We will present some of our slides and many Phys 403 student slides as examples. We will talk about why they are or are not well-constructed examples.

All remarks about slides are in these red boxes

Include an eye-catching feature on title slide
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
Choose readable font sizes and slide backgrounds

Write titles in size 32 bold

Write body text in size 18-20

Write comments / citations in size 14
Choose readable font sizes and slide backgrounds

Write titles in size 32 bold

Write body text in size 18-20

Write comments / citations in size 14

Text is too dark!
Choose readable font sizes and slide backgrounds

Write titles in size 32 bold

Write body text in size 18-20

Write comments / citations in size 14

Make good contrast between text and background
## Presentation components and grading scale

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Max. Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended both days</td>
<td>5</td>
</tr>
<tr>
<td>Title was sent to instructor on time</td>
<td>3</td>
</tr>
<tr>
<td>First slide has appropriate title, name, affiliation, date</td>
<td>3</td>
</tr>
<tr>
<td>Scientific background, goal and motivation were clearly and correctly presented</td>
<td>20</td>
</tr>
<tr>
<td>Research activities were clearly and correctly presented</td>
<td>20</td>
</tr>
<tr>
<td>Results were clearly and correctly presented</td>
<td>20</td>
</tr>
<tr>
<td>Technical aspects: good balance of text and figures, good quality figures, appropriate citations, correct spelling, correct number of significant digits, etc.</td>
<td>20</td>
</tr>
<tr>
<td>Time management: good balance between Introduction-Procedure-Results-Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Spoke clearly, at a good pace, loud enough, etc.</td>
<td>3</td>
</tr>
<tr>
<td>Finished on time and answered questions clearly and correctly</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
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Each speaker has 17 minutes, including questions. We recommend 15 min. talk + 2 min. questions.
OPTICAL STUDY OF FERROELECTRIC POTASSIUM DIDEUTERIUM PHOSPHATE (DKDP)
Phase transition of Helium 4

- Below $T_\lambda = 2.17$ K, helium exists in mixture of superfluid and normal liquid helium
The experimental concept in one animation ...

What happens if they are struck by pulses?

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

\[
M(t) = M_0 e^{\frac{-t}{T_2}}
\]
What happens to a nucleus in a magnetic field?

\[ \Delta E = \gamma \cdot \hbar \cdot B_0 = \hbar \omega_0 \]

Larmor frequency!

Energy

\[ B = 0 \quad B = B_0 \]

\[ M_z = +1/2 \quad M_z = -1/2 \]

\[ U = - \mu \cdot B \]

(Courtesy of Bishop, K)
Phase Transition in BaTiO$_3$
Phase Transition in BaTiO$_3$
Phase Transition in BaTiO$_3$
Phase Transition in BaTiO₃
Everybody loves an optical bench, but unless you map out the elements and the beam paths, it doesn’t mean much

Experimental Apparatus

- Beam Reducer
- Diffraction Grating
- Chopper
- PRQW
- Polarizer
- Polarizer
- Polarizer
- Chopper
- PRQW
Example of an image that is not a good setup diagram without labels (but it can go on a title slide)
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

Do not use note cards during your talk -- practice giving your talk out loud to smoothen your oral delivery
Setup diagrams, apparatus, measuring idea...

Schematic diagram adapted from notes

- **CRYOSTAT**
- **AC input**
- **SR830**
  - Lock-in amplifier
  - Ref In
- **DMM**
  - HP34401A
- **DT470**
  - 10μA
- **Resonator**
  - \( \text{Asin}(\omega t) \)
- **Receiver**
- **Transmitter**
- **LakeShore 110**
  - DC current supply
- **Function generator**
  - Agilent 33220A
- **DC bias for receiver**
  - 6.4μA
  - 3.2V
  - 500kΩ
Samples: preparation, configuration etc.

Silver Paint
Electrode
Sample
Leads
Setup of Source and Detectors

- $\theta_{AC}$
- $\theta_{AB}$
- $\theta_{BC}$

- C: Detector
- A: Source
- B: Detector

- Anode (to CFD)
- Dynode (to MCA)
- High voltage power supply

- Aperture
Presenting data is your most important and challenging task.
Examples of plots showing results

Raw tunneling data

Energy gap derived from tunneling conductivity

Fluorescence data + fitting results

Font too small!

Too many significant digits!
Examples of plots showing results

Difference in Up-Down (unnorma\textit{li}zed)

Fit equation \( Ne^{-t/\tau} (1 + \alpha \cos(\omega t + \delta)) \)

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?
Fitting to the Curie-Weiss law

\[ \varepsilon' = \frac{C}{T - T_C} + \text{off} \]

\[ C = 3563.3 \pm 0.4 \text{K} \]

\[ T_C = 118.9825 \pm 0.0003 \text{ K} \]

Courtesy Zongyuan Wang and Arnulf Taylor Su 2017
# AFM of Optical Data Storage Media

## CD

- Mark length: 0.99 - 2.96 μm
- Track pitch: 1.63 μm
- Track width: 0.50 μm

## DVD

- Mark length: 0.48 - 1.45 μm
- Track pitch: 1.00 μm
- Track width: 0.24 μm

## Blu-Ray

- Mark length: 0.14 - 0.41 μm
- Track pitch: 0.40 μm
- Track width: 0.15 μm

*Units in μm*
Fitting the data

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

Offset, intrinsic to the experiment

\[ C \approx 26 \]
\[ T_\lambda \approx 2.17 \]

Fit to the exponents as well

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

The data refuses to fit to this function

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

\[
\chi^2 / \text{ndf} \quad 361.7 / 14
\]

\[
C \quad 14.56 \pm 0.04278
\]

\[
\gamma \quad 0.1668 \pm 0.003116
\]

\[
T_{\text{off}} \quad -0.2356 \pm 0.005738
\]

\[
T_\lambda \quad 2.17 \pm 0.0
\]
Finish your talk with discussion 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

**Speed of the second sound in He$^4$**

- Great data but symbols are too small

**Angular Dependence of Gamma Emissions of Na22**

- Nice figure

- Gaussian Fitting standard deviation = 84.1
- half-width = 12.9
Too many lines – graph should be “polished” (Optical Pumping)
Typical Problems

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

$dI/dV$ (mS) vs. $U_{DC}$ (mV)

Use more contrasting colors for lines
Deadlines

• All talk **titles** should be submitted via email to Prof. Colla no later than midnight **Thursday, October 7th**

• **Presentation files** should be uploaded on **my.physics** no later than **11:00 AM the day of your presentation**