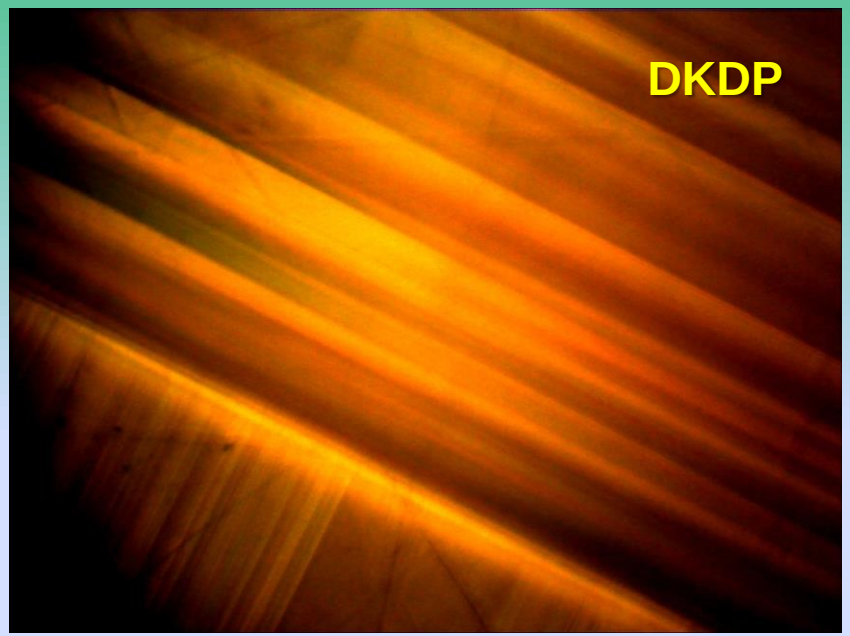
# Effective Lab Oral Report – Spring 2021

**David Hertzog, Eugene V Colla, Virginia Lorenz**
*University of Illinois at Urbana-Champaign*




**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**

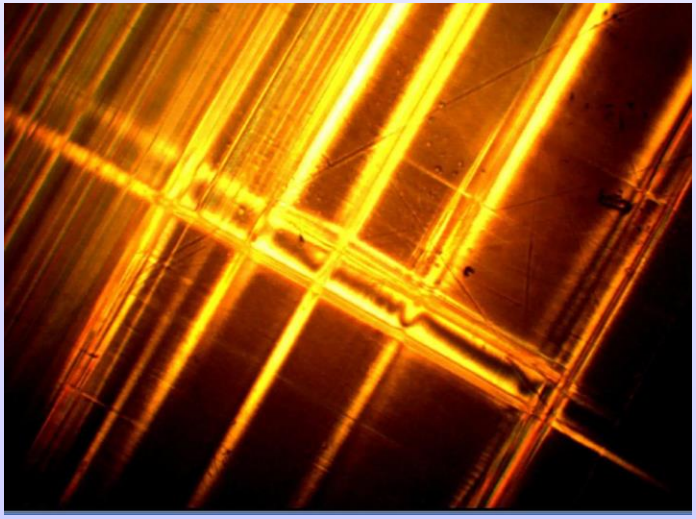
# Presentation components and grading scale.

| CRITERIA | Max. Score |
|---|---|
| Both days 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 slide

Title

# OPTICAL STUDY OF FERROELECTRIC POTASSIUM DIDEUTERIUM PHOSPHATE (DKDP)



Author name

**Student name**

**2/19/13**

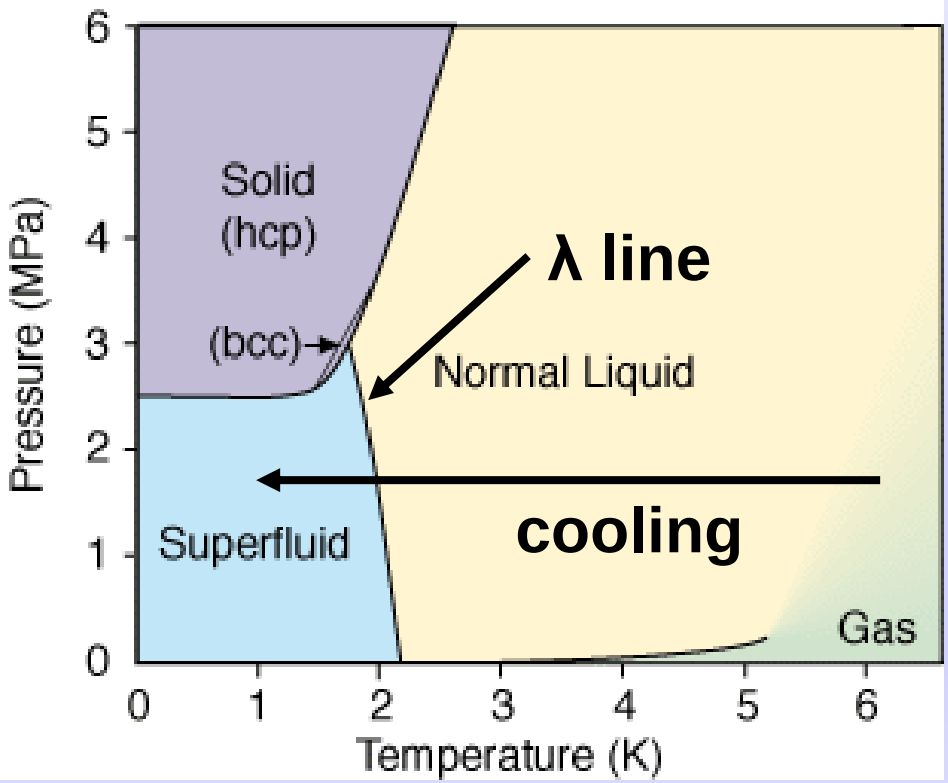
Date

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

Affiliation

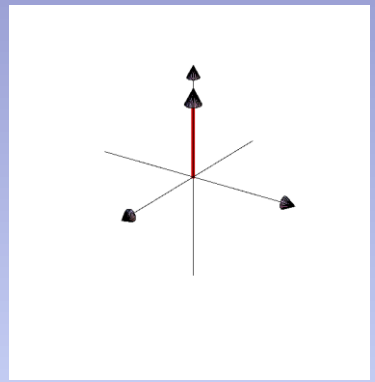
# Phase transition of Helium 4

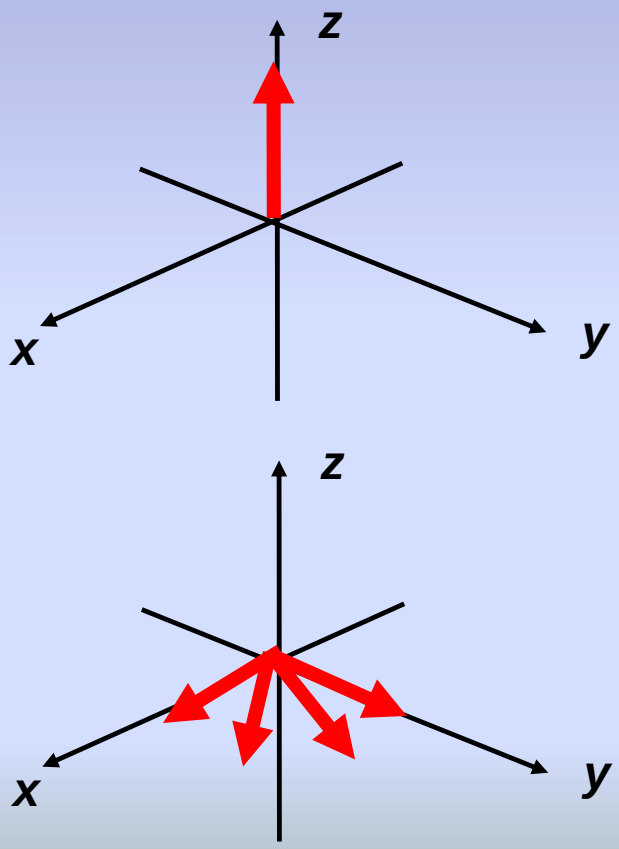
- **Below $T_\lambda$ = 2.17 K, helium exists in mixture of superfluid and normal liquid helium.**



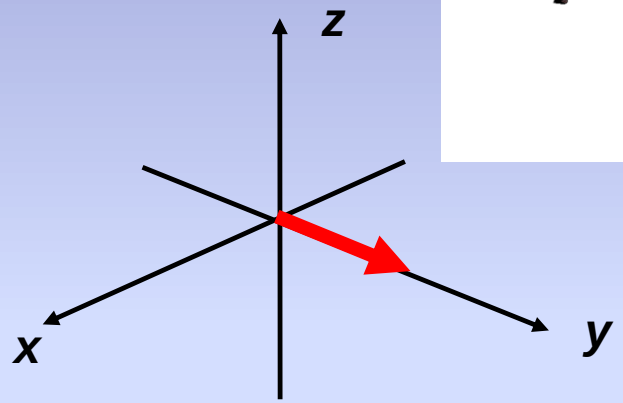
# What happen if they are struck by pulses ?

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






**$90^0$ Pulse**



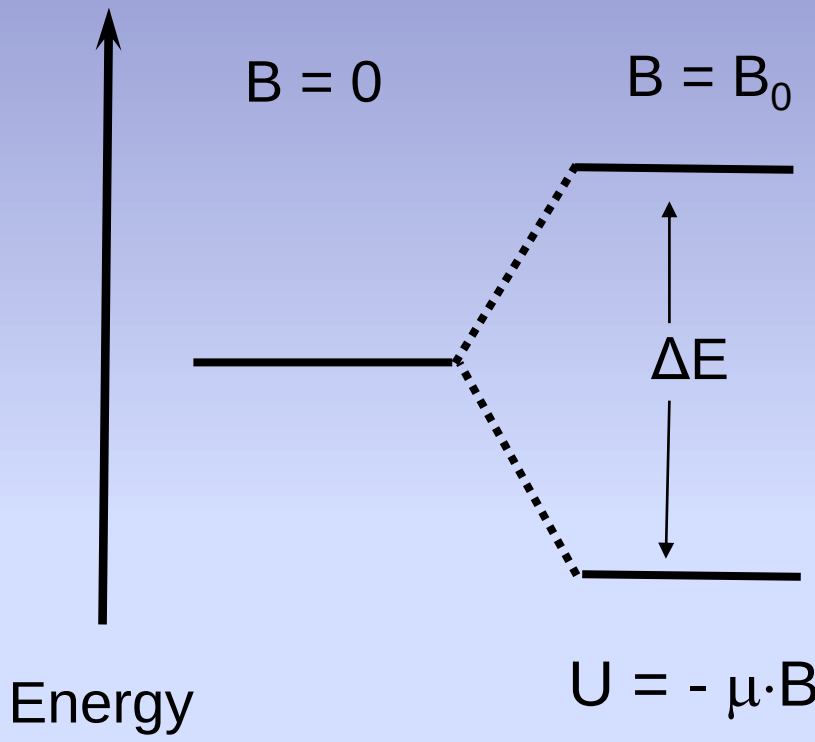


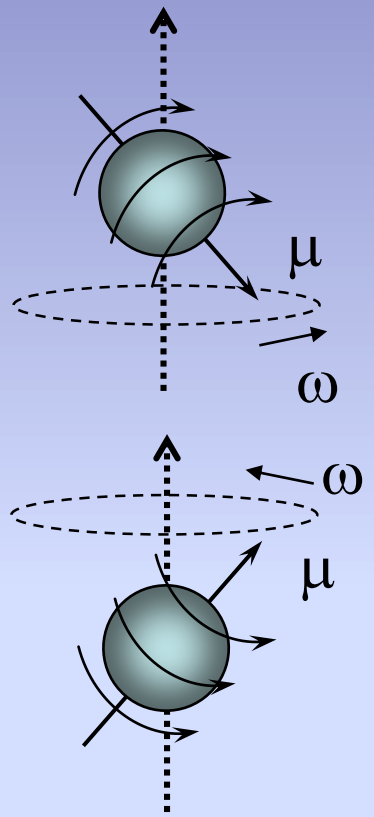


?

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

# What happens to a nucleus in a magnetic field ?

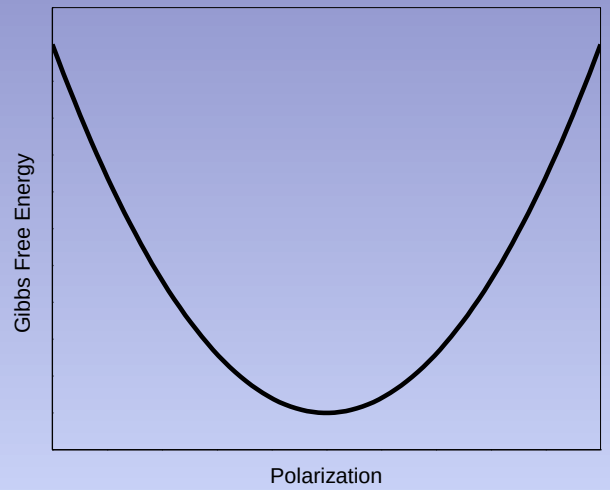


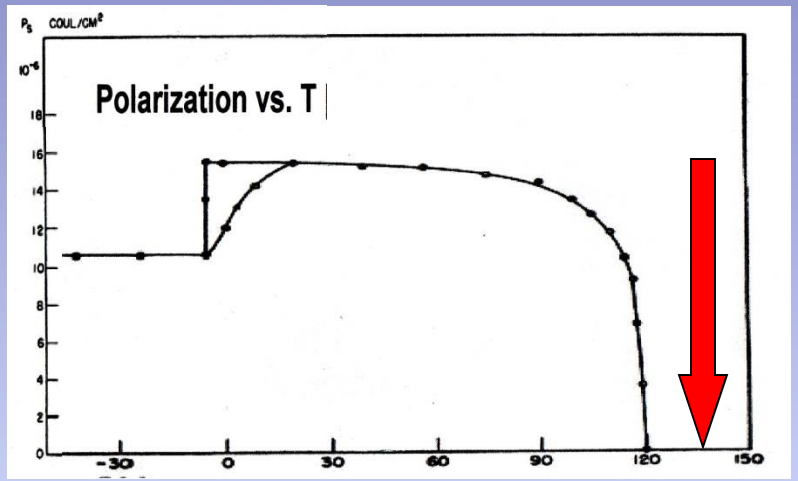



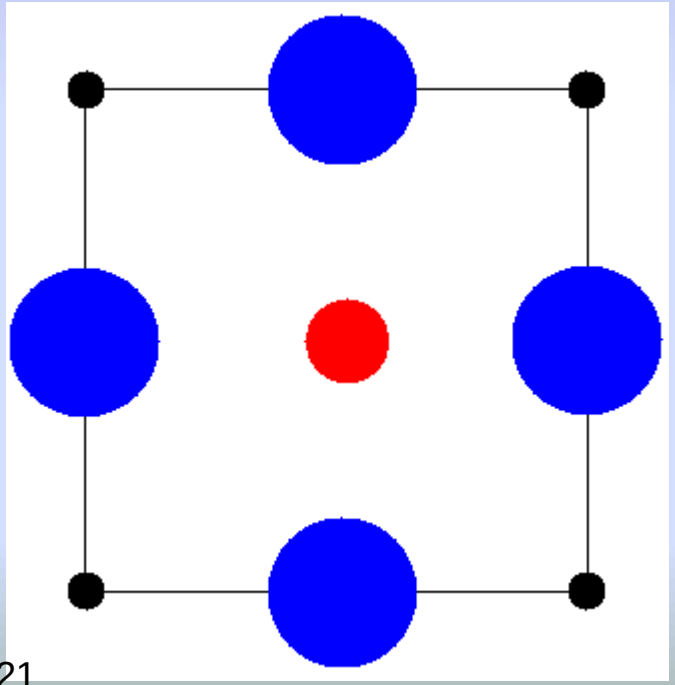

*(Courtesy of Bishop. K)*

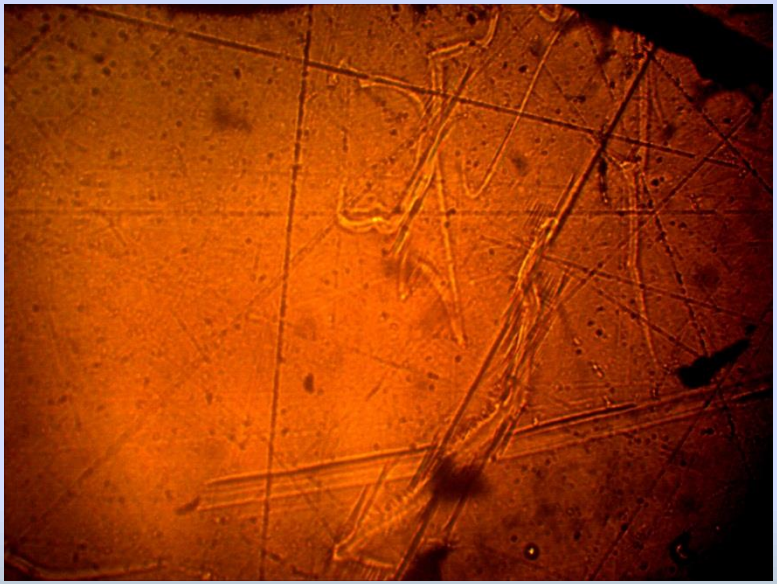
$$\Delta E = \gamma \cdot \hbar \cdot B_0 = \hbar\omega_0$$ → *Larmor frequency!*

# Phase Transition in $BaTiO_3$

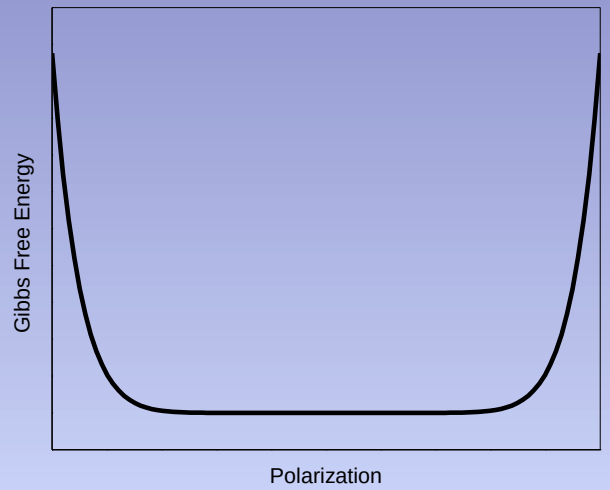


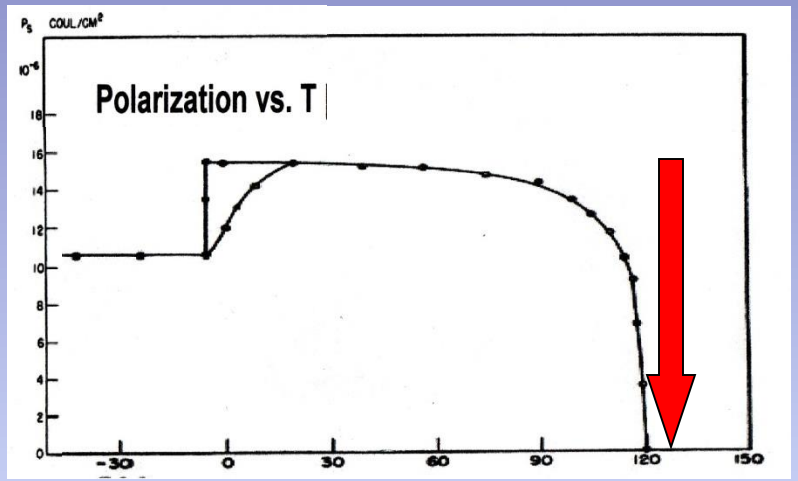



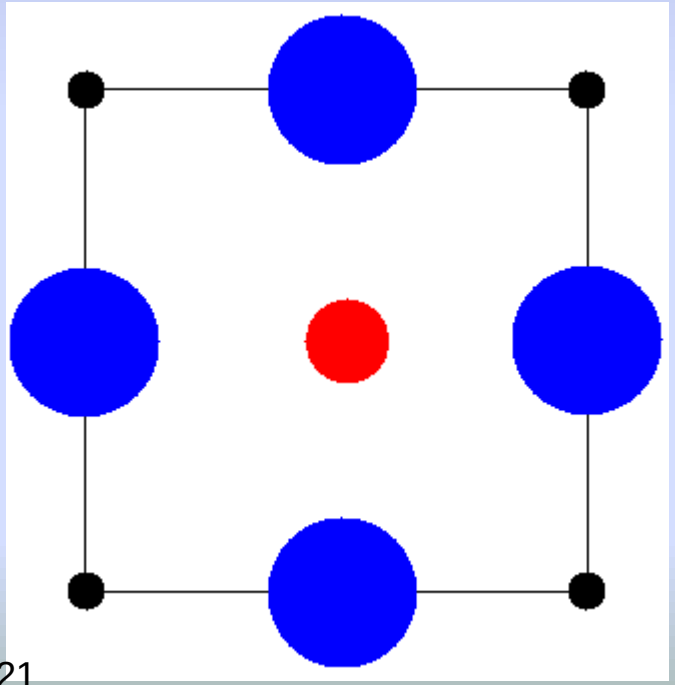



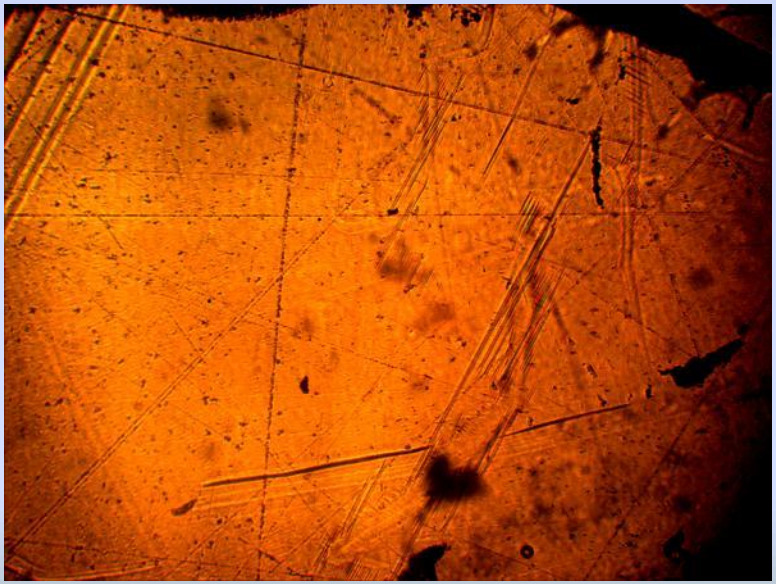


# Phase Transition in $BaTiO_3$

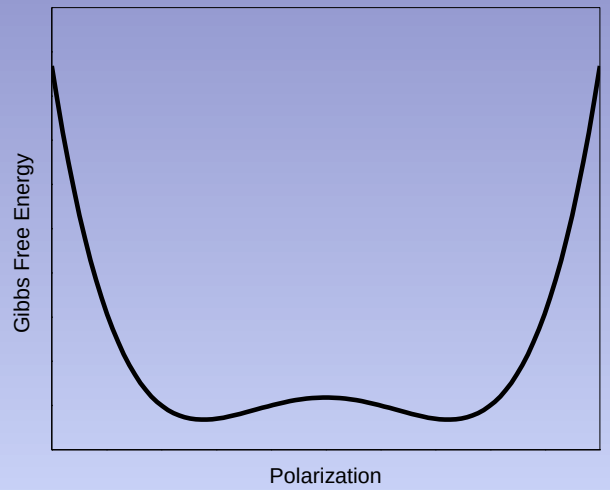


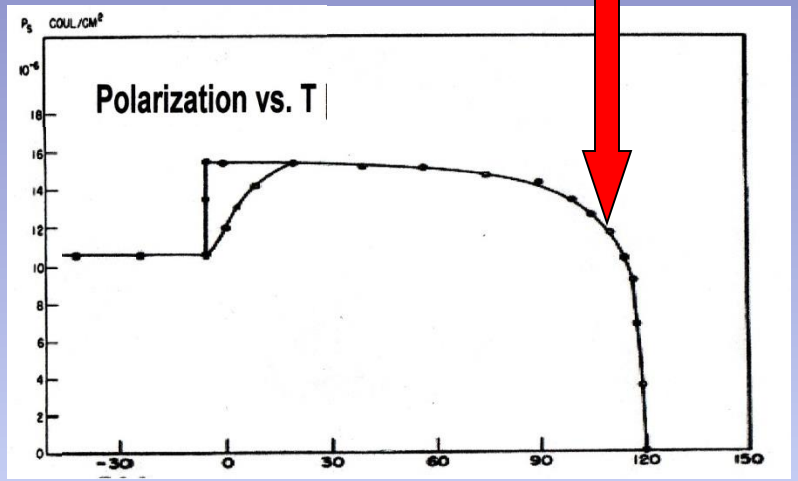



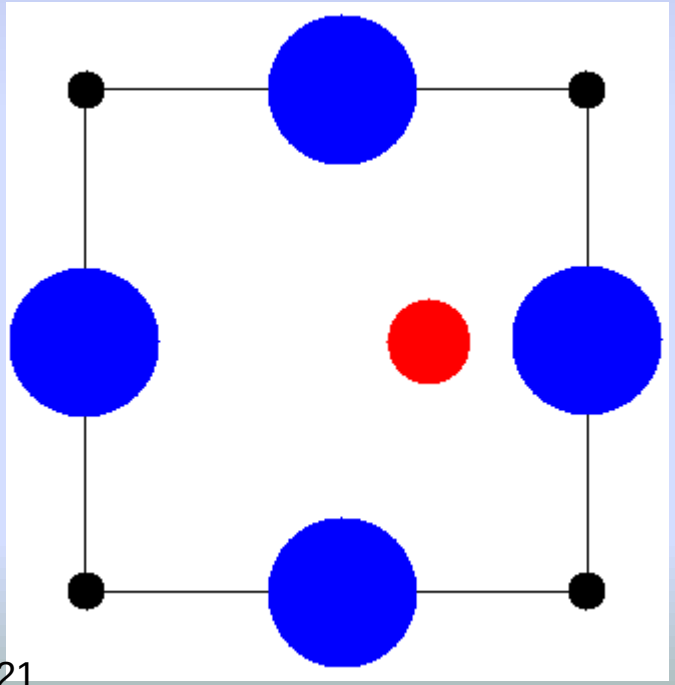



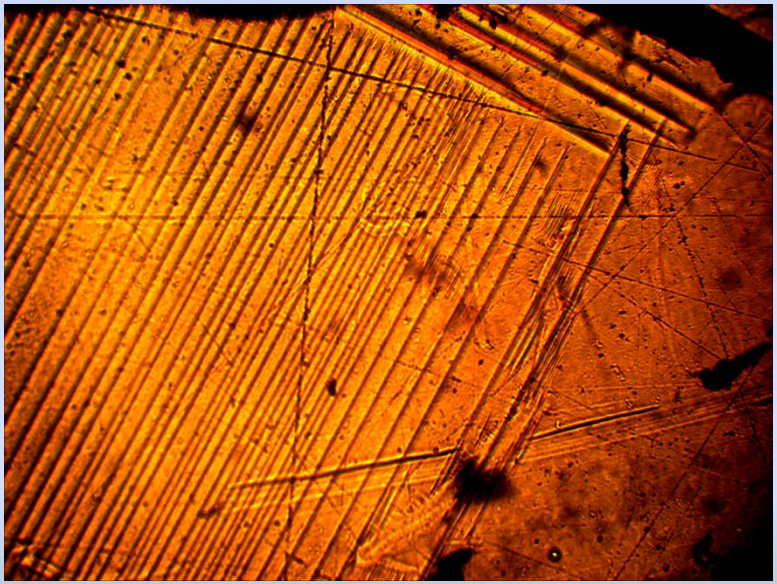


# Phase Transition in $BaTiO_3$

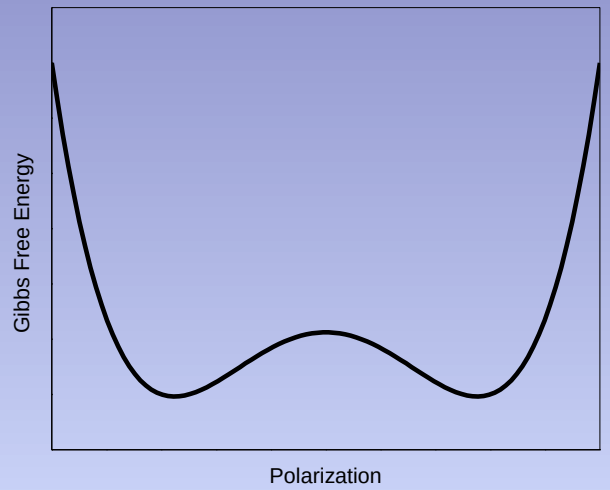


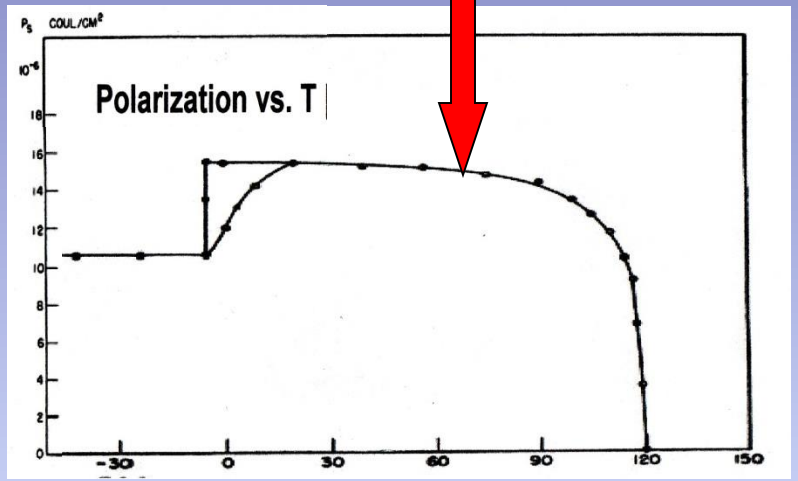



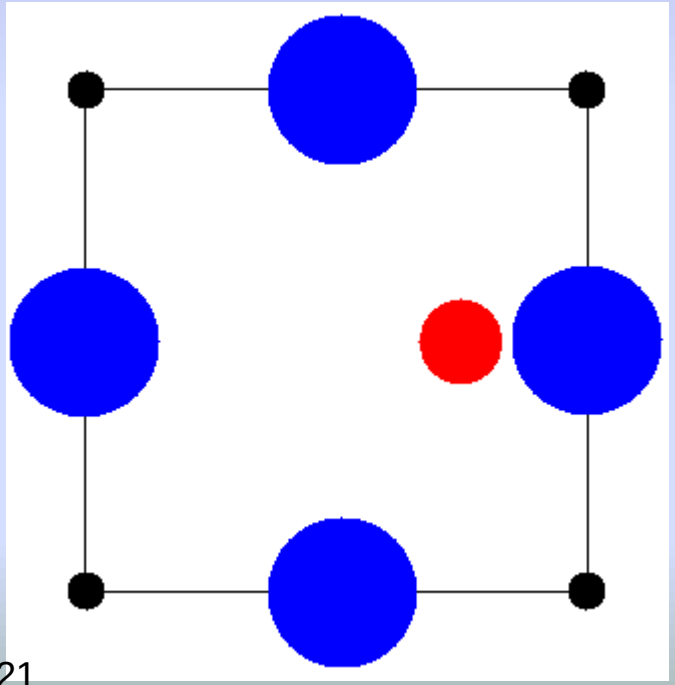



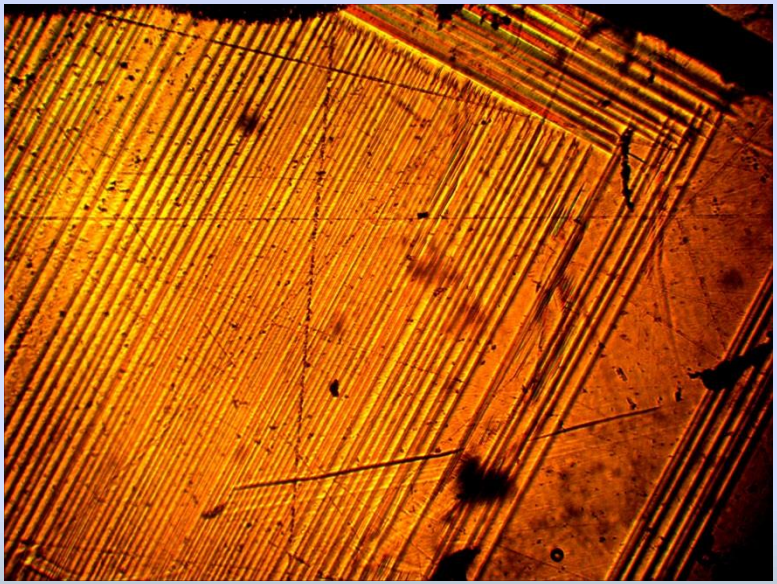


# Phase Transition in $BaTiO_3$



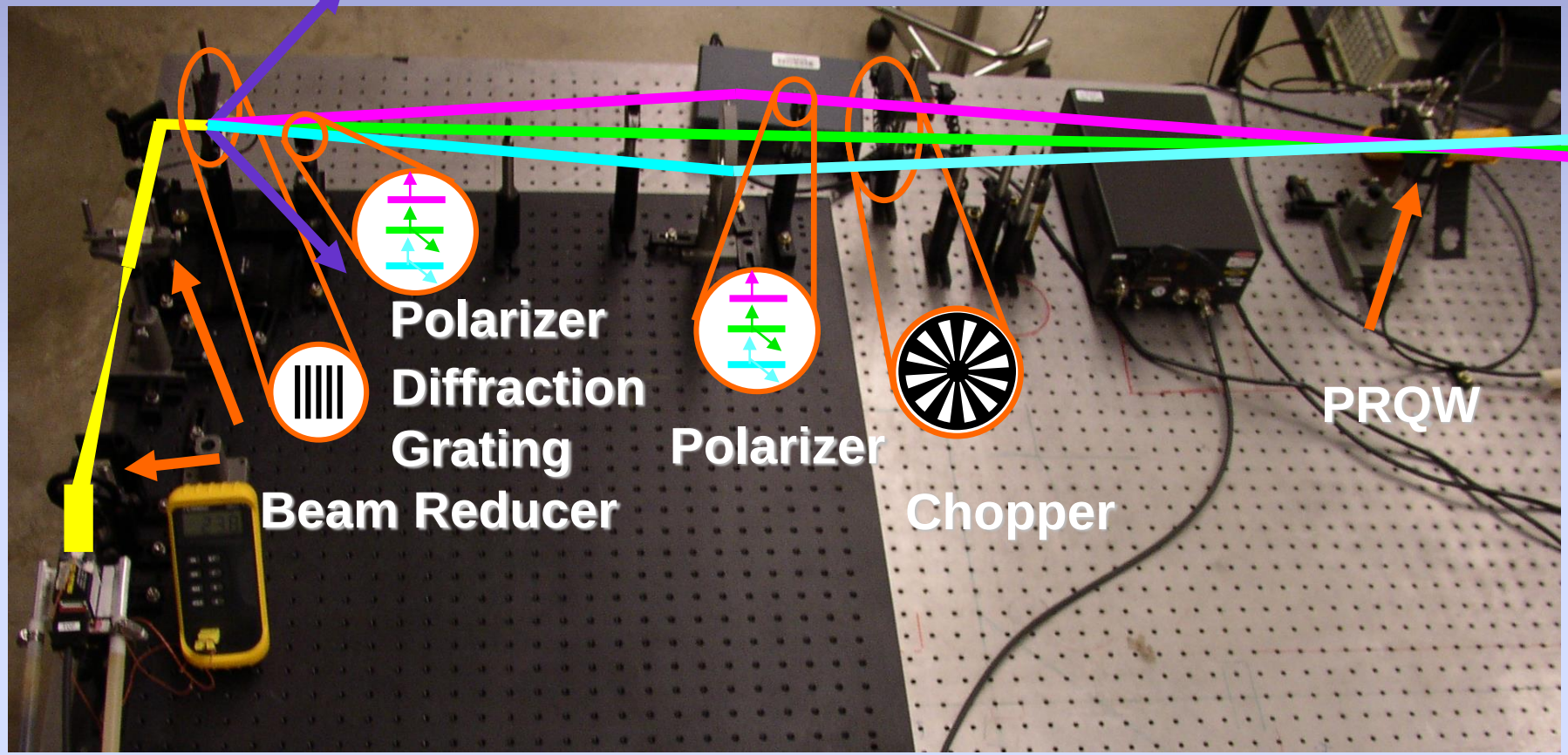





Everybody loves an optical bench, but unless you map out the elements and the beam paths, it doesn't mean much

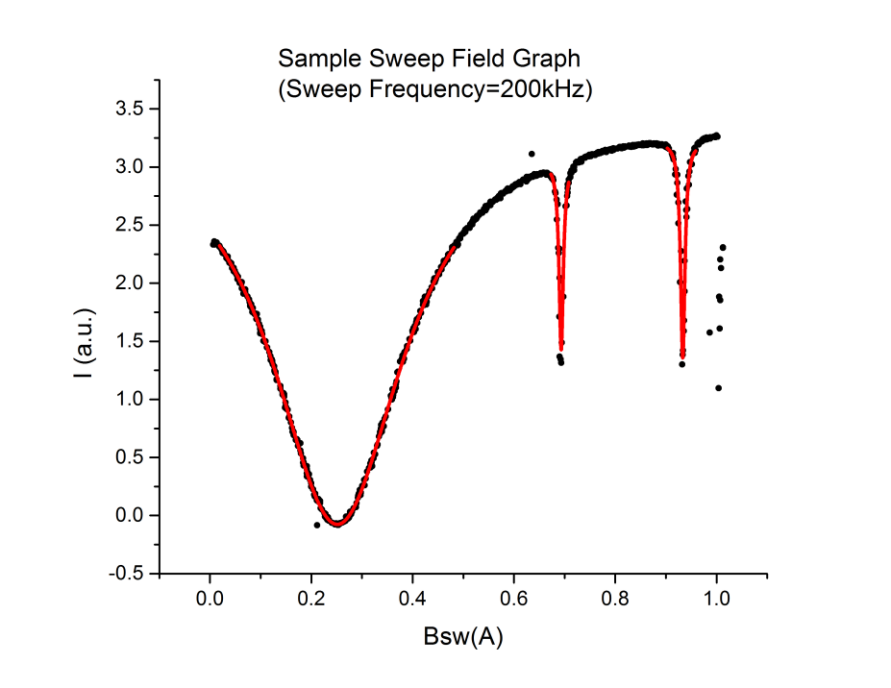
# Experimental Apparatus



# An example of image which is nice but does not help too much

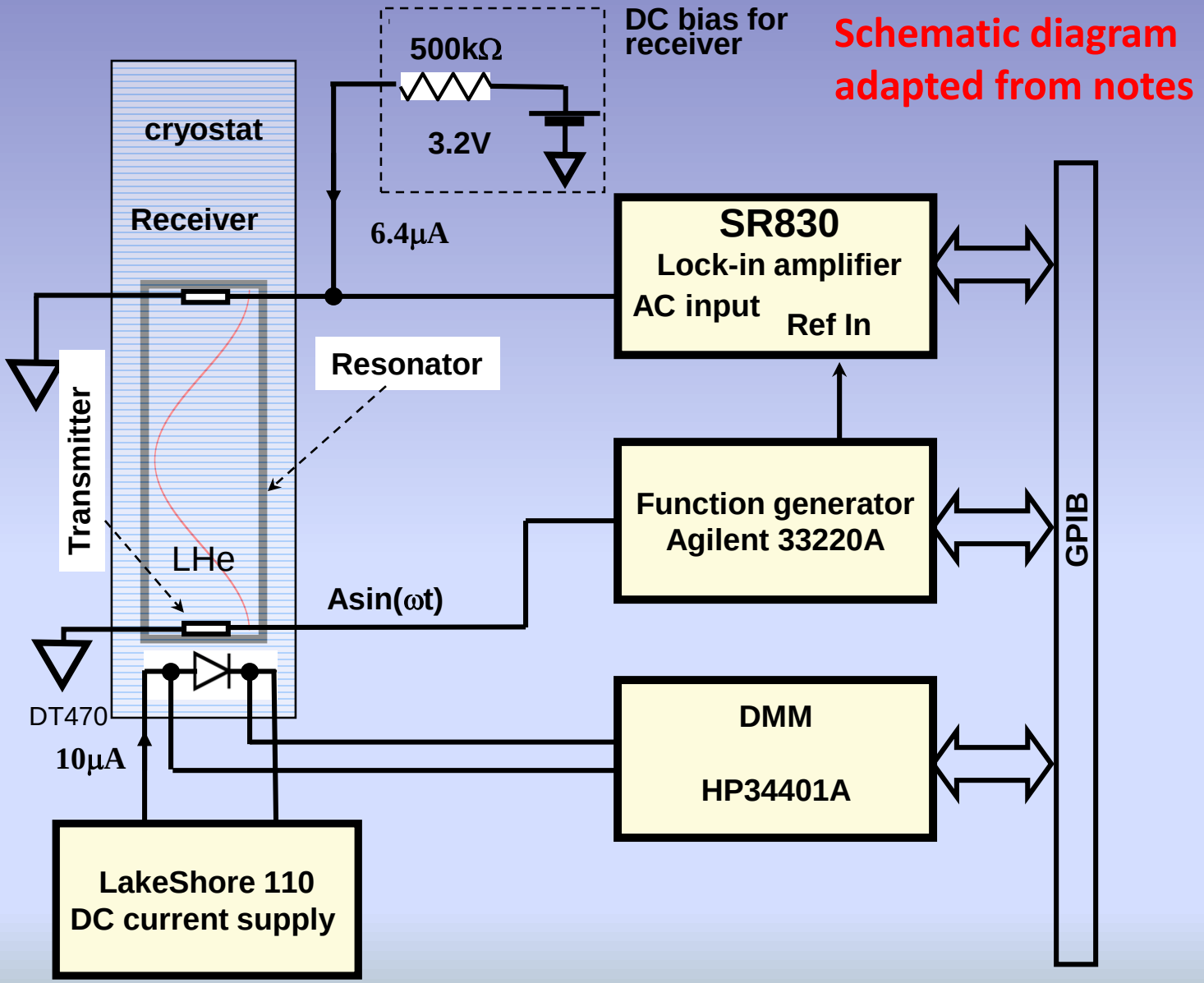
# Magnetic Field Calibration

- 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.

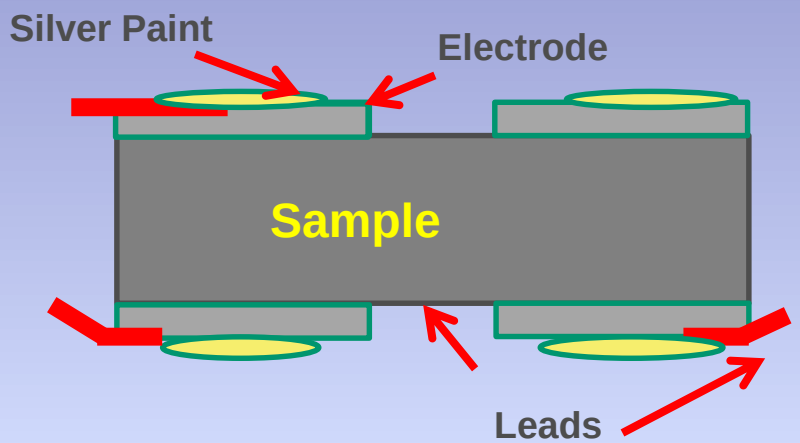


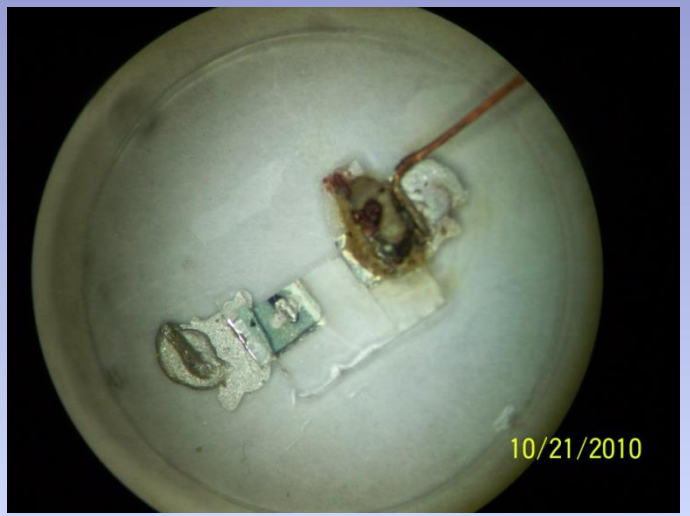

Too many words on slide

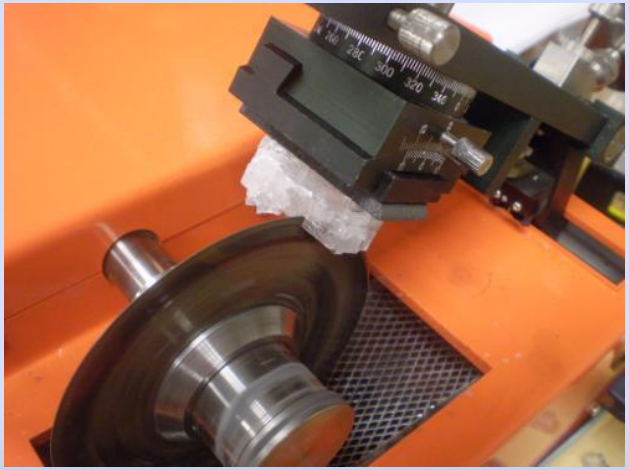
# Setup diagrams, apparatus, measuring idea…

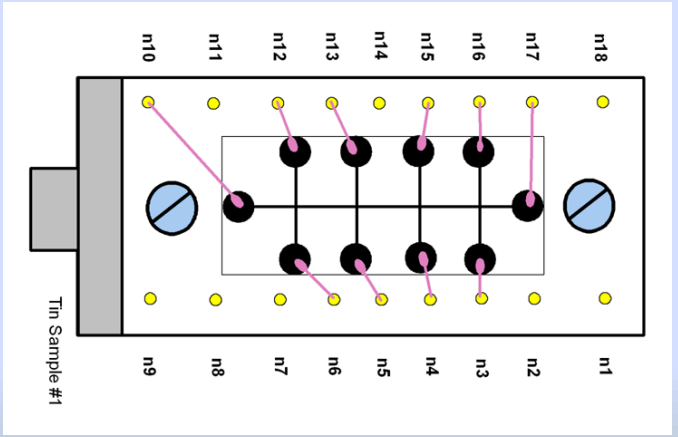


# Samples: preparation, configuration etc.

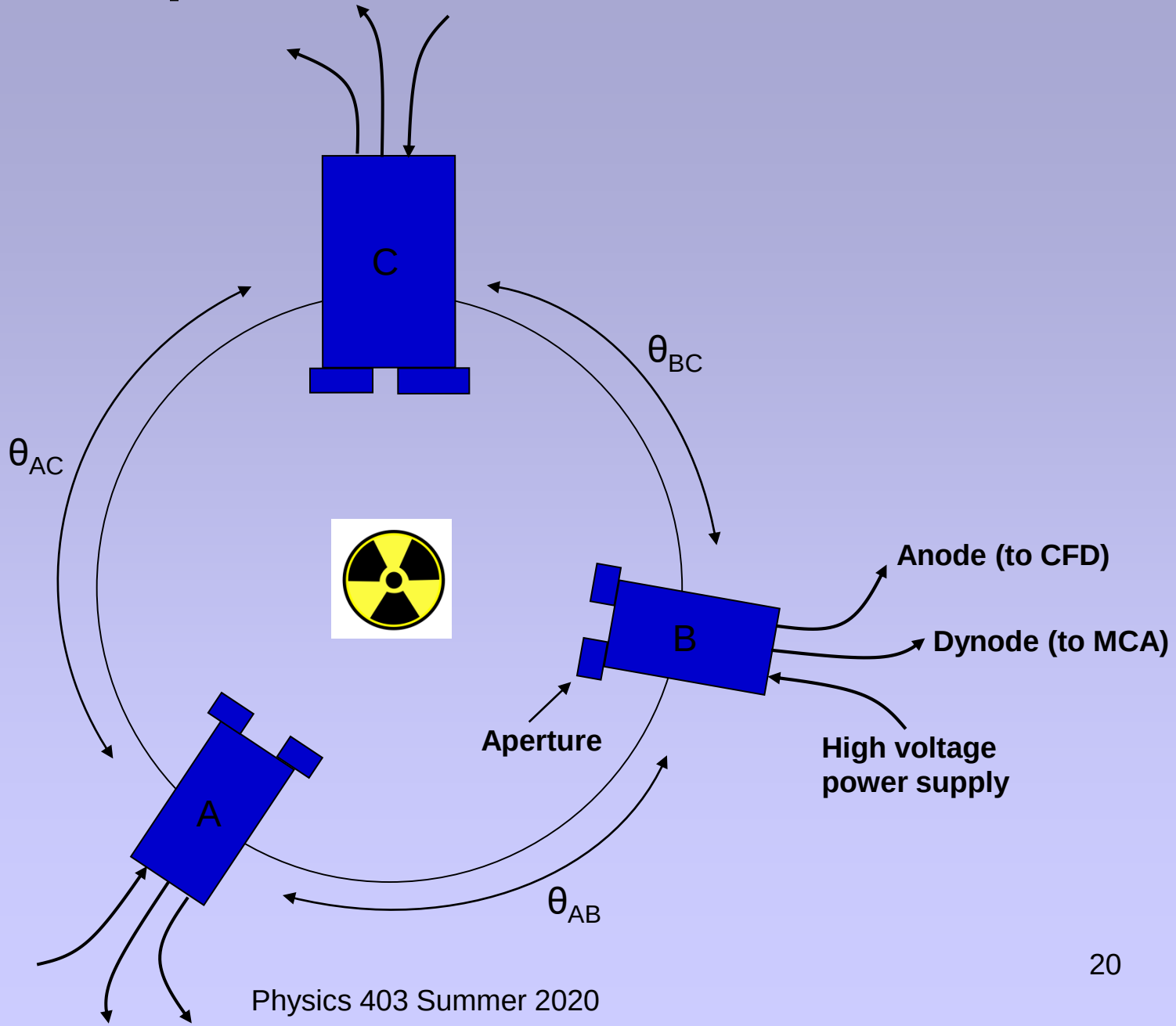


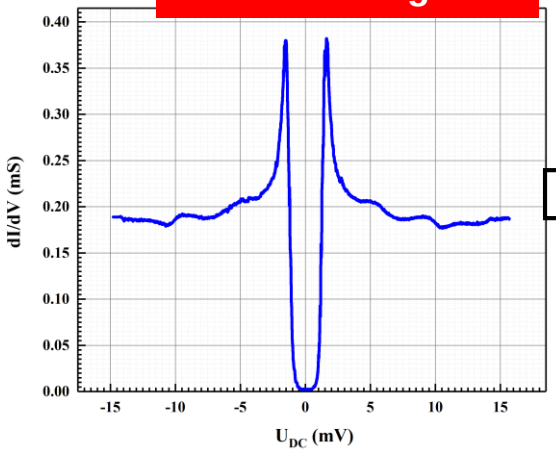


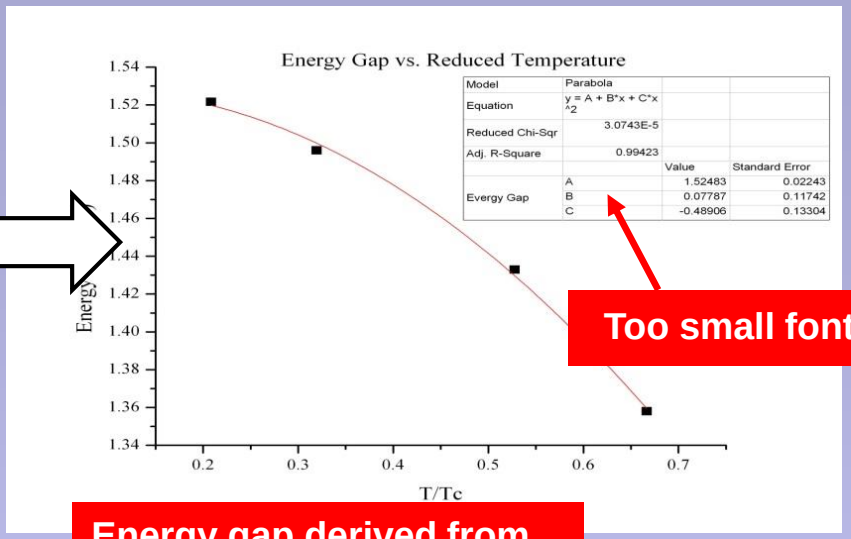
# Setup of Source and Detectors



# Results

Raw tunneling data

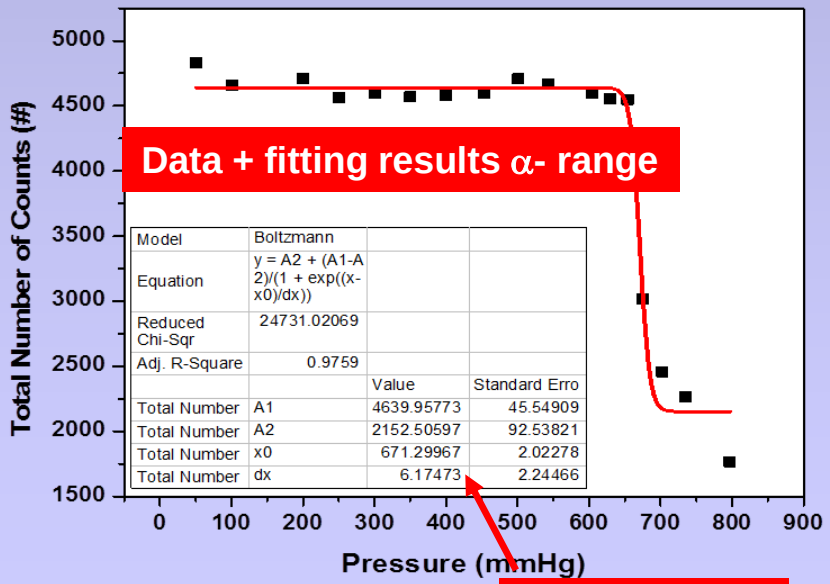



Too small font !

Energy gap derived from tunneling conductivity

Count Rate vs. Pressure (Argon)

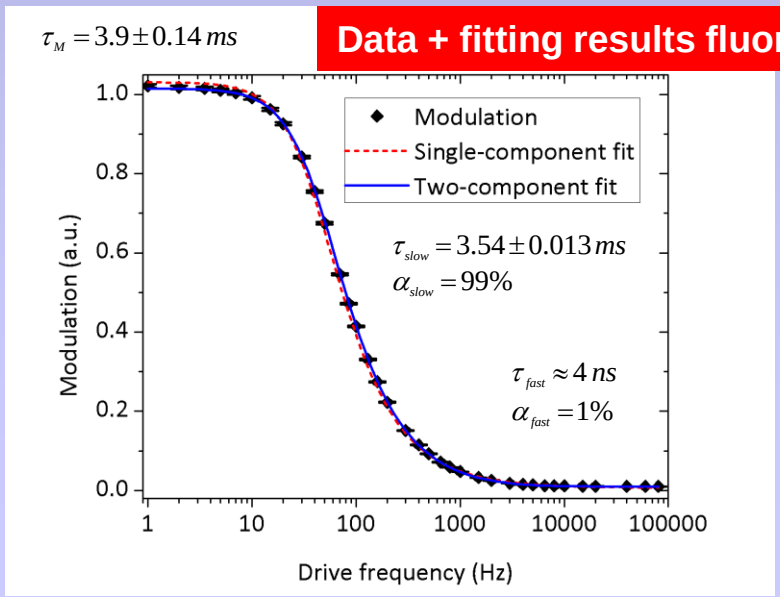



Data + fitting results α- range

| Model | Boltzmann | | |
|---|---|---|---|
| Equation | y = A2 + (A1-A2)/(1 + exp((x-x0)/dx)) | | |
| Reduced Chi-Sqr | 24731.02069 | | |
| Adj. R-Square | 0.9759 | | |
| | | Value | Standard Erro |
| Total Number | A1 | 4639.95773 | 45.54909 |
| Total Number | A2 | 2152.50597 | 92.53821 |
| Total Number | x0 | 671.29967 | 2.02278 |
| Total Number | dx | 6.17473 | 2.24466 |

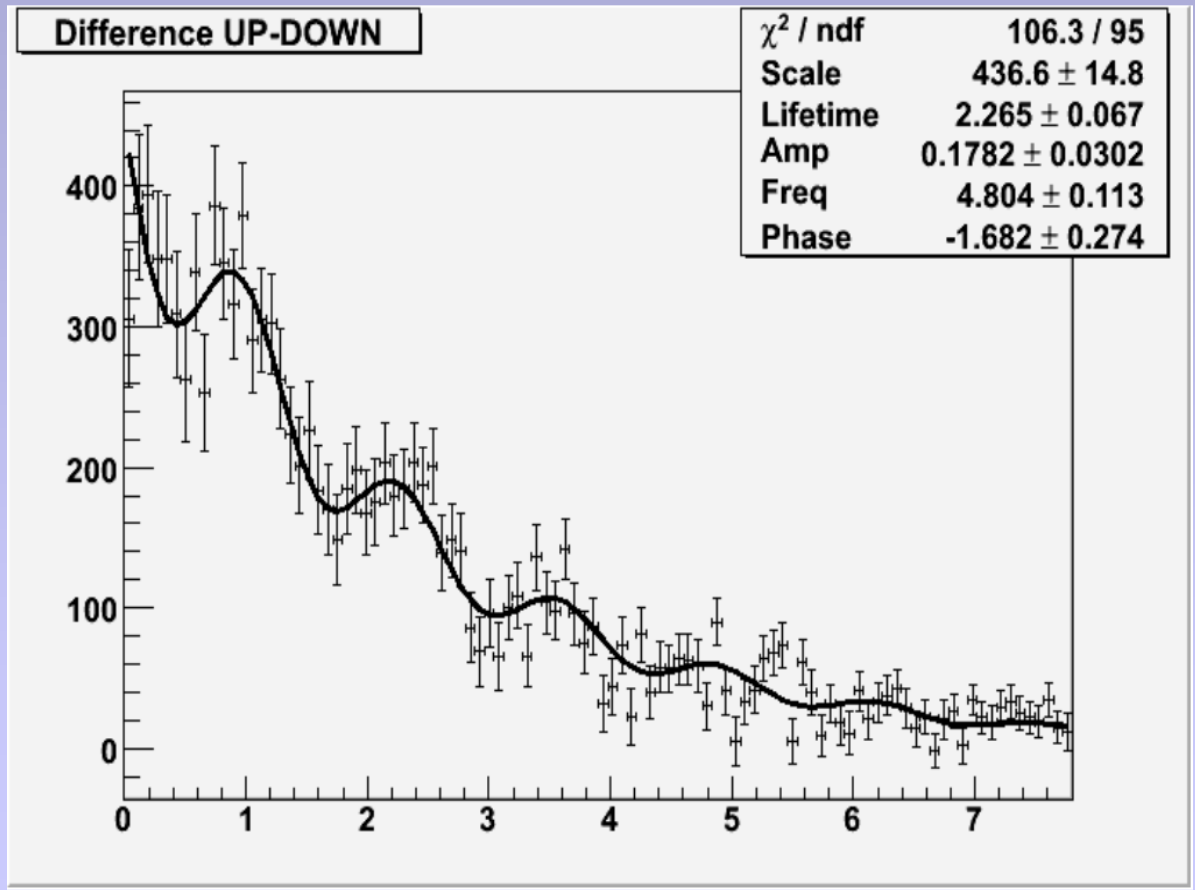
Too many SD !

Data + fitting results fluorescence



# Difference in Up-Down (unnormalized)

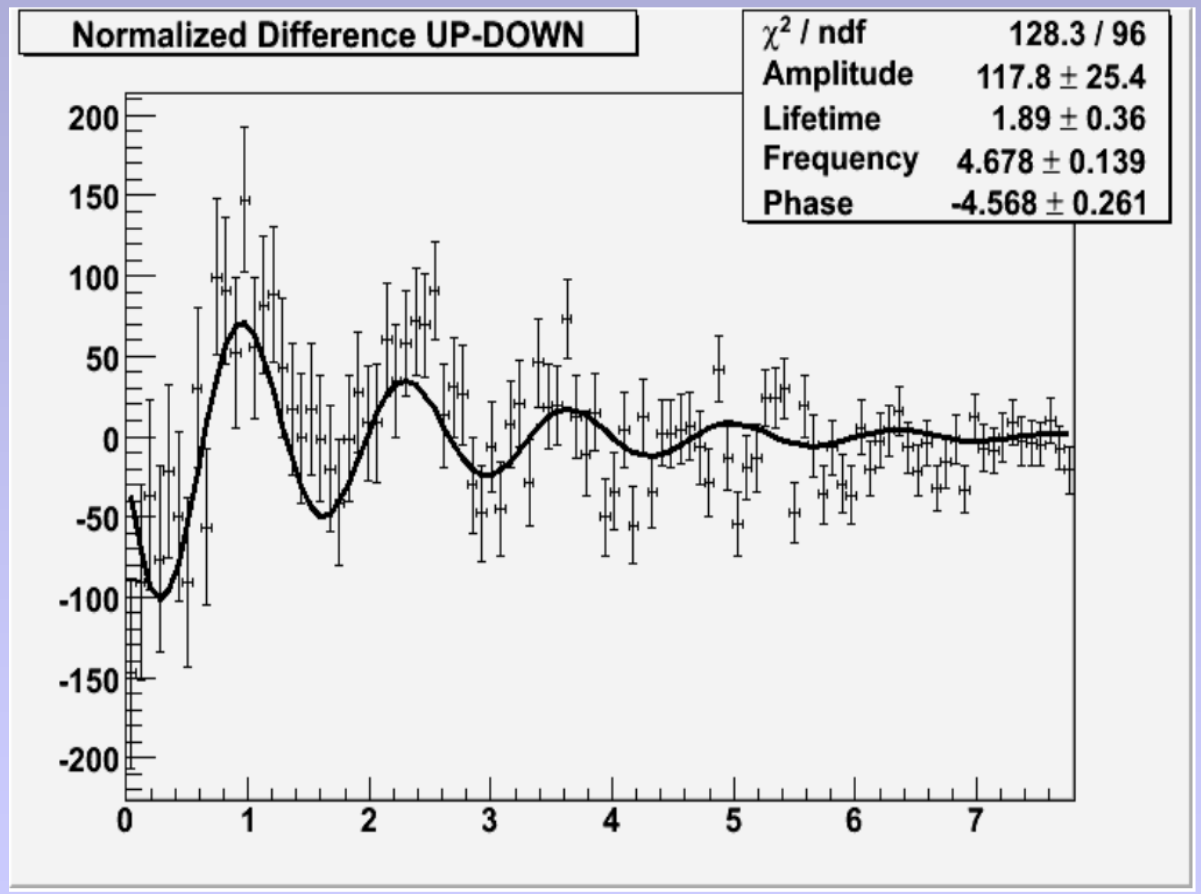
**Fit equation** $Ne^{\frac{-t}{\tau}}\left(1+\alpha\cos(\omega t+\delta)\right)$




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

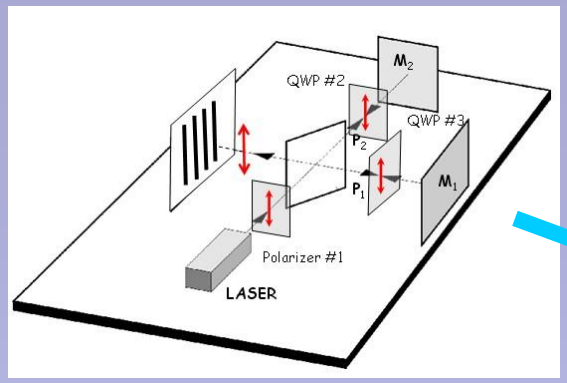
# Difference in Up-Down (normalized)

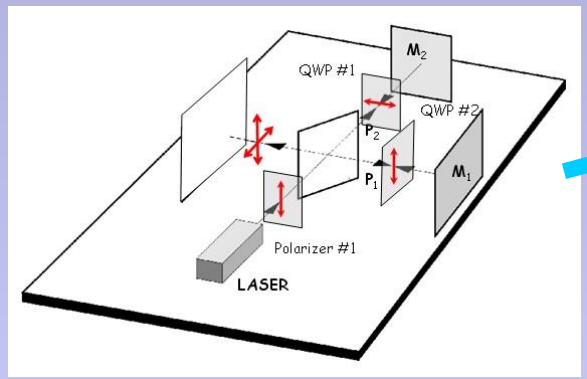
**Fit equation** $Ne^{\frac{-t}{\tau}}\left(1+\alpha\cos(\omega t+\delta)\right)$

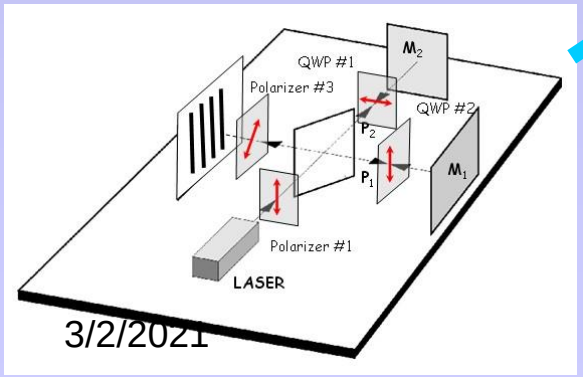



**Courtesy Samuel Homiller and Pakpoom Buabthong Fall 2013**

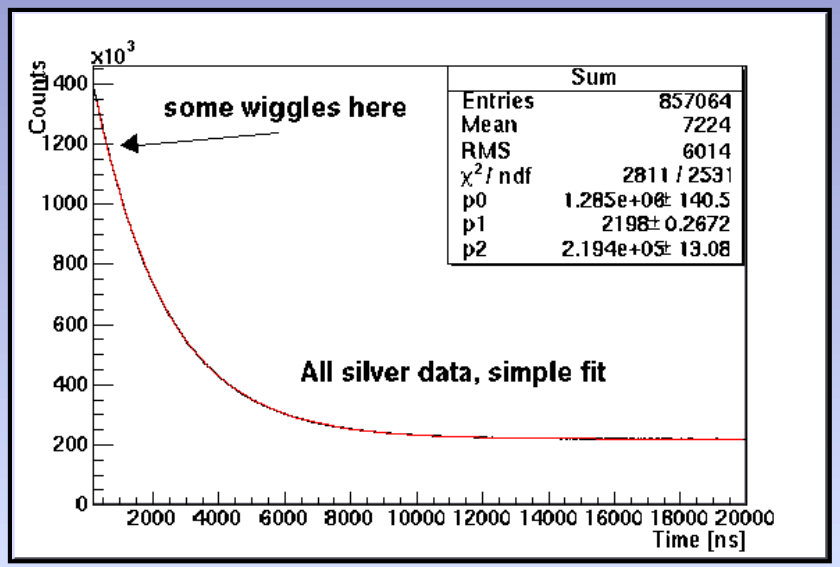
# Results – witnessing a mystery?

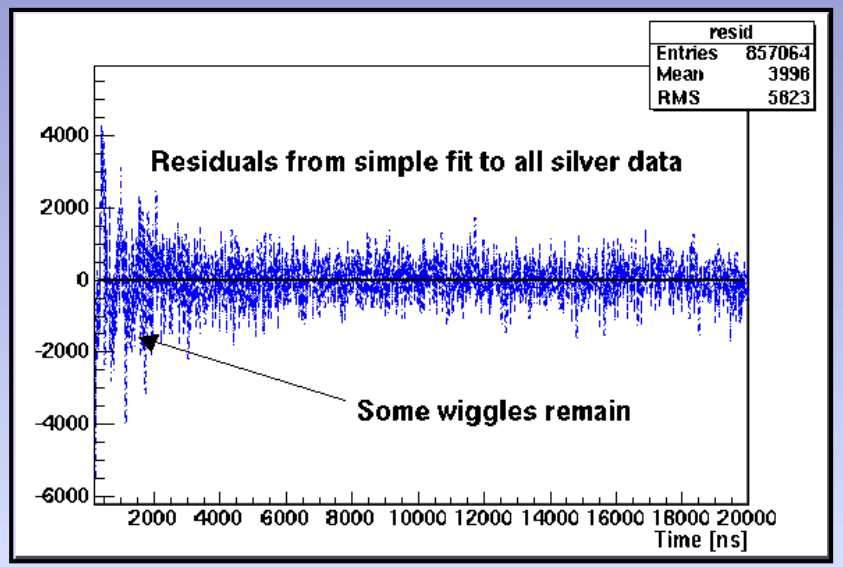


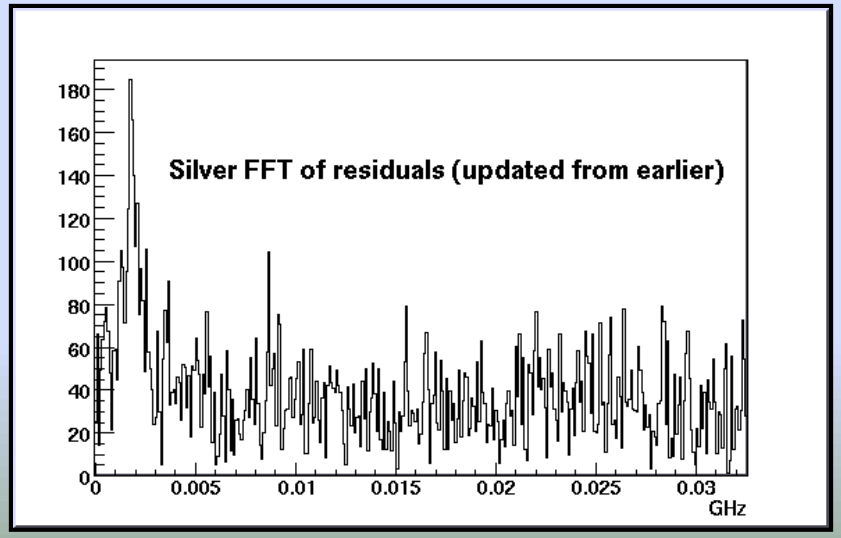



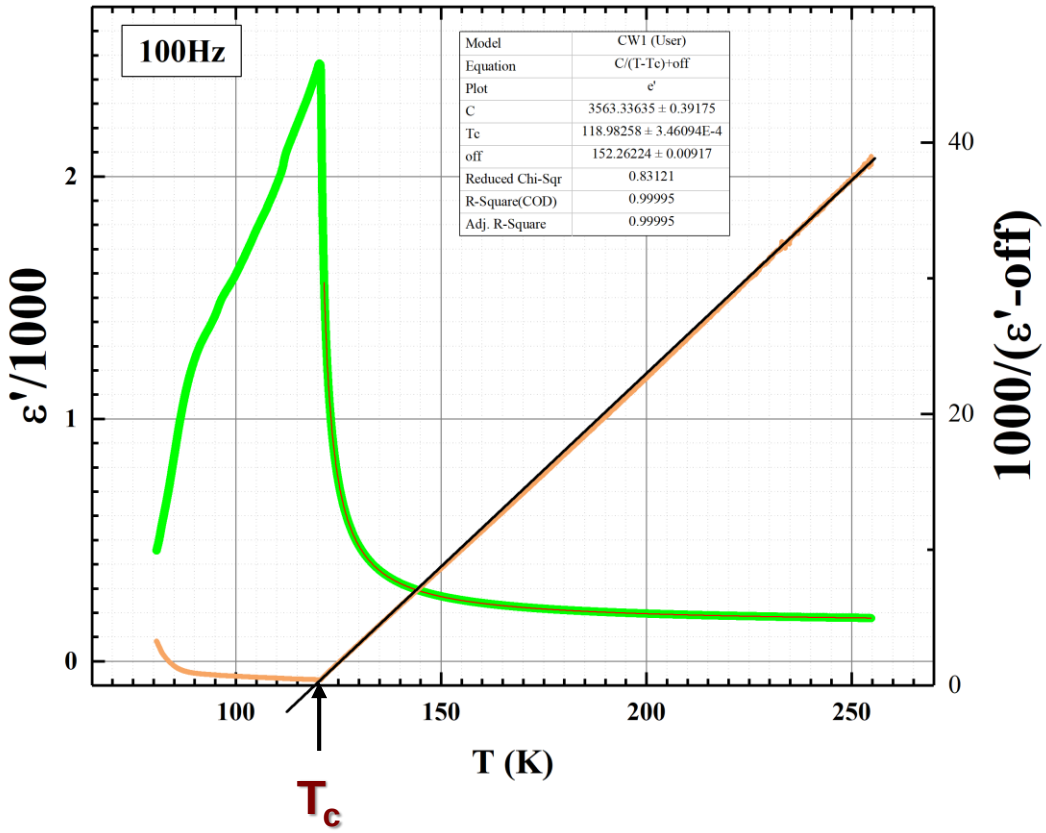

# Presenting data is your most important and challenging task



# Fitting to the Curie-Weiss law




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

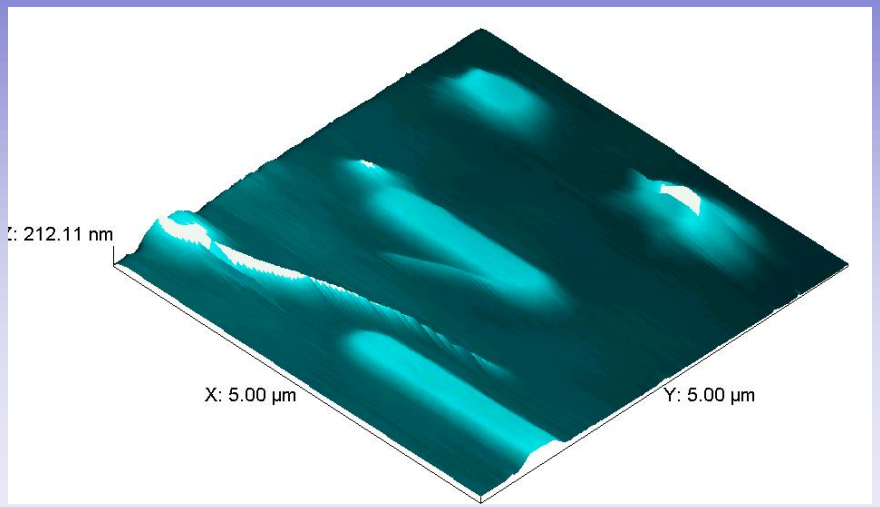
$C = 3563.3 \pm 0.4\text{K}$

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

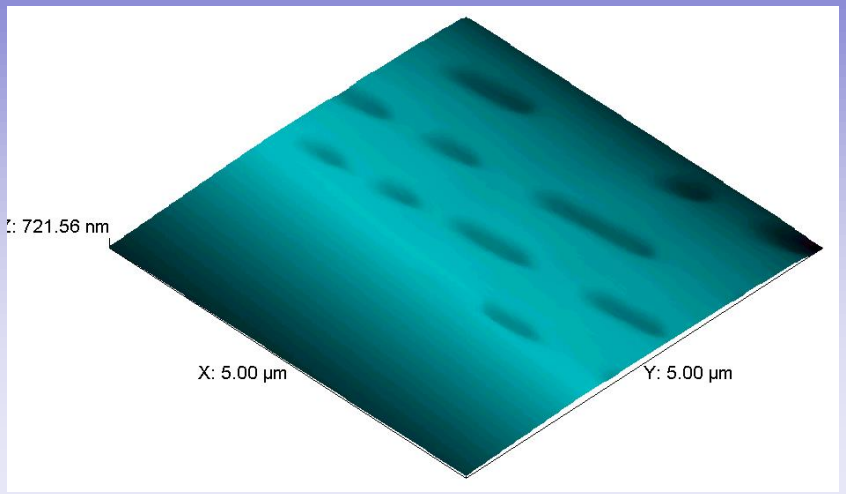
**Courtesy Zongyuan Wang and Arnulf Taylor Su 2017**

# AFM of Optical Data Storage Media

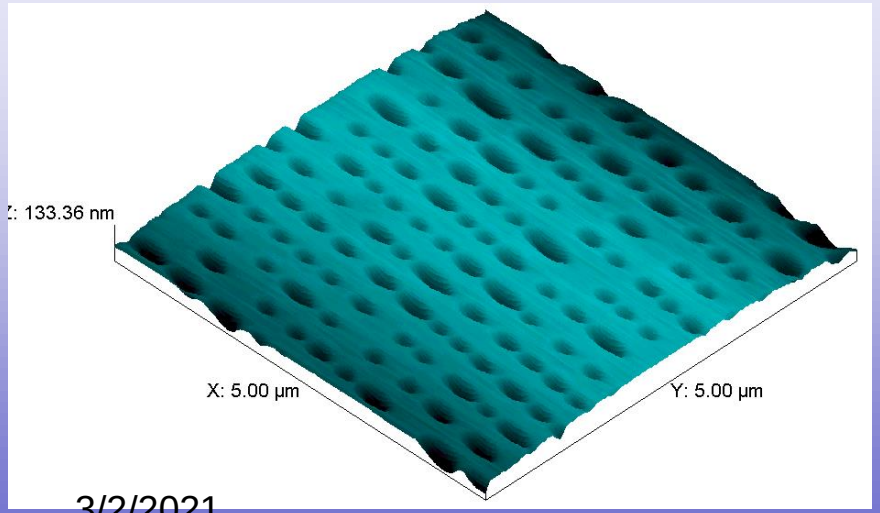
**CD**




**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**

# Fitting the data

$$V = C\sqrt{\left(\frac{T - T_{offset}}{T_\lambda}\right)\left(1 - \left(\frac{T - T_{offset}}{T_\lambda}\right)^{5.6}\right)}$$

$$\rightarrow \quad V = C\left[\left(\frac{T - T_{offset}}{T_\lambda}\right)\left(1 - \left(\frac{T - T_{offset}}{T_\lambda}\right)^{\beta}\right)\right]^{\gamma}$$

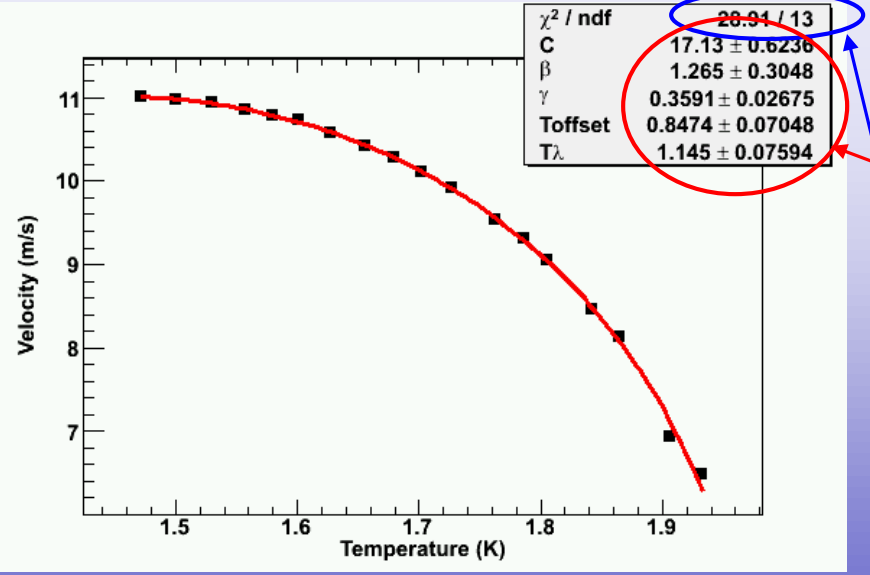
Offset, intrinsic to the experiment

Fit to the exponents as well

$C \approx 26$

$T_\lambda \approx 2.17$

**Reference, where this equation came from?**




**Perform the 5 parameter fit-**

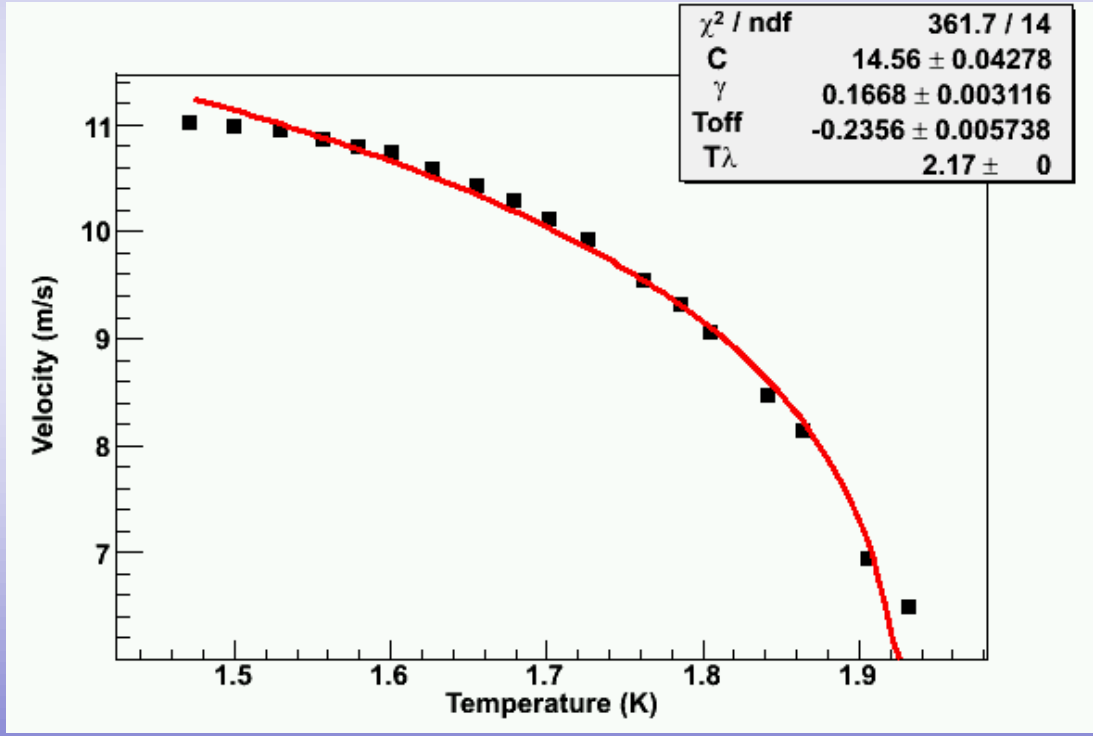
**The values that are obtained are not very close to the expected values**

**Also, the fit is not the best**

**Try to fit the data with this function**

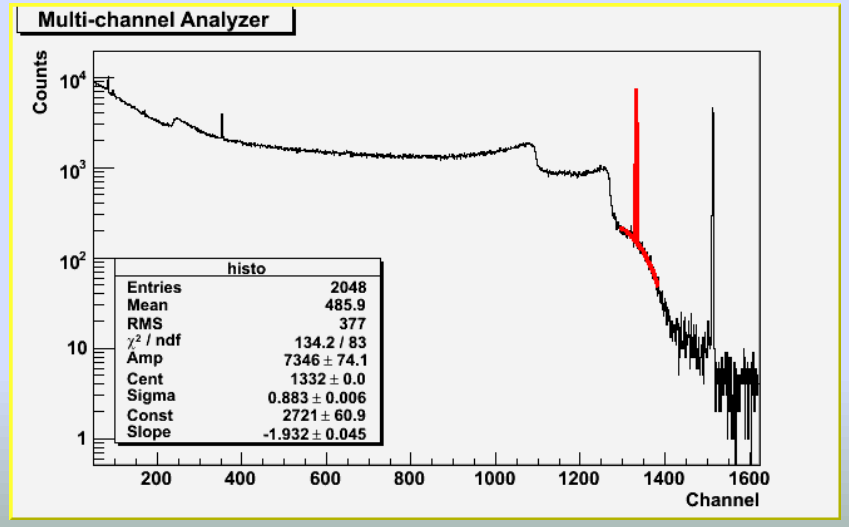
$$V = \left(1 - \frac{T - T_{offset}}{T_\lambda}\right)^\gamma$$

**The data refuses to fit to this function**

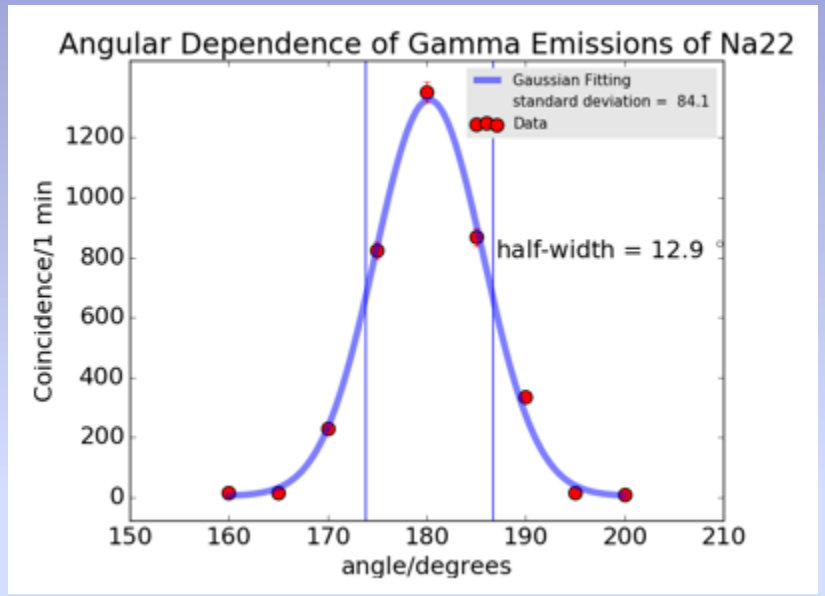


# Finish your talk with the data analysis and conclusions and a slide showing the main points you want us to remember

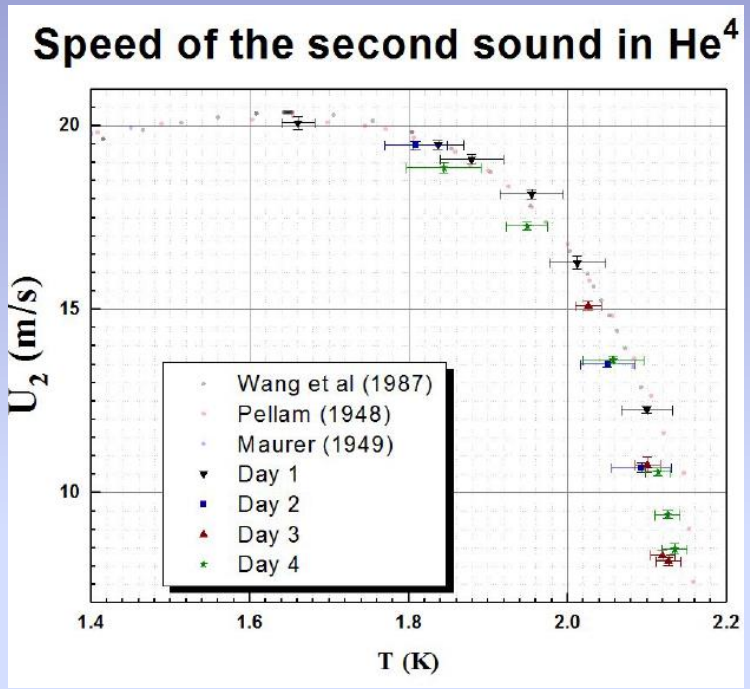
- **Make sure you discuss the principal uncertainties.**
  - ***For most of these experiments, it will be how accurately does your instrument measure something***
  - ***A few experiments will also have statistical uncertainties … more data leading to a better finding***
- **Include a representative (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

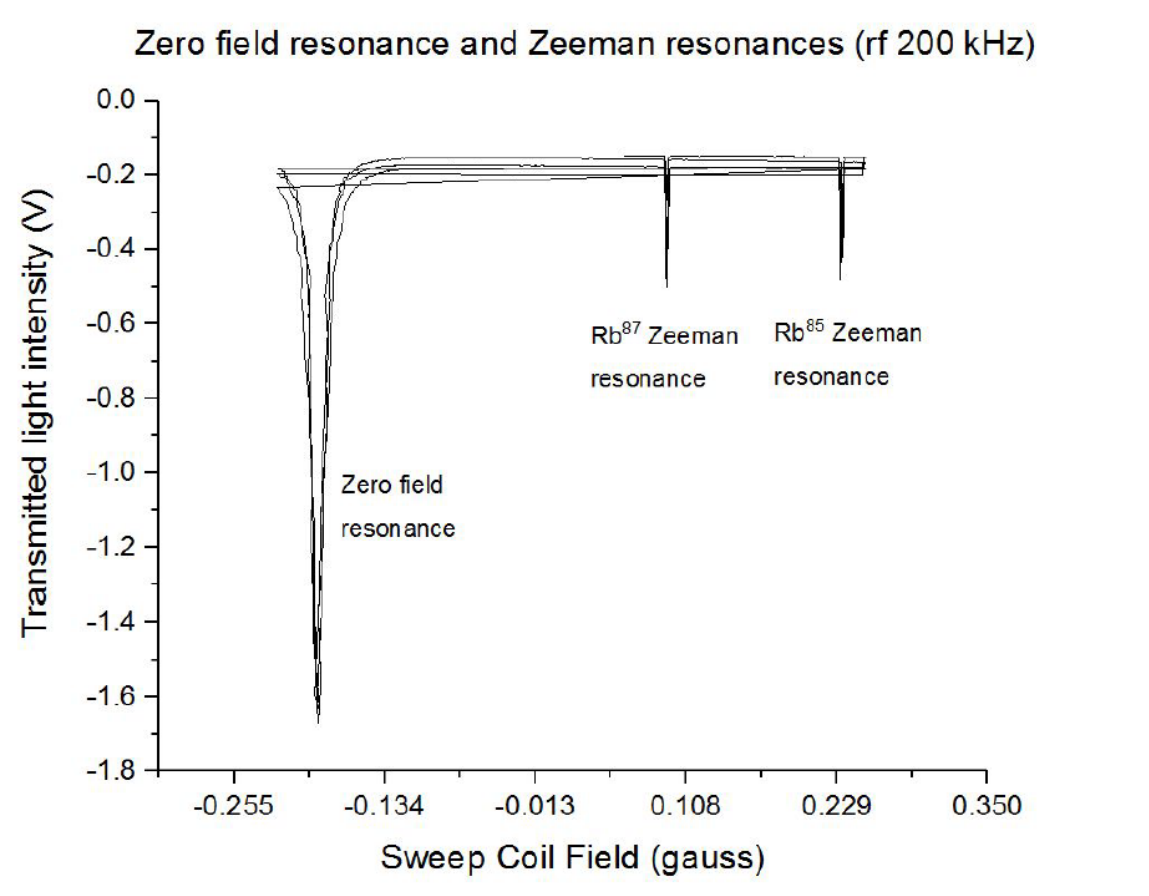



Nice Figure



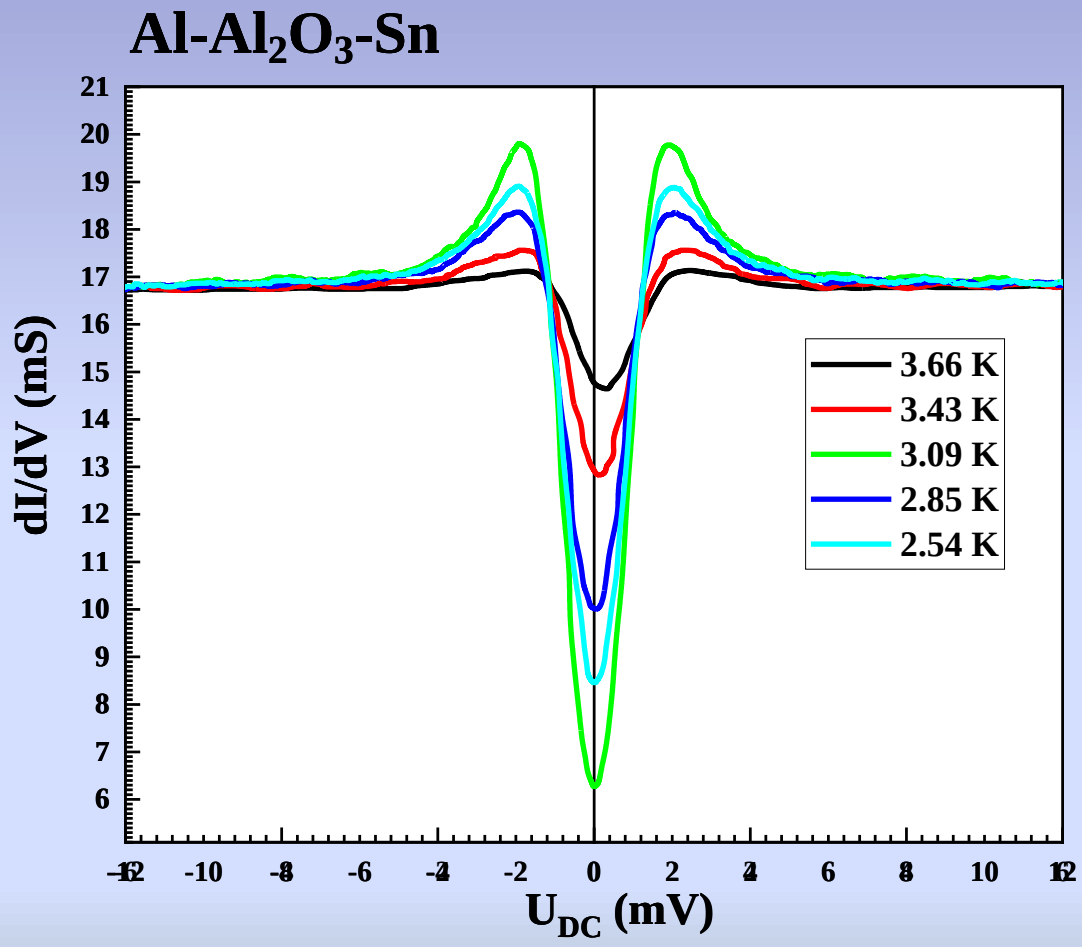

Great Data but lines are too thick, and symbols are too small

# Typical Problems




**Too many lines – graph should be “polished” (Optical Pumping)**

# Typical Problems




Use more contrast color for lines

# Deadlines

- All talk **titles** should be submitted not later than on midnight **Friday March 12th**
- **Presentation files** should be uploaded electronically not later than
  - **11:00 am March 16th O1-1 - O1-10**
  - **and**
  - **11:00 am March 18h O1-11 - O1-20**