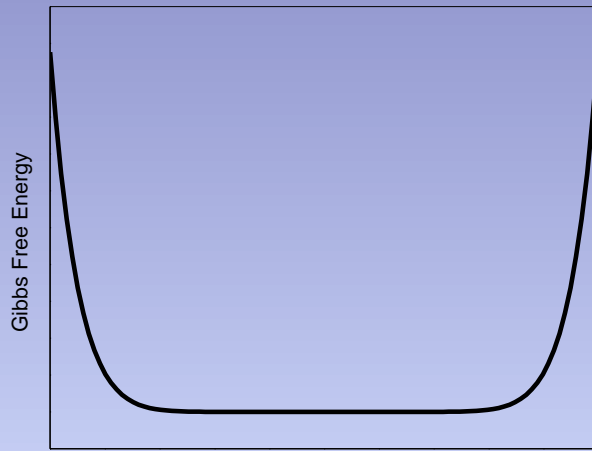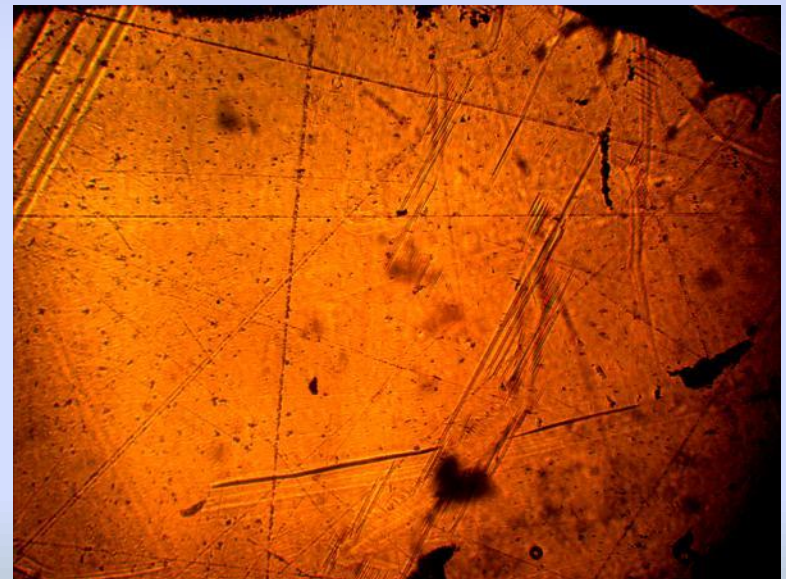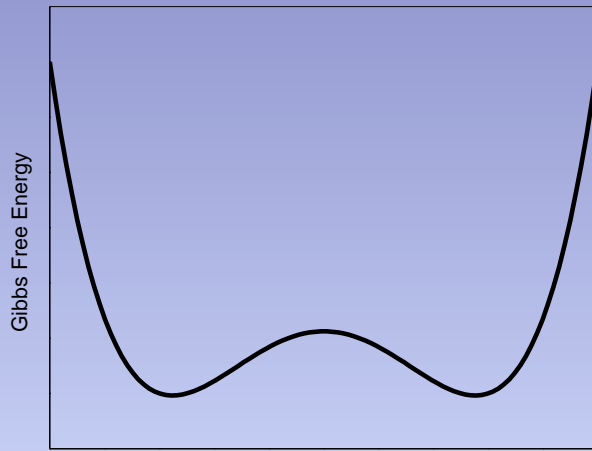
Phase Transition in BaTiO₃

Phase Transition in BaTiO$_3$

Phase Transition in BaTiO$_3$

Gibbs Free Energy vs. Polarization
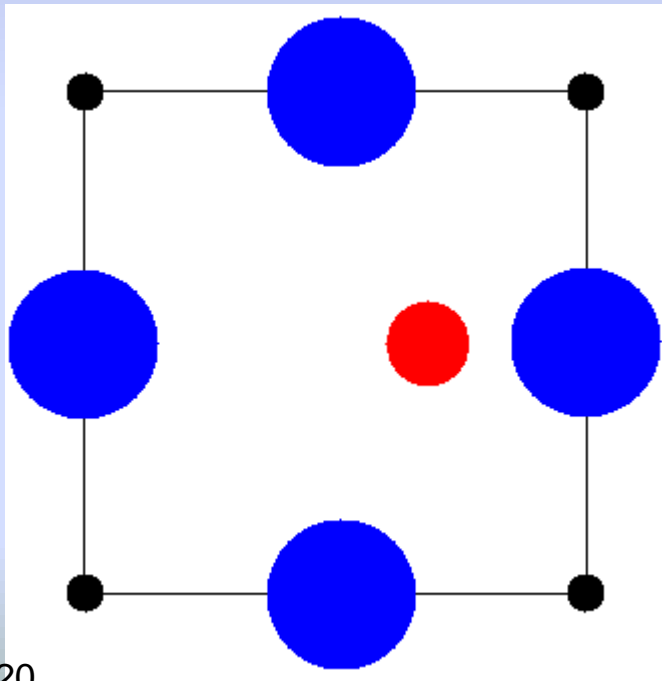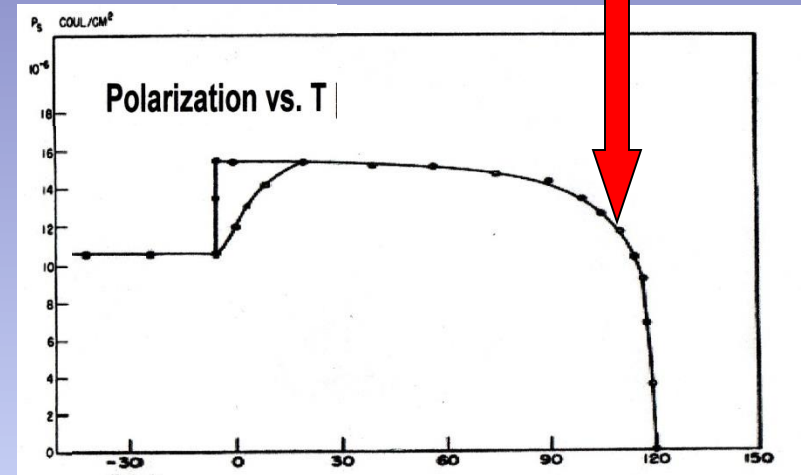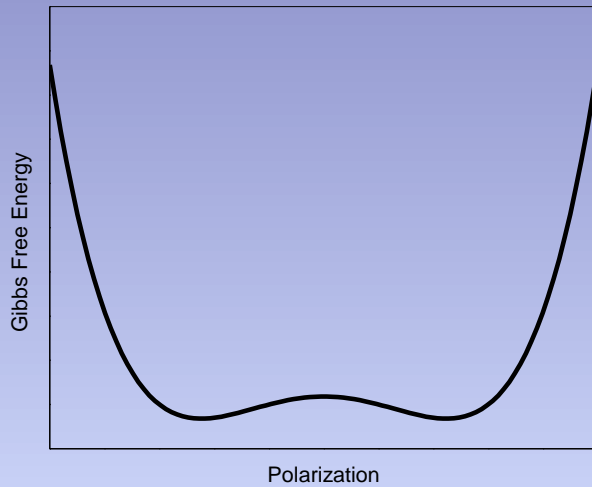
Polarization vs. T
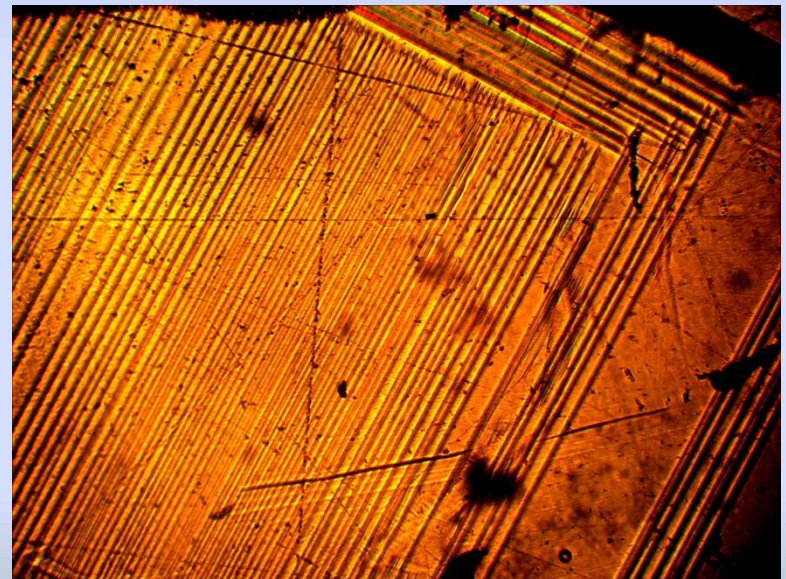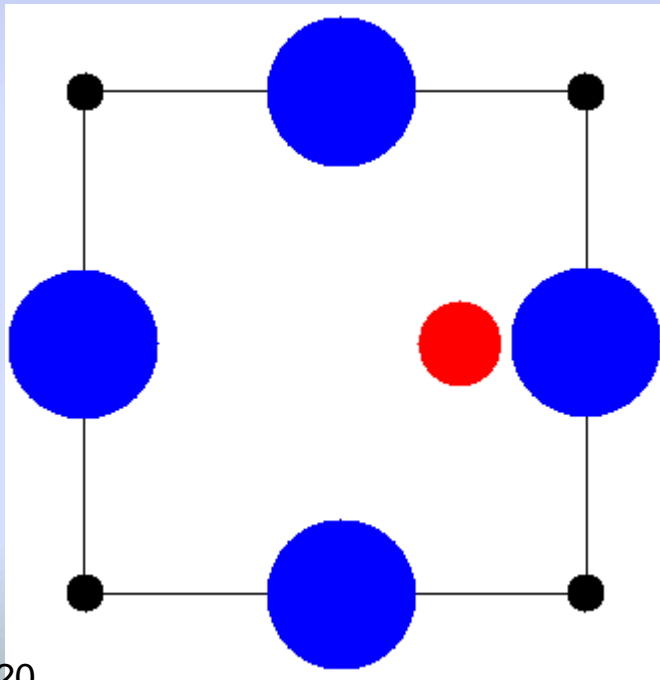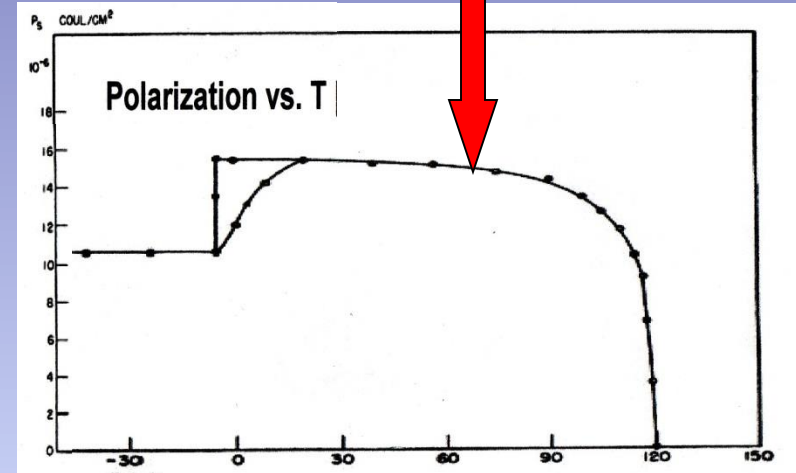
Experimental Apparatus
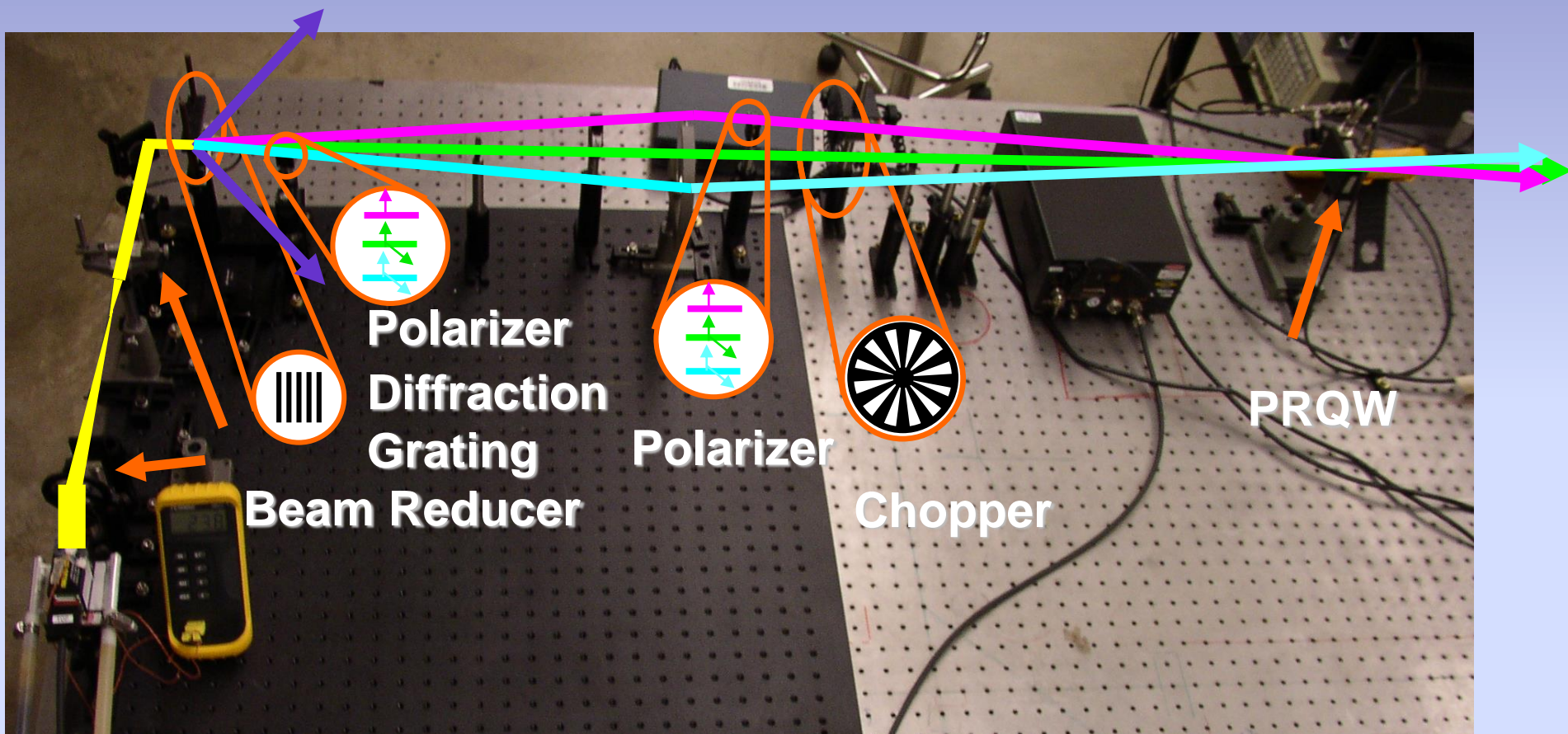
An example of image which is nice but does not help too much

Magnetic Field Calibration

□The magnetic field from the Earth and other residual magnetic fields is minimized by rotating the stand and adjusting the vertical field coils to minimize the zero field peak width.
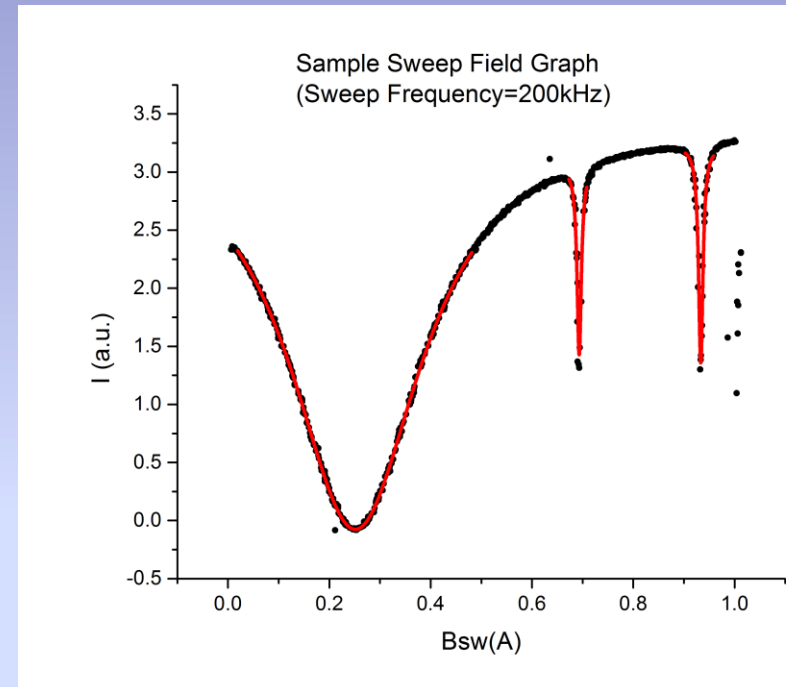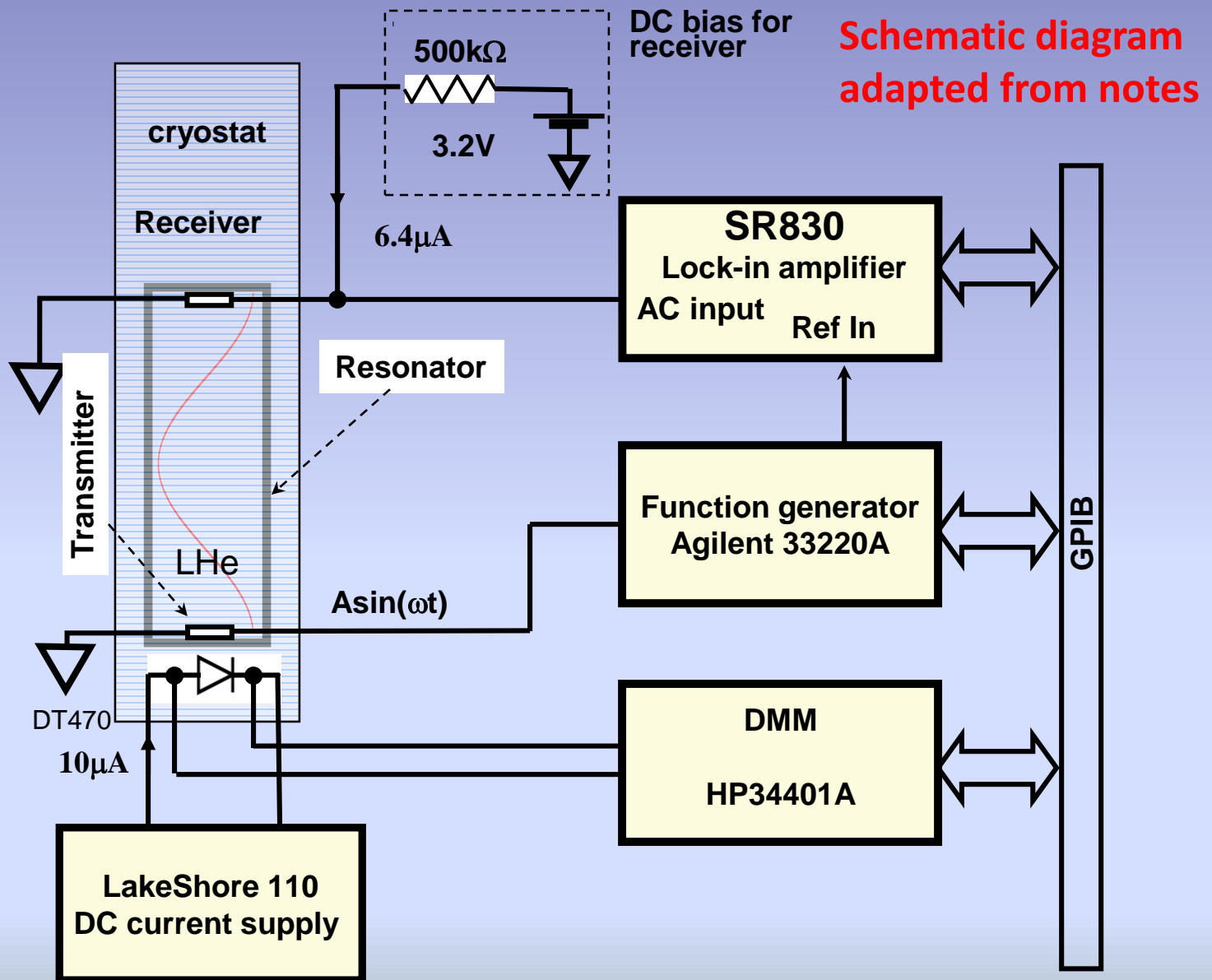
□With the main field coils off, the sweep field is applied to determine the center of the zero field resonance (was found to be at 0.251A; using the geometry of the coils, this corresponds to 0.151 gauss).

□RF field is adjusted to provide maximum transition probability.

Sample Sweep Field Graph
(Sweep Frequency=200kHz)

Too many words on slide

Schematic diagram adapted from notes

DC bias for receiver

500kΩ

3.2V

cryostat

Receiver

6.4µA

SR830
Lock-in amplifier
AC input   Ref In

Resonator

Transmitter

LHe

Asin(ωt)

Function generator
Agilent 33220A

DT470

10µA

DMM

HP34401A

GPIB

LakeShore 110
DC current supply

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Silver Paint

Electrode

Sample

Leads

10/21/2010
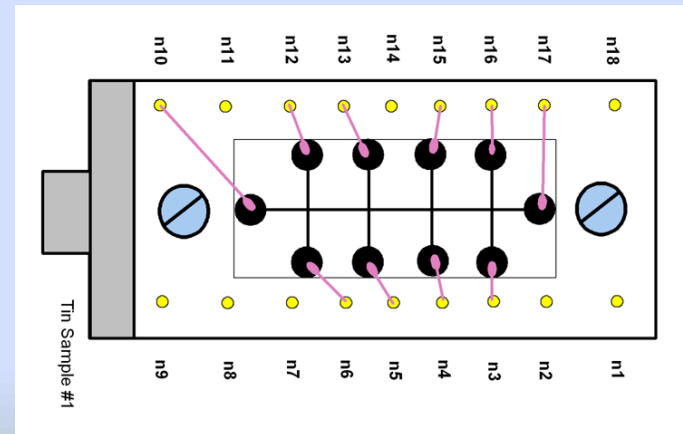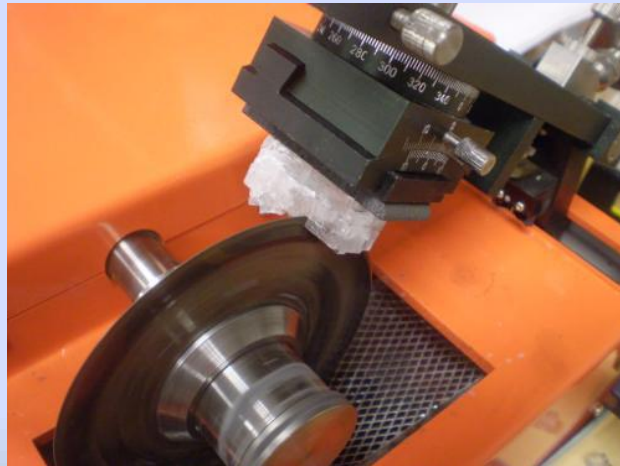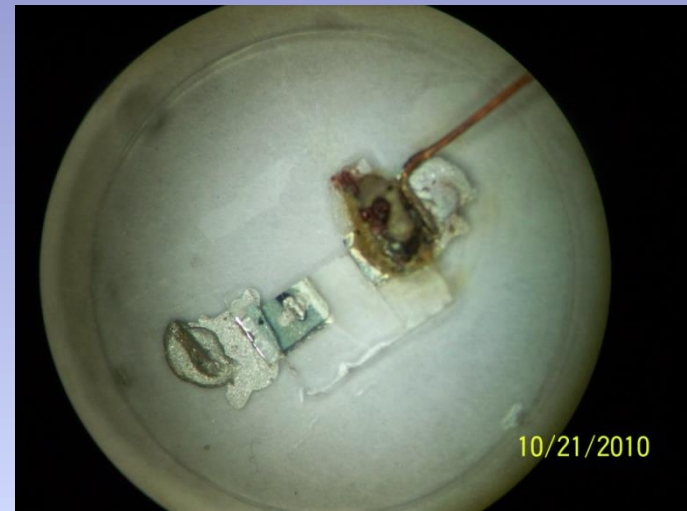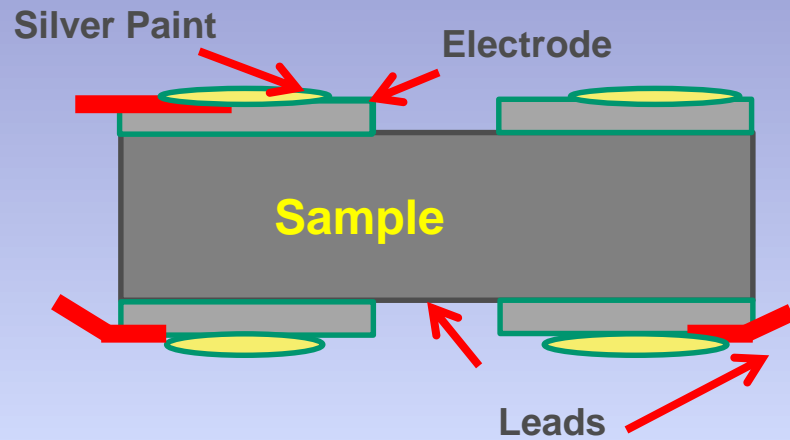
Setup of Source and Detectors

C

θ_{BC}

θ_{AC}

Anode (to CFD)

B

Dynode (to MCA)

Aperture

High voltage
power supply

A

θ_{AB}

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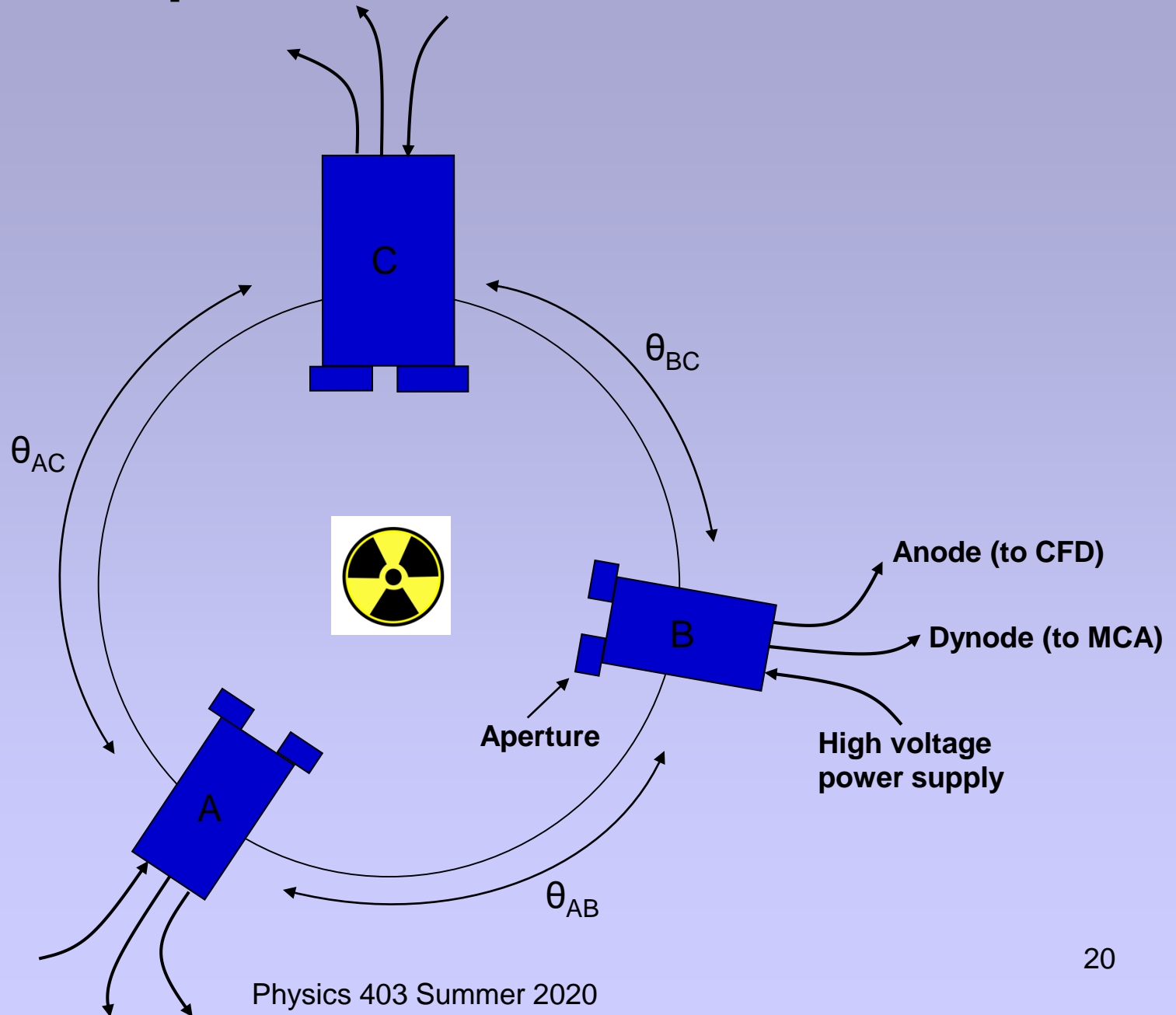
Raw tunneling data
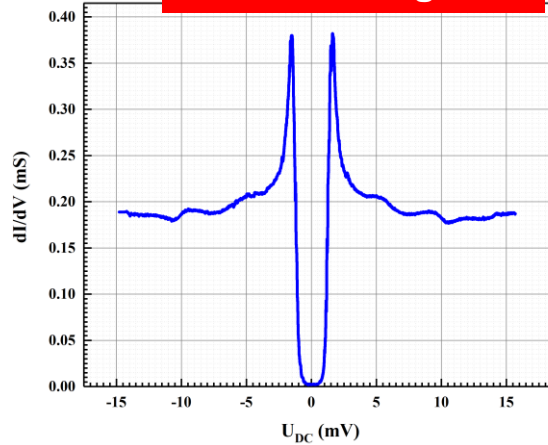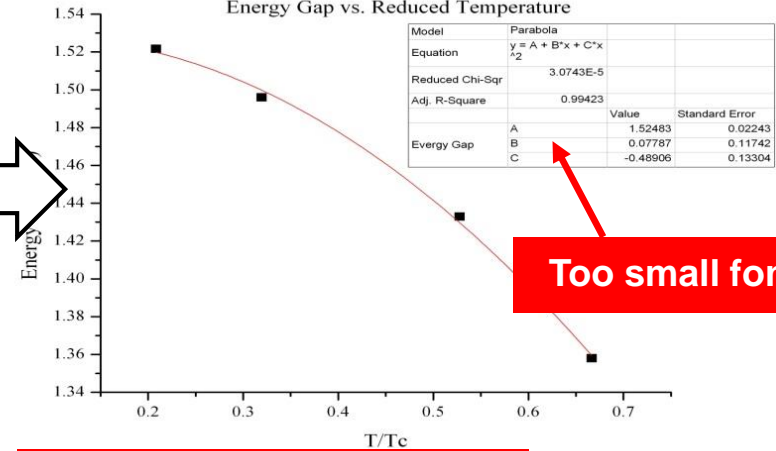
Too small font !

Energy gap derived from tunneling conductivity
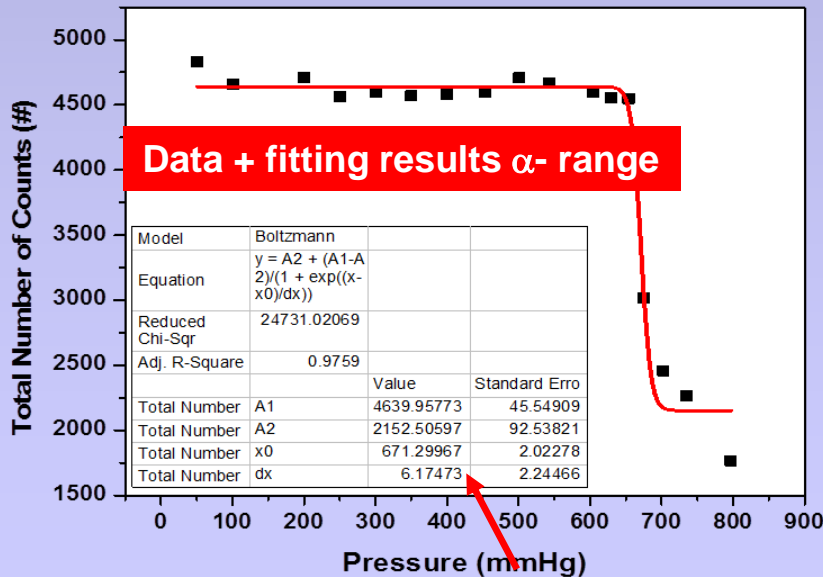
Data + fitting results α- range

Data + fitting results fluorescence

$\tau_M = 3.9 \pm 0.14\, ms$

$\tau_{slow} = 3.54 \pm 0.013\, ms$

$\alpha_{slow} = 99\%$

$\tau_{fast} \approx 4\, ns$

$\alpha_{fast} = 1\%$

Too many SD !

7/7/2020

21
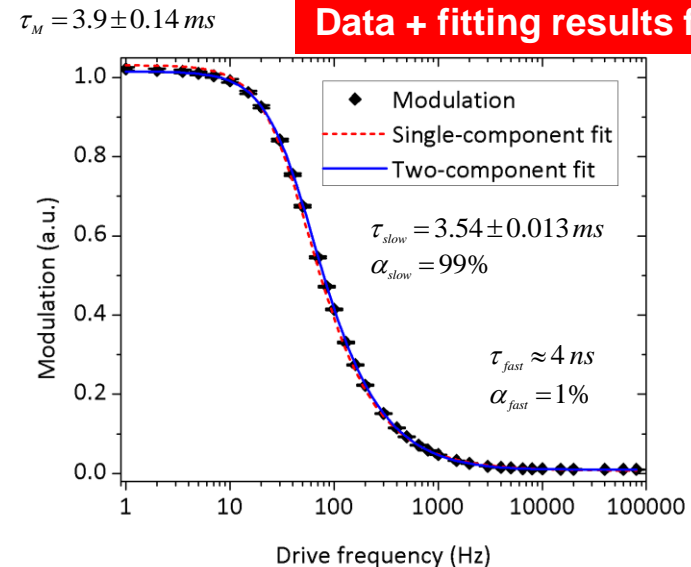
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Difference in Up-Down (unnormalized)

Fit equation $\quad Ne^{\frac{-t}{\tau}}\left(1+\alpha\cos(\omega t+\delta)\right)$

χ^2 / ndf	106.3 / 95
Scale	436.6 ± 14.8
Lifetime	2.265 ± 0.067
Amp	0.1782 ± 0.0302
Freq	4.804 ± 0.113
Phase	-1.682 ± 0.274
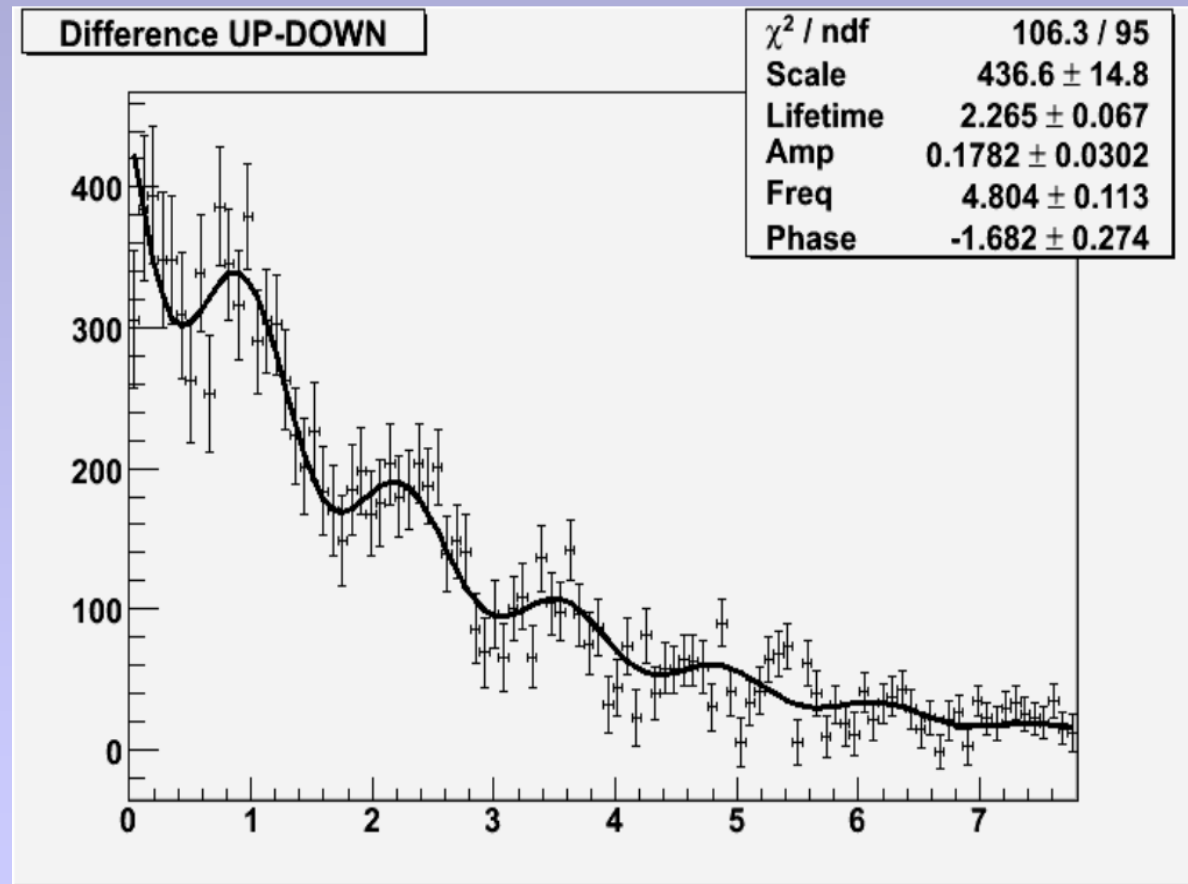
Difference UP-DOWN

**Courtesy Samuel Homiller and
Pakpoom Buabthong Fall 2013**

Difference in Up-Down (normalized}

Fit equation $$Ne^{\frac{-t}{\tau}}\left(1+\alpha\cos(\omega t+\delta)\right)$$
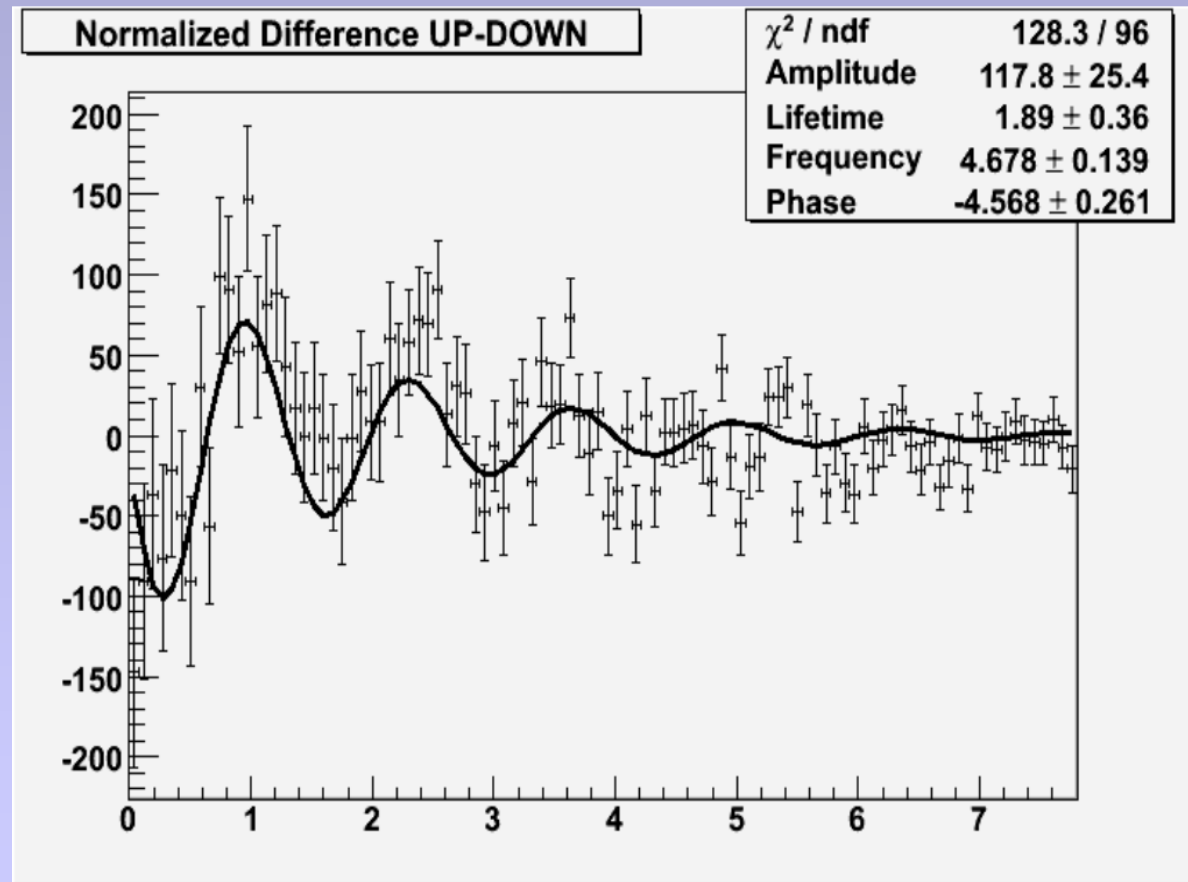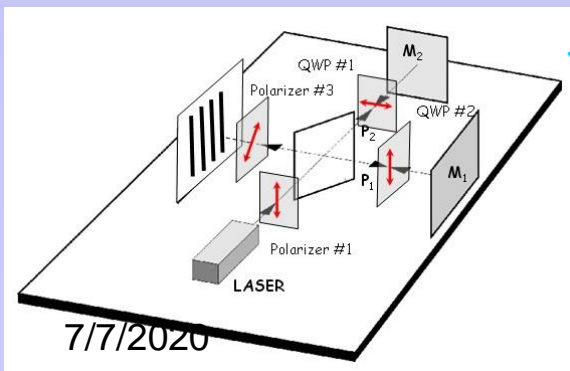

Normalized Difference UP-DOWN	
χ^2 / ndf	128.3 / 96
Amplitude	117.8 ± 25.4
Lifetime	1.89 ± 0.36
Frequency	4.678 ± 0.139
Phase	-4.568 ± 0.261

Courtesy Samuel Homiller and Pakpoom Buabthong Fall 2013
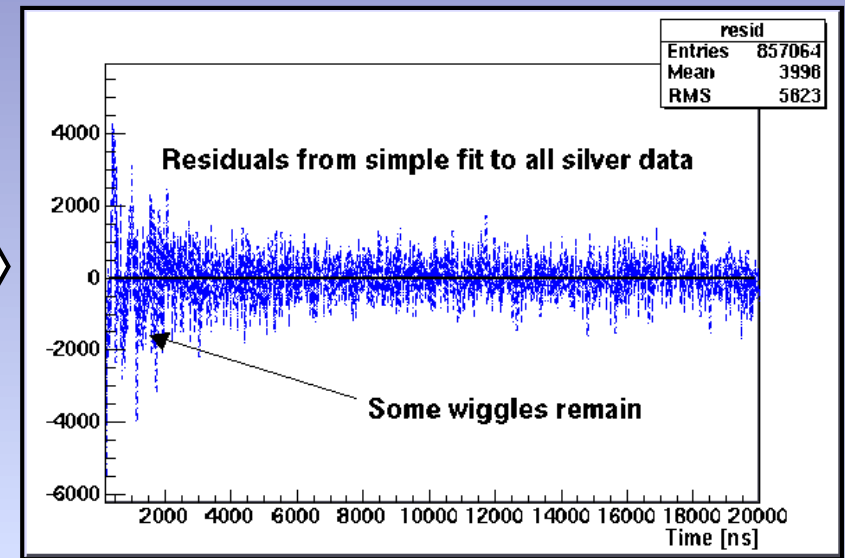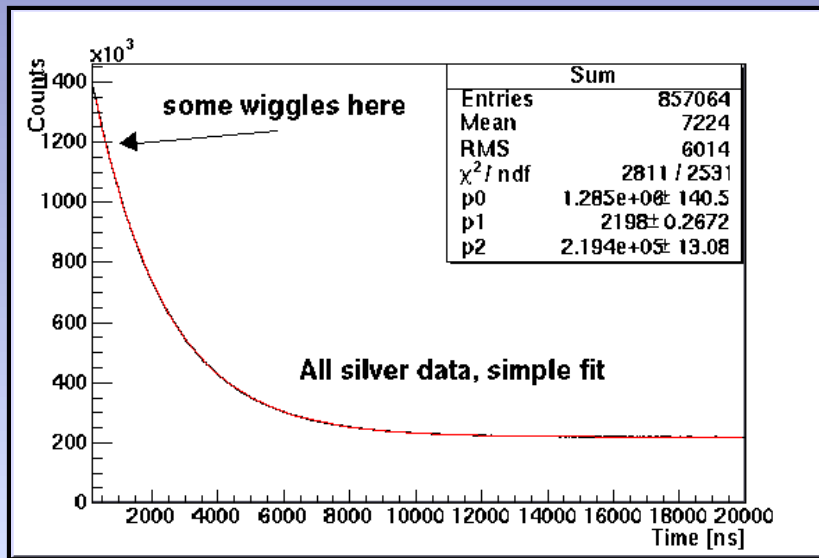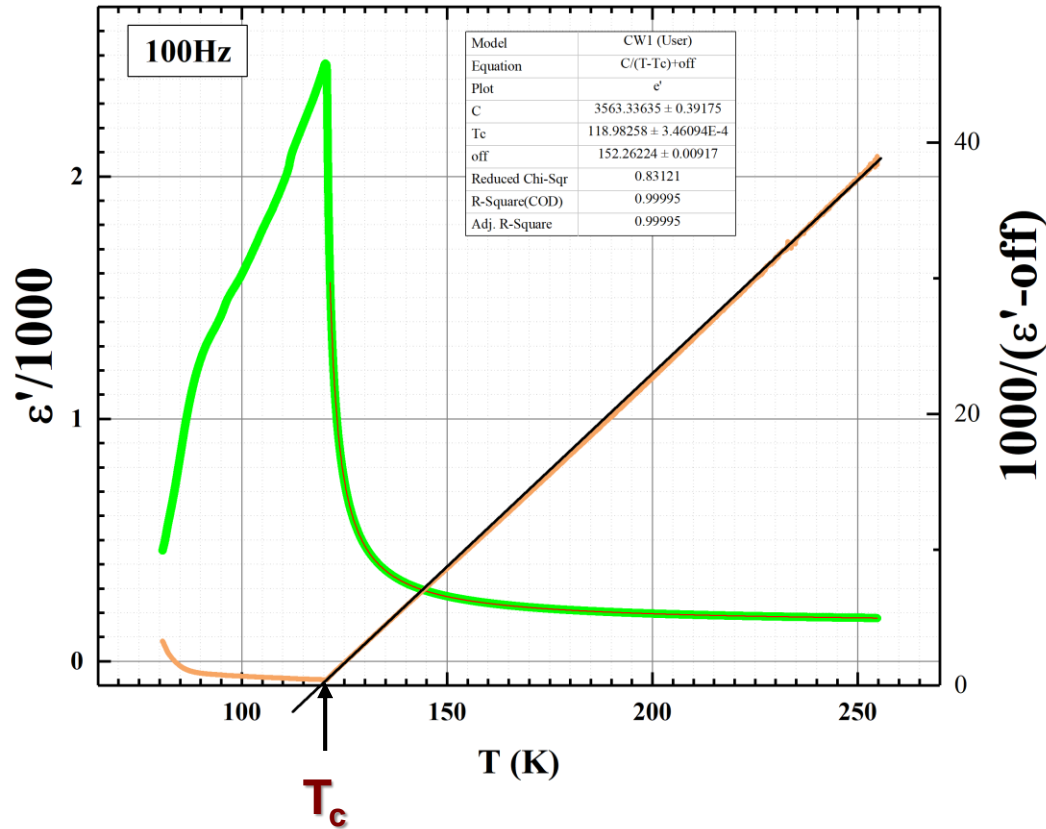
7/7/2020

24
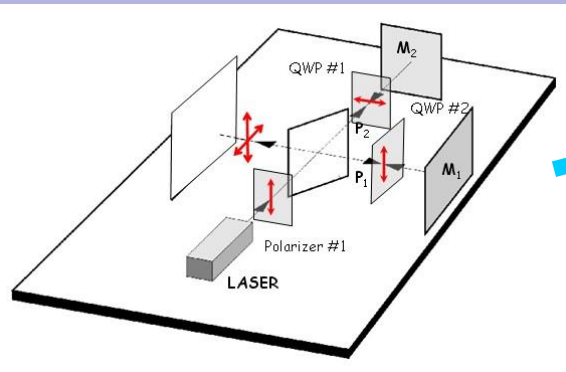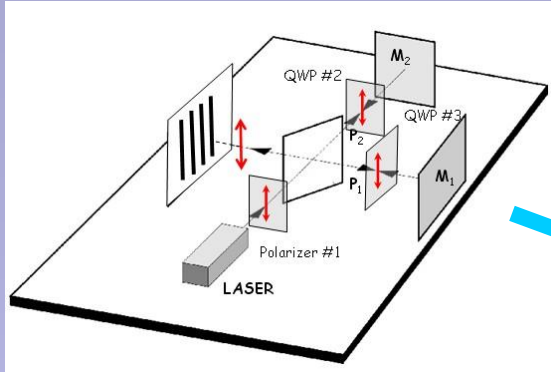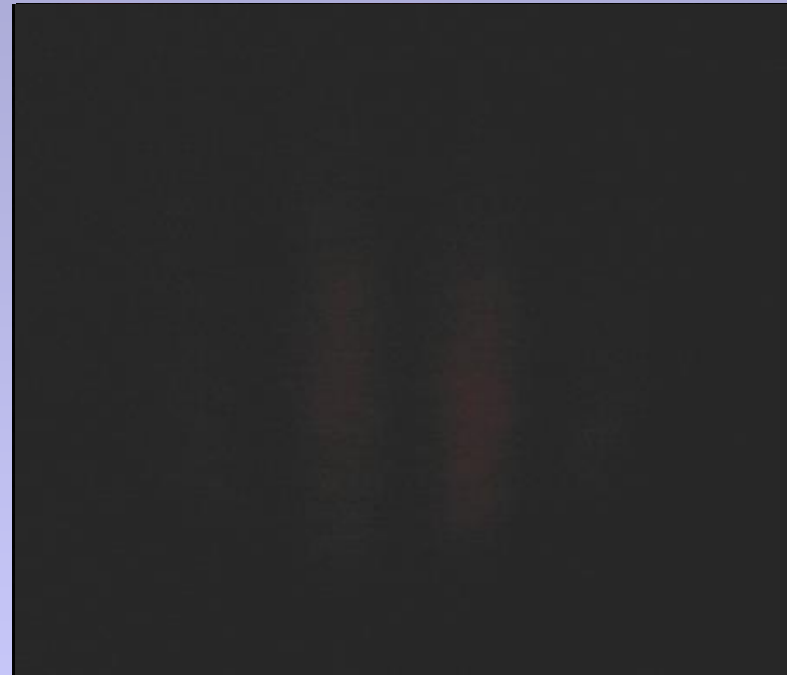
Presenting data is your most important and challenging task
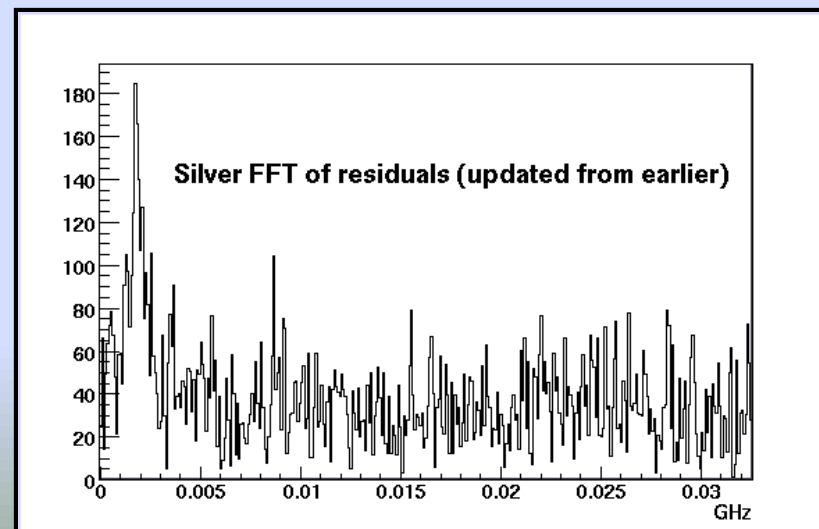
Fitting to the Curie-Weiss law

$$\varepsilon' = \frac{C}{T - T_C} + off$$

$$C = 3563.3 \pm 0.4\,\mathrm{K}$$

$$T_C = 118.9825 \pm 0.0003\,\mathrm{K}$$

Courtesy Zongyuan Wang and Arnulf Taylor Su 2017

AFM of Optical Data Storage Media

CD
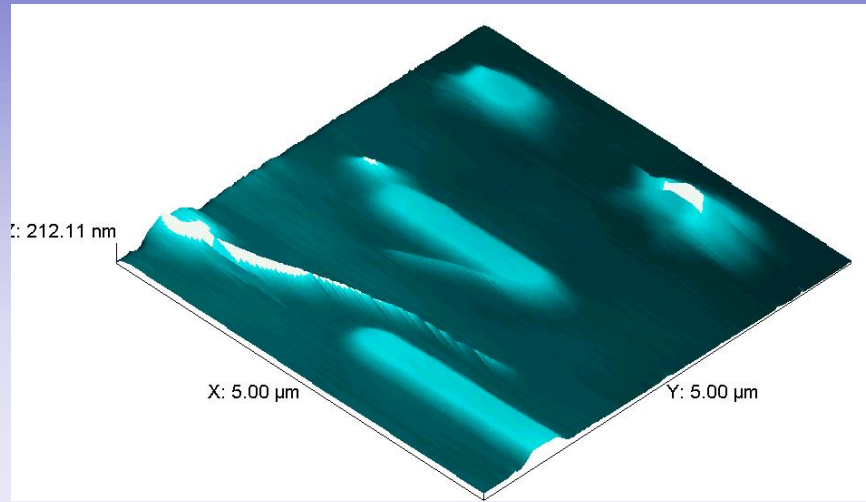
DVD
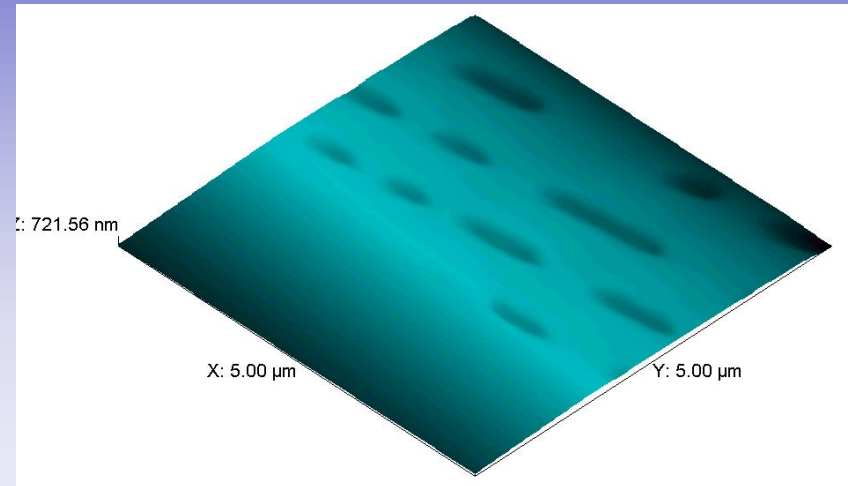
Blu-Ray
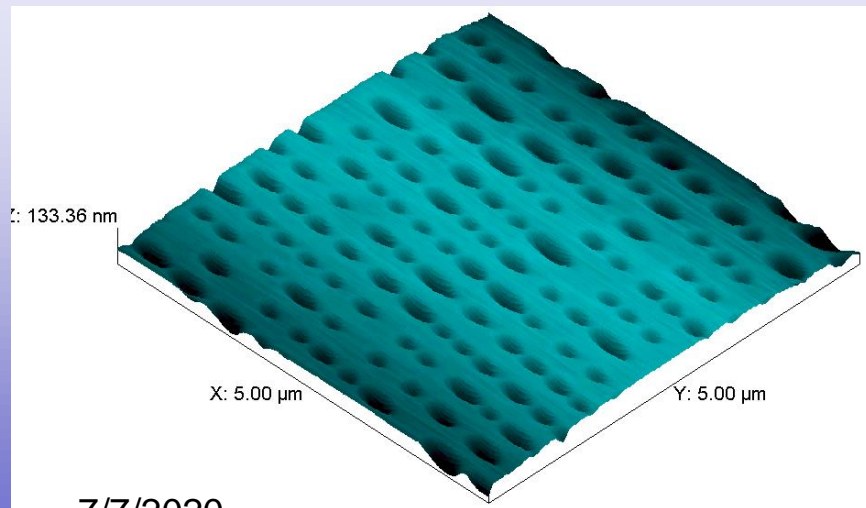
	CD	DVD	Blu-Ray
Mark length	0.99 - 2.96	0.48 - 1.45	0.14 - 0.41
Track pitch	1.63	1.00	0.40
Track width	0.50	0.24	0.15

Units in μm

27

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$$V = C\sqrt{\left(\frac{T - T_{offset}}{T_\lambda}\right)\left(1 - \left(\frac{T - T_{offset}}{T_\lambda}\right)^{5.6}\right)} \qquad \Longrightarrow \qquad V = C\left[\left(\frac{T - T_{offset}}{T_\lambda}\right)\left(1 - \left(\frac{T - T_{offset}}{T_\lambda}\right)^{\beta}\right)\right]^{\gamma}$$

Offset, intrinsic to the experiment

Fit to the exponents as well

$$C \approx 26$$

Reference, where this equation came from?

$$T_\lambda \approx 2.17$$
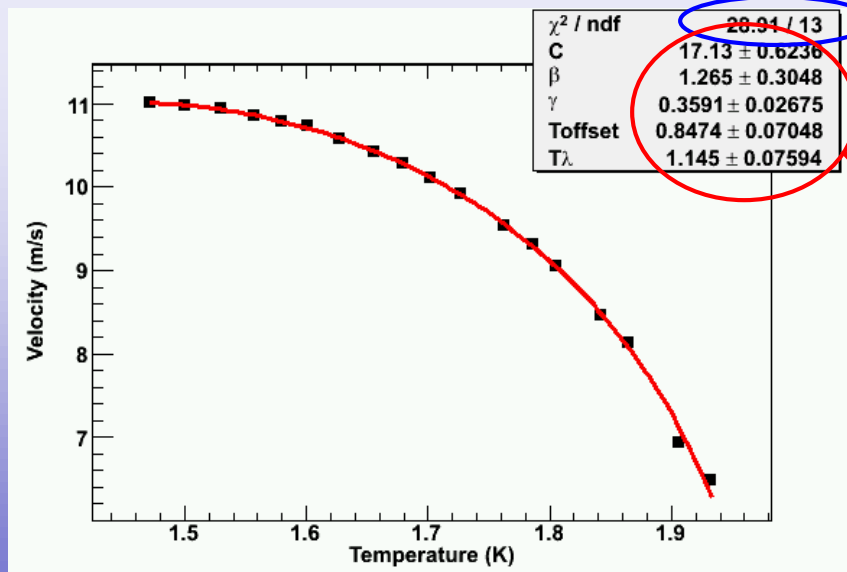
Perform the 5 parameter fit-

χ² / ndf	28.91 / 13
C	17.13 ± 0.6236
β	1.265 ± 0.3048
γ	0.3591 ± 0.02675
Toffset	0.8474 ± 0.07048
Tλ	1.145 ± 0.07594

The values that are obtained are not very close to the expected values

Also, the fit is not the best

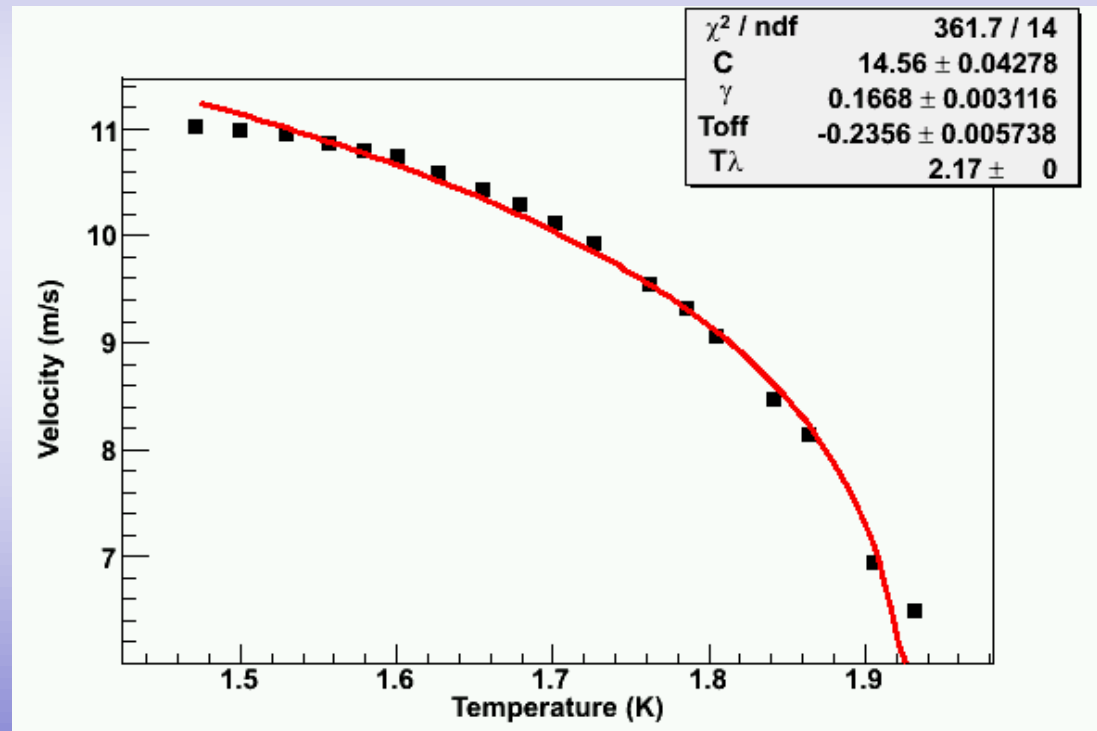# Try to fit the data with this function

The data refuses to fit to this function

$$V = \left(1 - \frac{T - T_{\text{offset}}}{T_\lambda} \right)^{\gamma}$$

χ^2 / ndf	361.7 / 14
C	14.56 ± 0.04278
γ	0.1668 ± 0.003116
Toff	-0.2356 ± 0.005738
Tλ	$2.17 \pm$ 0

# Finish your talk with the data analysis and conclusions and a slide showing the main points you want us to remember

- **Make sure you discuss the principal uncertainties.**
  - *For most of these experiments, it will be how accurately does your instrument measure something*
  - *A few experiments will also have statistical uncertainties … more data leading to a better finding*
- **Include a representative (simplified) graphic**
  - *This slide will be up during question period so this graphic will get burned into people's memory*
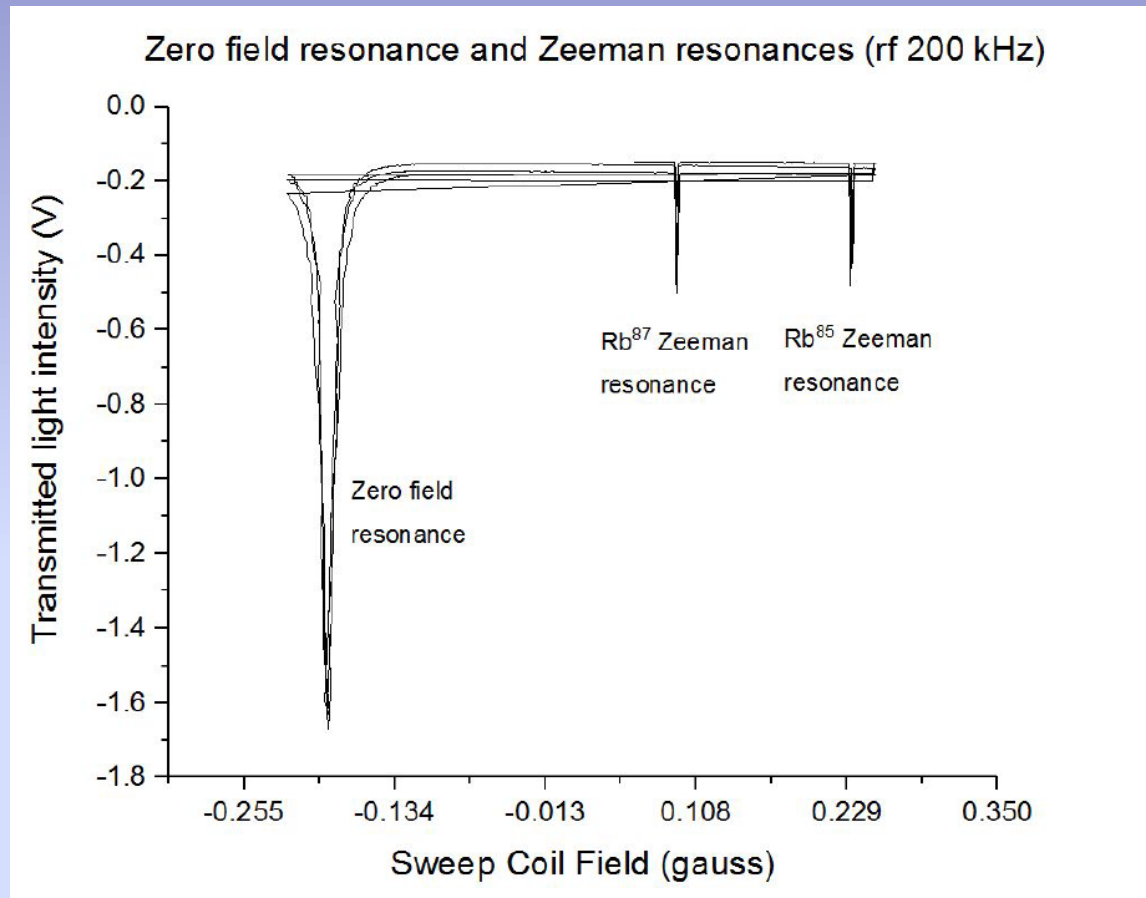- **Because this is a lab, offer some advice for others who follow**
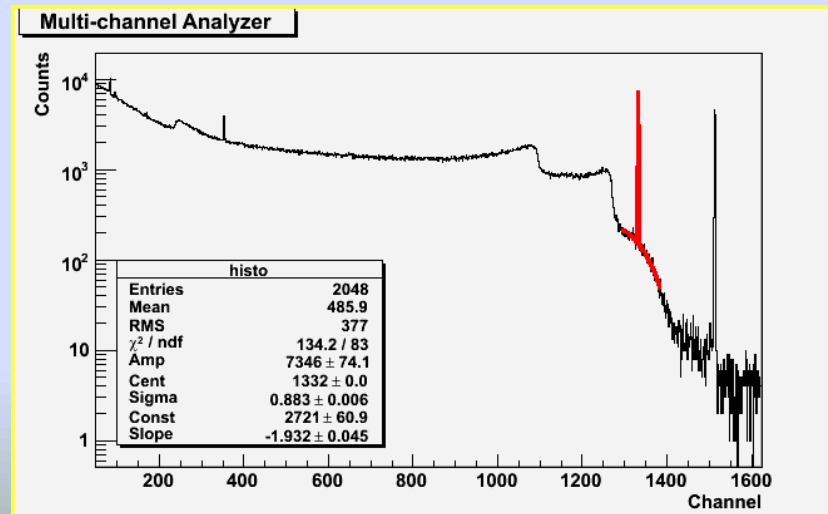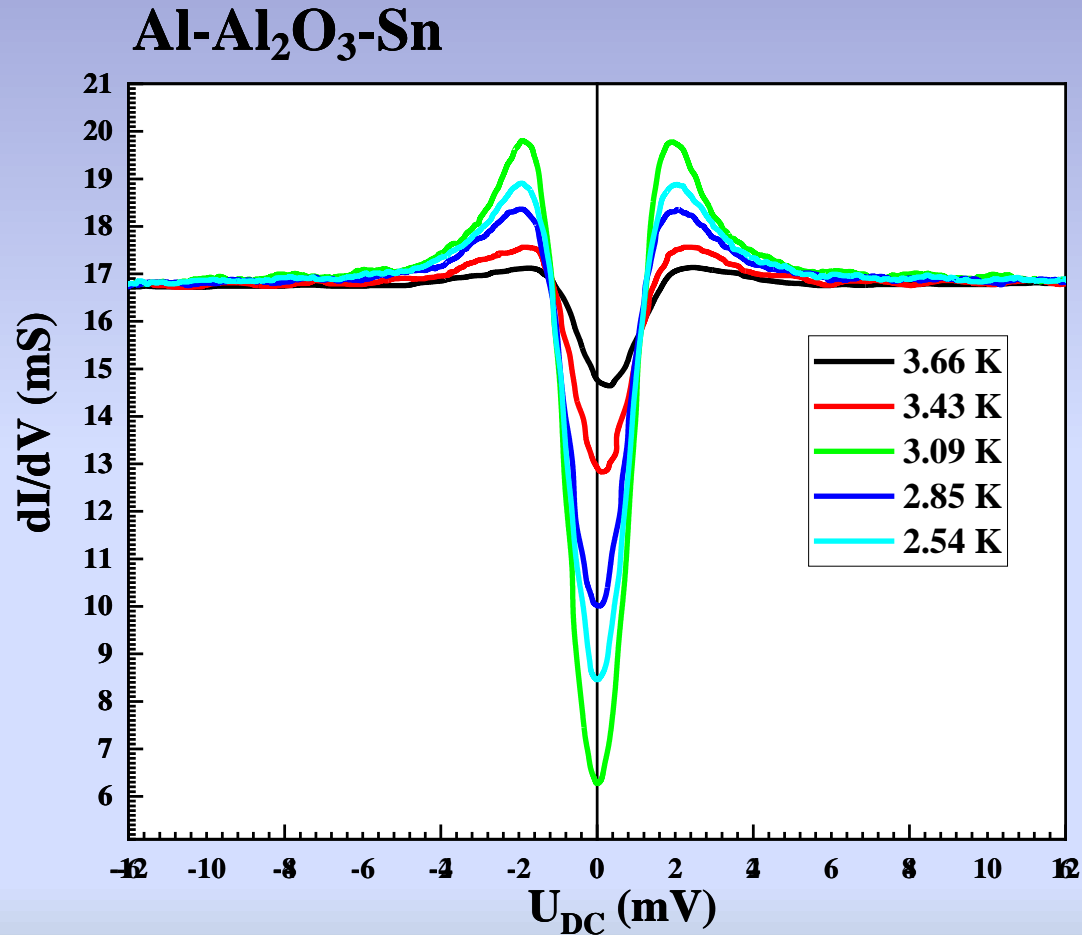
Typical Problems
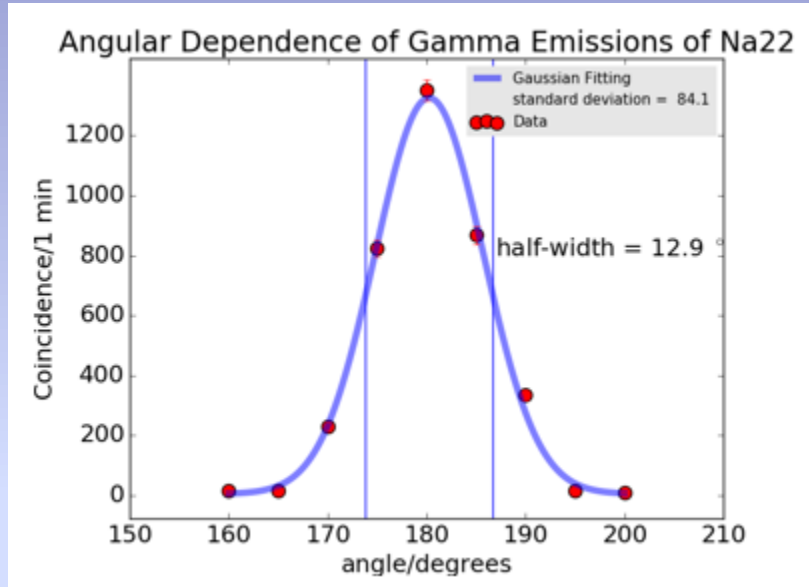
Nice Figure
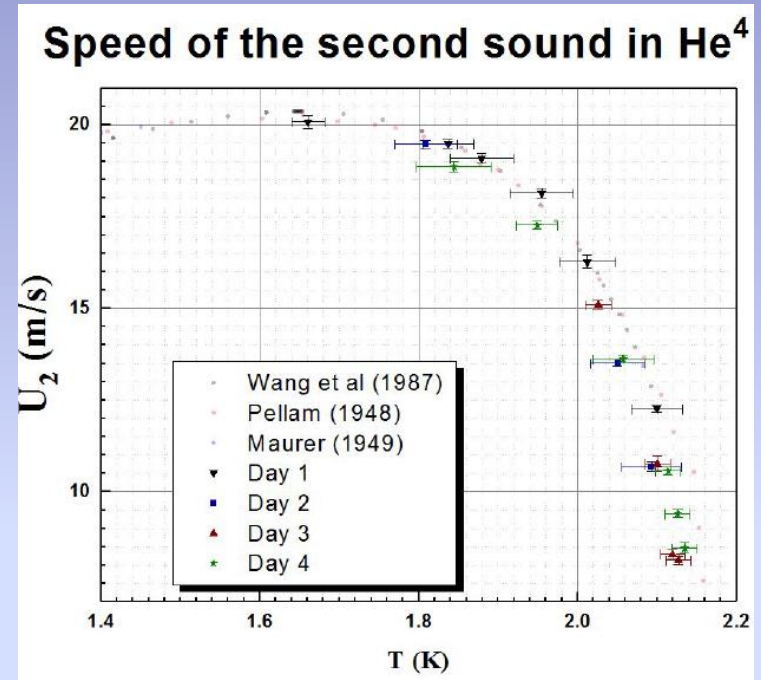
Great Data but lines are too thick, and symbols are too small

Typical Problems

Too many lines – graph should be "polished" (Optical Pumping)

Typical Problems

Al-Al$_2$O$_3$-Sn

Use more contrast color for lines

Deadlines

☐ **All talk titles should be submitted not later than on midnight Friday July 10th**

☐ **Presentation files should be uploaded electronically not later than July 13th 5pm**