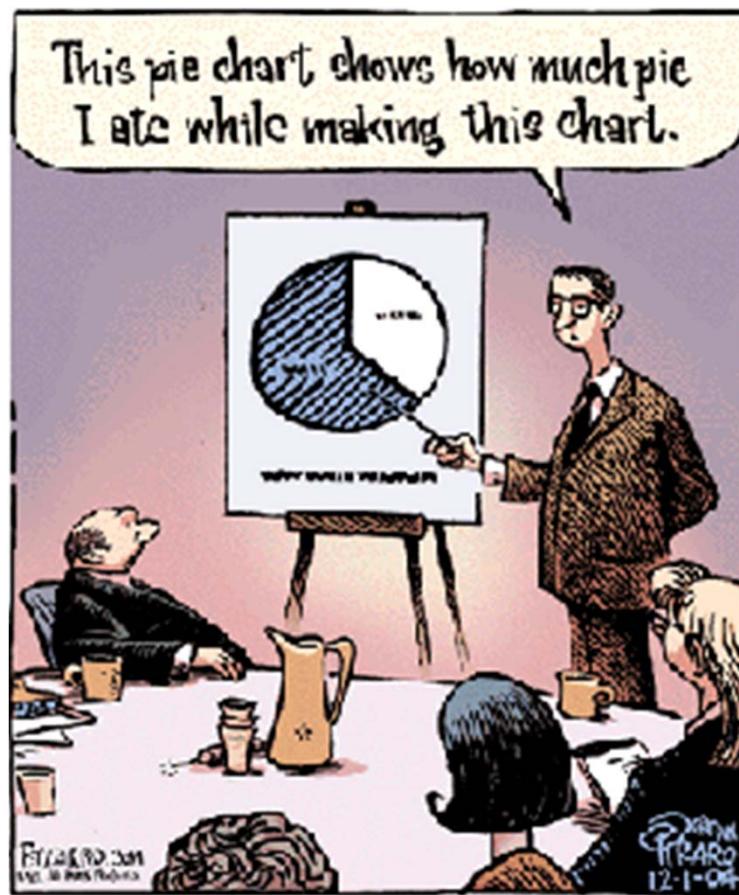


# Tips for creating and giving scientific presentations



# **How to get started?**

**Step 1: Identify your audience:** this will control the level of your presentation and the amount of background material you need to orient everyone in the audience

**Step 2: Determine how much time you have for your presentation:** this will control how much time you have to talk about each part of your outline (see below)

**Step 3: Identify the main points you want to convey:** you can reasonably convey only 2-3 main points in a 20- or 30-minute talk

**Step 4: Create an outline of your talk:** this will build in the logical organization of your presentation and help you decide what figures and other supporting evidence you need to make your points



# Organizing a 25-minute scientific talk

## Background and Introduction (~6 minutes)

⇒ 4–5 slides

- ~1 Title slide - Your names, date, citation to paper
- ~1 Outline slide – Organization of talk
- ~1 Overview slide – Why is this research important?
- ~1-2 Background slides – Provides essential background for non-experts

## Methods (~6 minutes)

⇒ 2–3 slides

Theoretical/experimental methods used in paper

# Organizing a 25-minute scientific talk

## Results (~9 minutes)

⇒ 4–5 slides

- ~ What did you (or the authors) find?  
Only develop 1-2 key results

## \*Critique and Citation Summary (~3 minutes)

⇒ 2 slides

- 1 critique slide – What was wrong with/good about the paper?
- 1 citation slide – What happened with the result/field after the paper?

## Summary (~1 minute)

⇒ 2 slides

- 1 Summary slide - Review the main points/ criticisms
- 1 Acknowledgment slide – Acknowledge sources of material, help received, etc.

\*Journal club only

# The title slide and outline prepares the audience to listen and shows organization of talk

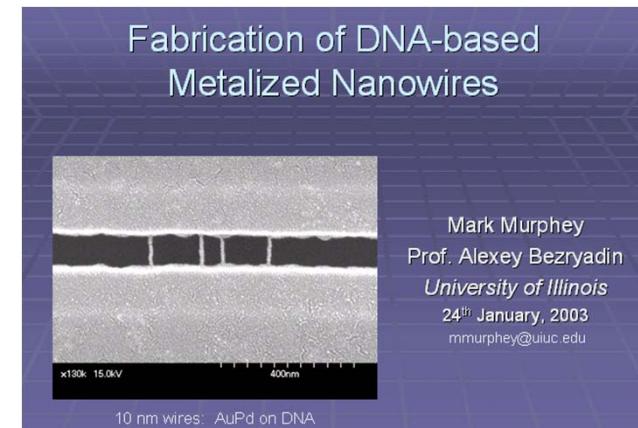
## Title slide

Your names and affiliations

Paper citation (for JC)

Venue and date

Attention-getting graphic



## Outline or overview of presentation

Prepares the audience to listen

Provides a logical structure for your talk

Provides motivation and context

Summarizes key points (limit to two or three for a 20- to 30-minute talk)



# Particle Physicists Ask ...

## 1. Why matter?

- CP Violation

## 2. Why mass?

- Higgs field

## 3. Why this standard model?

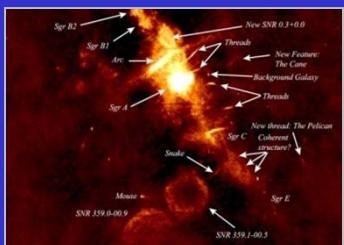
- SUSY or other extensions



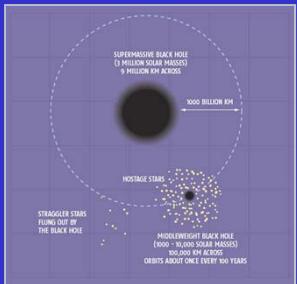
# Overview



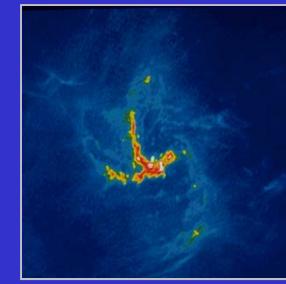
Black holes and star clusters



The galactic center



Intermediate-mass black hole  
kinematics



Here, we have a **VISUAL** and **WRITTEN** outline and it's not too long !

# The “body” of your presentation is the intellectual content of your talk

## Problem statement, motivation

~1–2 slides

## Previous work

~1–2 slides

## Methods

~1–3 slides

## Key Results

~5–6 slides

**What's this all about?**

- Quark Gluon Plasma (QGP)
  - hypothesized state of deconfined quarks and gluons
  - expected in the early universe, big-bang stage

**pp vs A-A collisions**

hard-scattered participants in p-p  
soft-scattered participants in A-A

cone of hadrons

gluon radiation

Energy-loss increased medium-induced gluon radiation

hadron-dissociated saturated broadened?

**High  $p_T$**

- Hard-scattering occurs at earliest times during a high-energy nuclear collision
  - well before QGP is expected to form (equilibrium)
- These “fast” scatterers will experience the strongly interacting medium created in the collision.
- They will lose energy in the hot, dense medium (by gluon bremsstrahlung) and their outgoing energy distribution will be modified downward.
- Net effect: depletion in yield of high  $p_T$  particles compared to p-p case.
- The game is then to make the comparison

# Provide a “summary” slide

Recap key results and conclusions  
Reiterate main critiques (for JC)

**Summary**

- Non-Gaussianity in the CMB tells about creation of the initial density perturbations in the universe.
- The probability distribution of the nonlinear parameter in our model gives drastically improved constraints on non-Gaussianity.

Next: generalize our method to smaller scale fluctuations and apply to COBE and MAP data

Contact: Michael Schneider [mdschnei@uiuc.edu](mailto:mdschnei@uiuc.edu)

This slide will probably stay on the screen during the question period and will thus get the longest audience exposure—make it count!



# Summary & Conclusions

Not “exciting” but it has the pieces

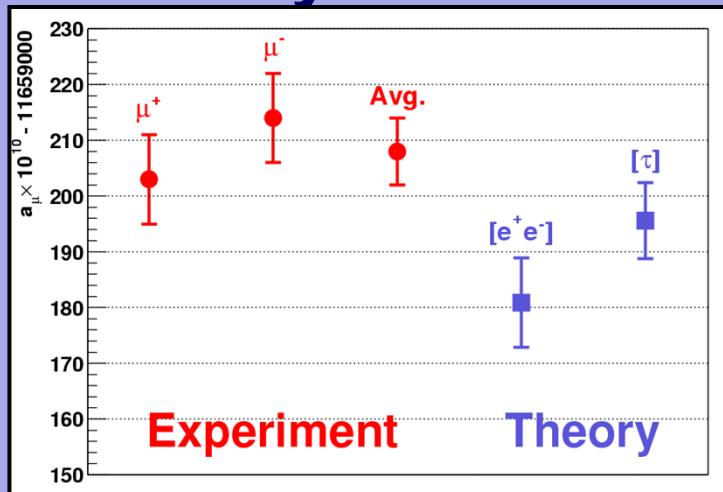
- All g-2 data published
  - ❖ Systematics lowered again
- Consistent results, consistently above theory
  - ❖ ee – tau controversy still quite active
  - ❖ considerably more “ee” type data on the way
- The systematic limit is “far” away ...we should go there

What was shown

Where things stand:  
summarized nicely  
on the plot

What to do next

Note e-mail and web link



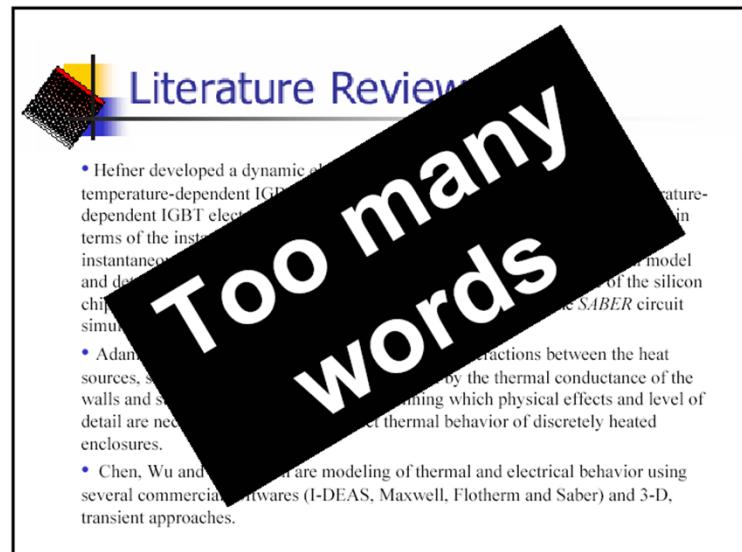
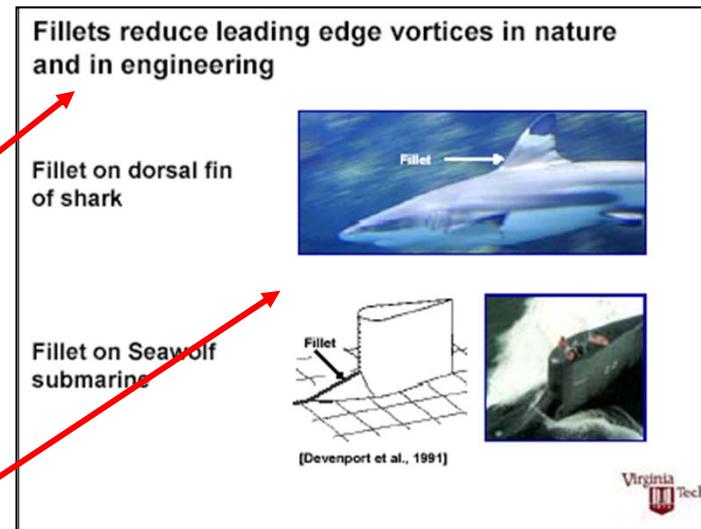
# Tips for preparing your talk (cont.)

Have only 1 idea per slide

Use the header to state the main idea of the slide, and use the body of the slide to support that idea

Use well-labeled graphs and figures to illustrate your key points...this makes the slide more real and interesting to the audience

Avoid too much text....



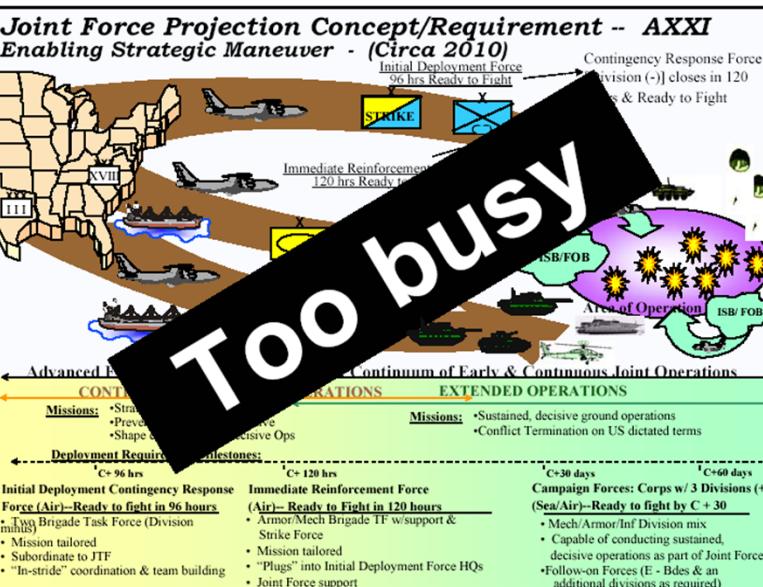
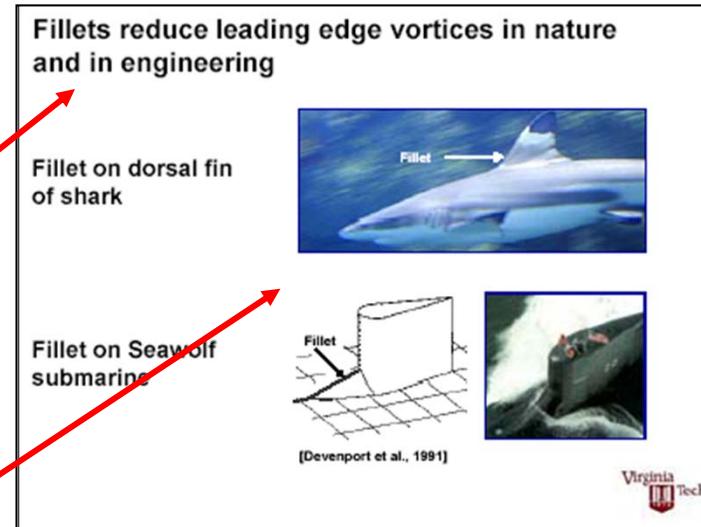
# Tips for preparing your talk (cont.)

Have only 1 idea per slide

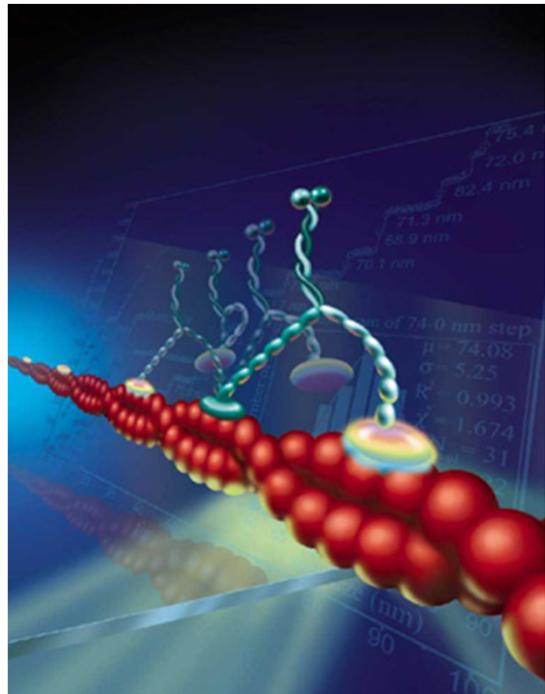
Use the header to state the main idea of the slide, and use the body of the slide to support that idea

Use well-labeled graphs and figures to illustrate your key points...this makes the slide more real and interesting to the audience

....or too many distracting images



# Use figures to illustrate your key points



Myosin “walking” on actin  
*Courtesy of P. Selvin*

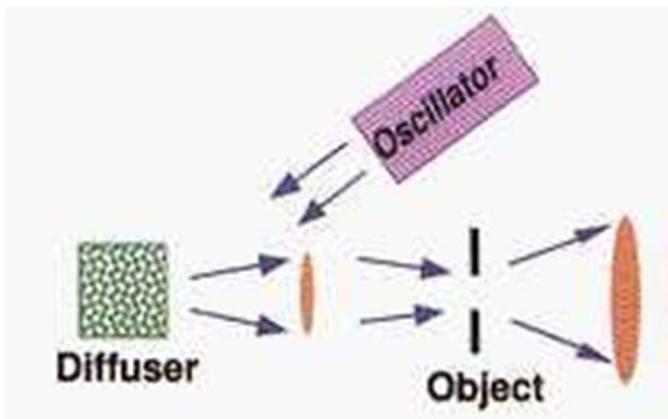
## Figures:

- enliven slides
- promote audience interest
- provide supporting evidence for key points
- help explain complex ideas and relationships quickly
- show how things work, etc.

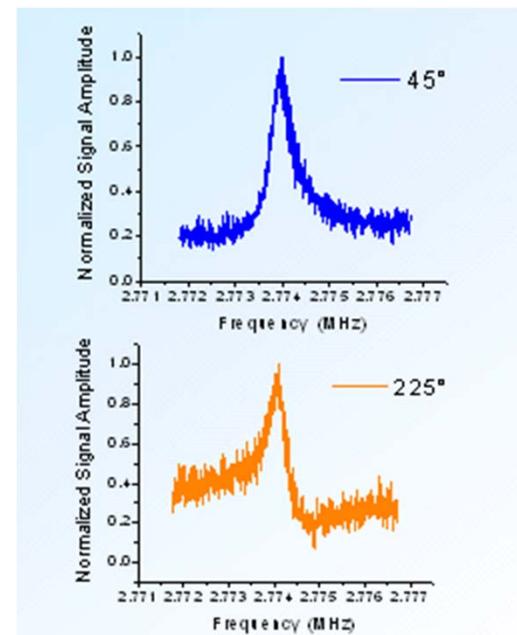


# Label all elements in a figure

- Point out important features
- Label both axes of graphs and show units
- Provide a brief caption
- Give credit to source



The Nike laser system uses discharge pre-amplifiers.  
(Courtesy US Navy)

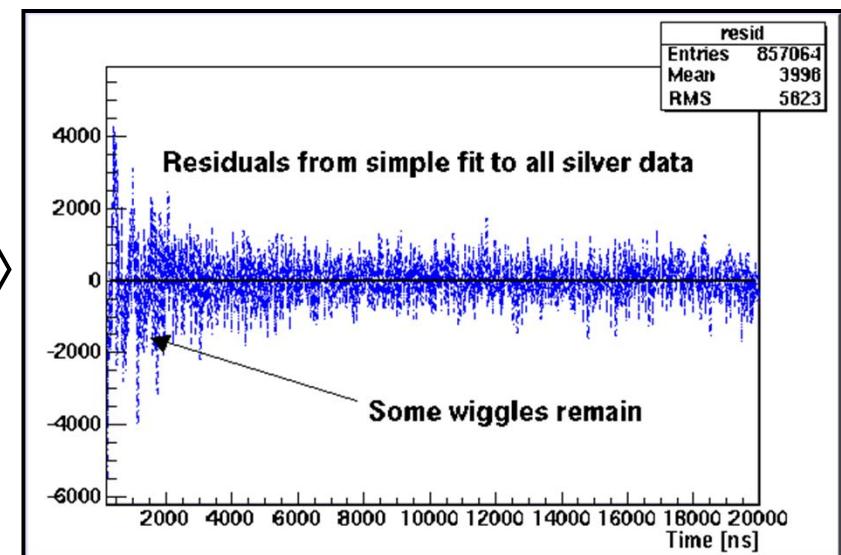
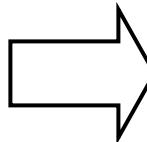
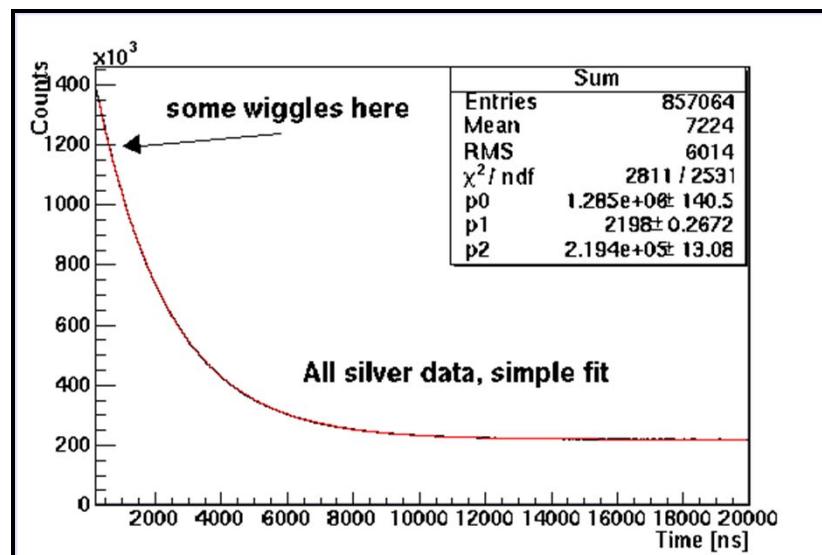


Sample normalized signals from the two-beam optical drive.  
(Courtesy C. Michael)



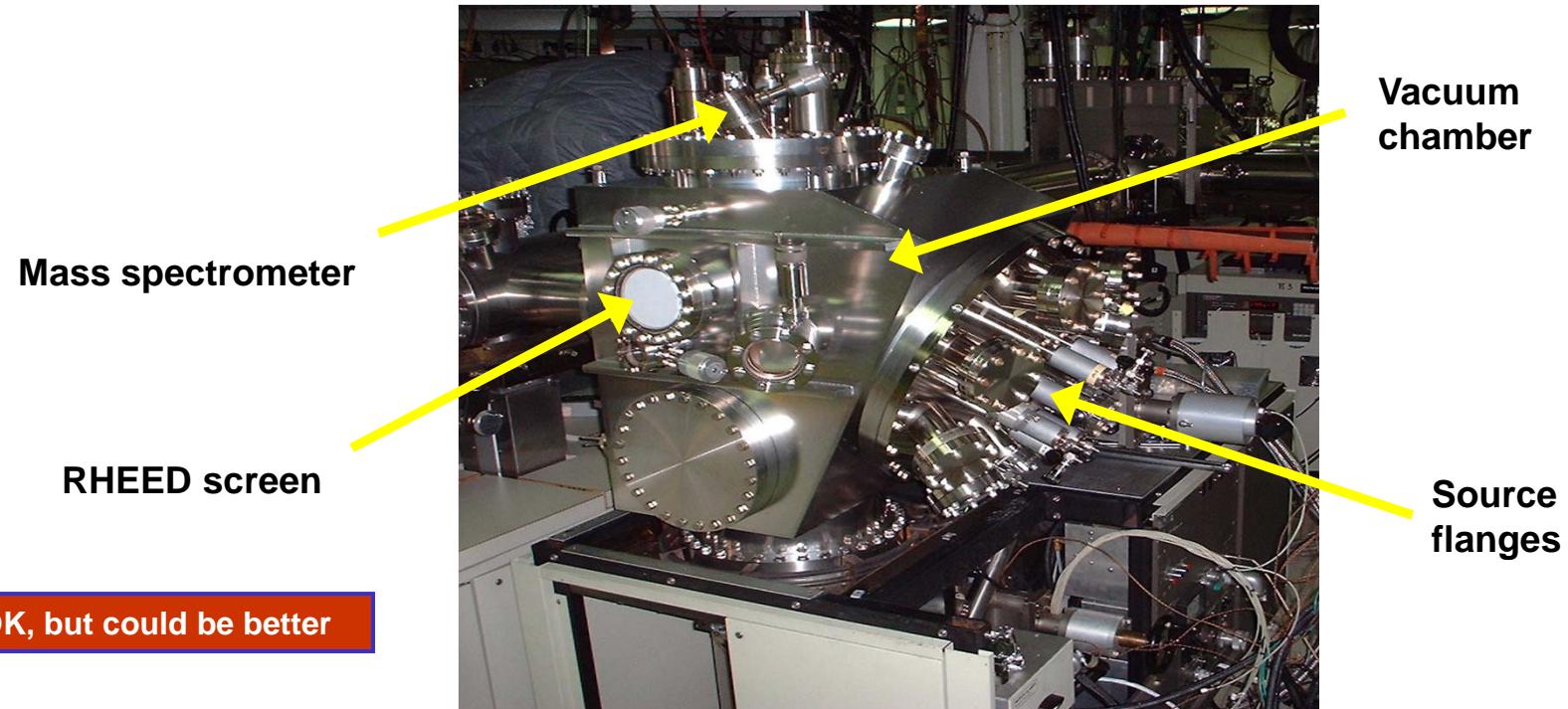
# Presenting data is your most important and challenging task

- Avoid copying a graph from a formal article – they have a different style, e.g., labels are too small
- Use color and make lines thick, labels legible
- Label axes and annotate important points with arrows and add words
- Use tables sparingly – if used highlight important parts

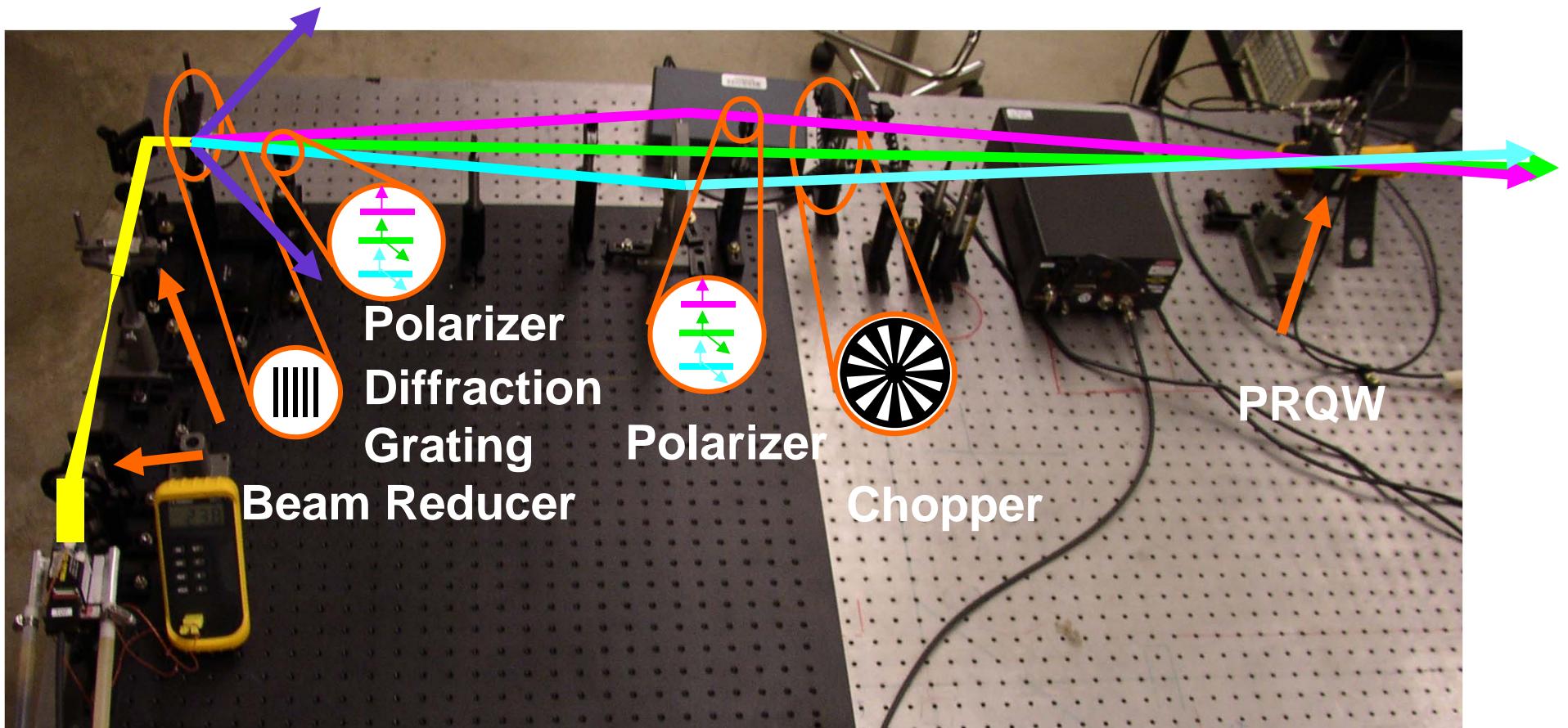


Show the equipment IF it helps as part of your proof – but sparingly, not just because you love it

- **Photographs** give scale and reality – but add labels
- **Schematics** provide concept
- **Diagrams** strip away unnecessary details
- **ALL OF THESE** can be useful in combination

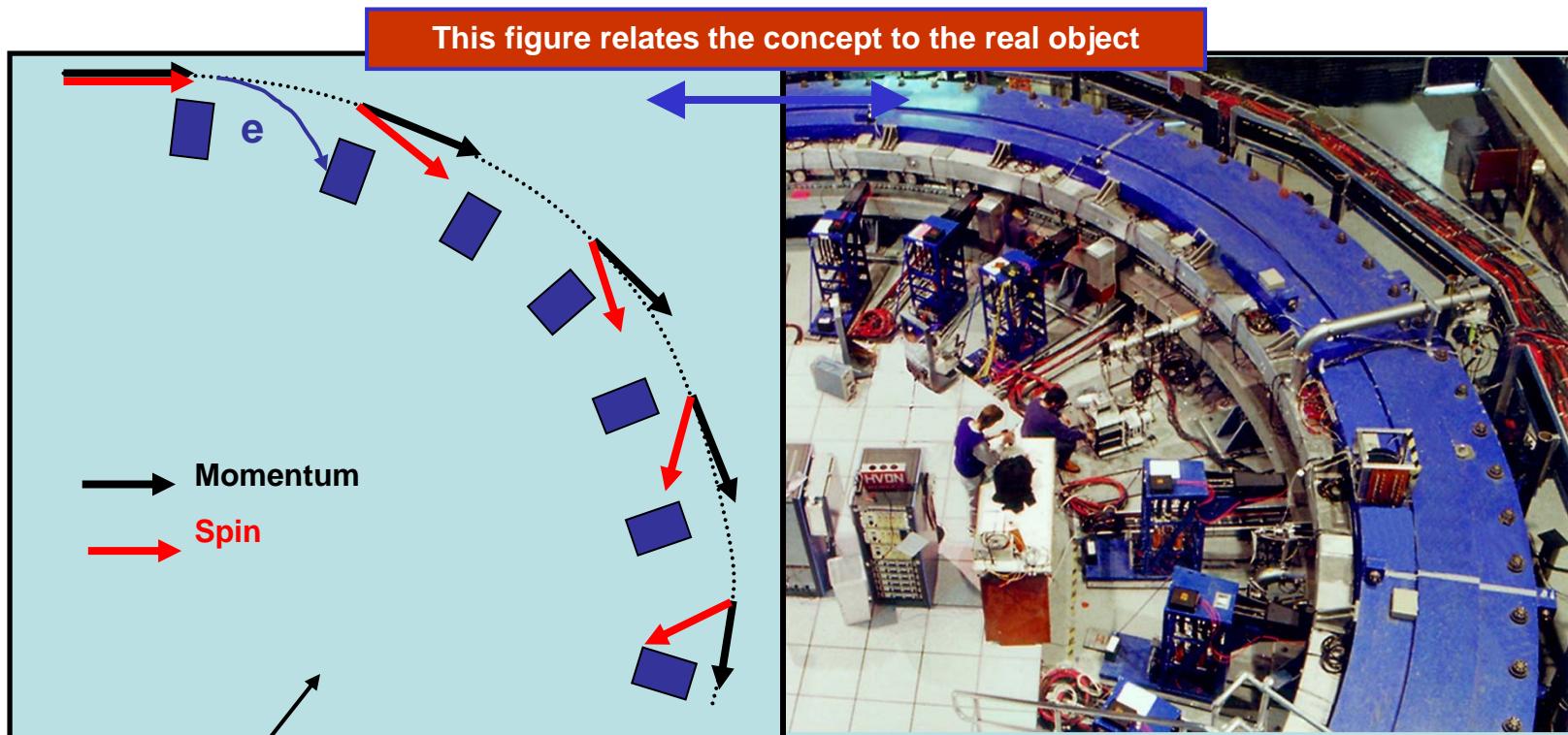


# Experimental Apparatus



Here we add detail to picture of the optical  
bench—much more useful

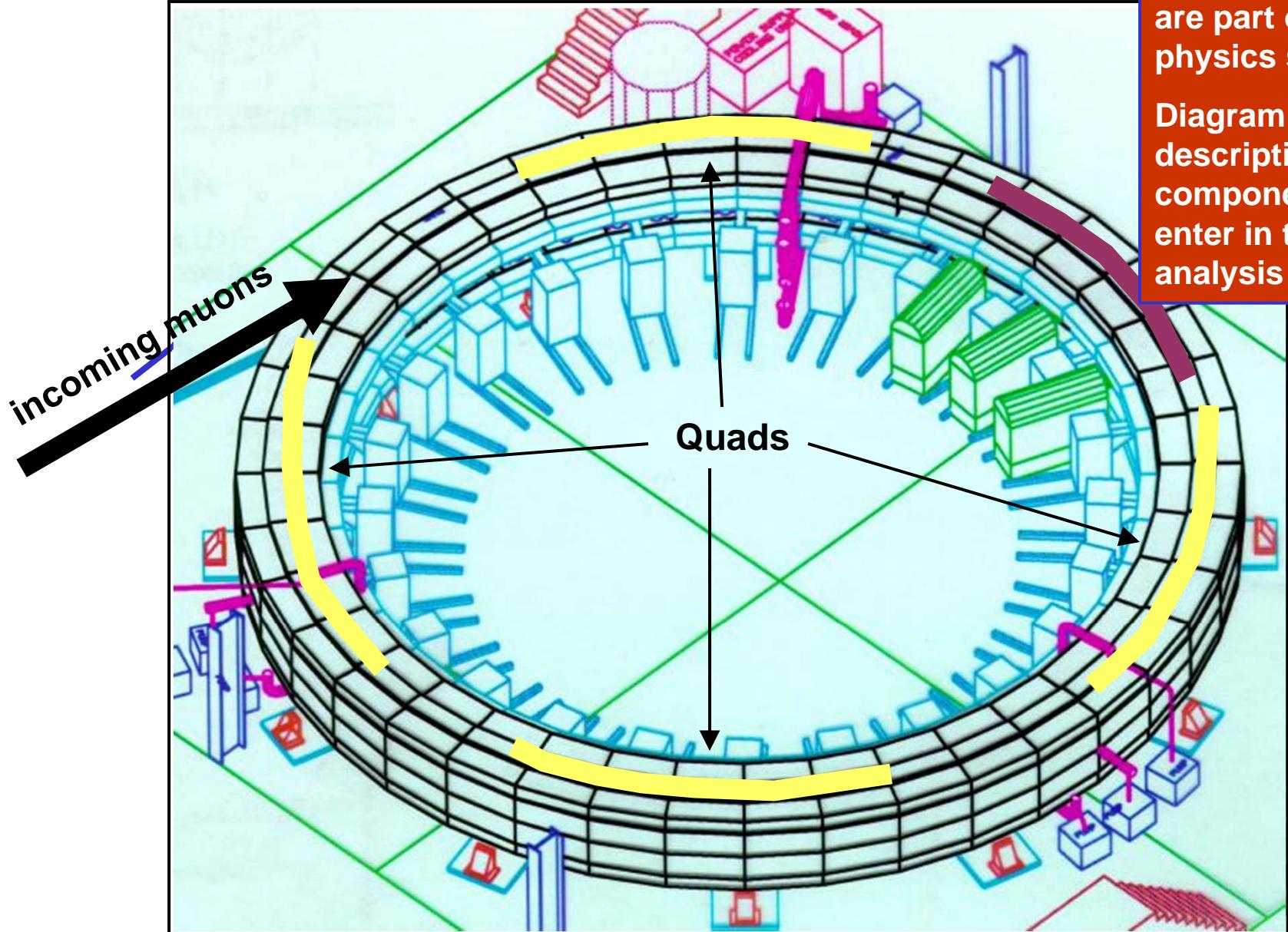
# $a_\mu$ is proportional to the difference between the spin precession and the rotation rate



This supports assertion  
in sentence headline

$$\Delta\omega = \omega_a = \left( \frac{g - 2}{2} \right) \frac{eB}{mc}$$

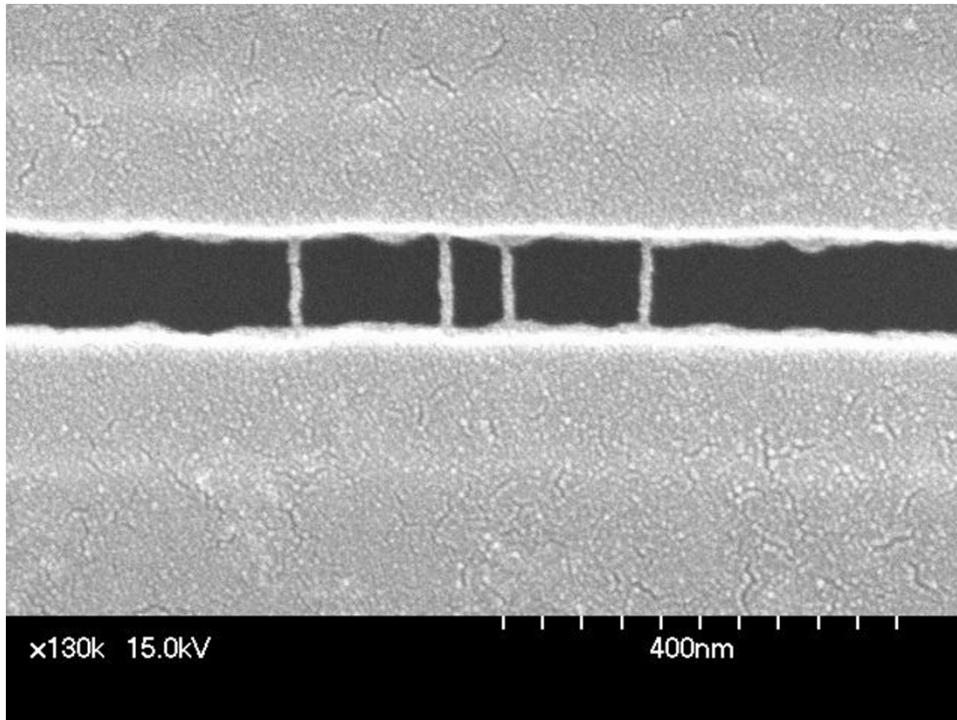
# BNL Storage Ring



**Features:**  
Blue/Black circles  
are part of the  
physics story  
  
Diagram allows  
description of  
components that  
enter in the data  
analysis

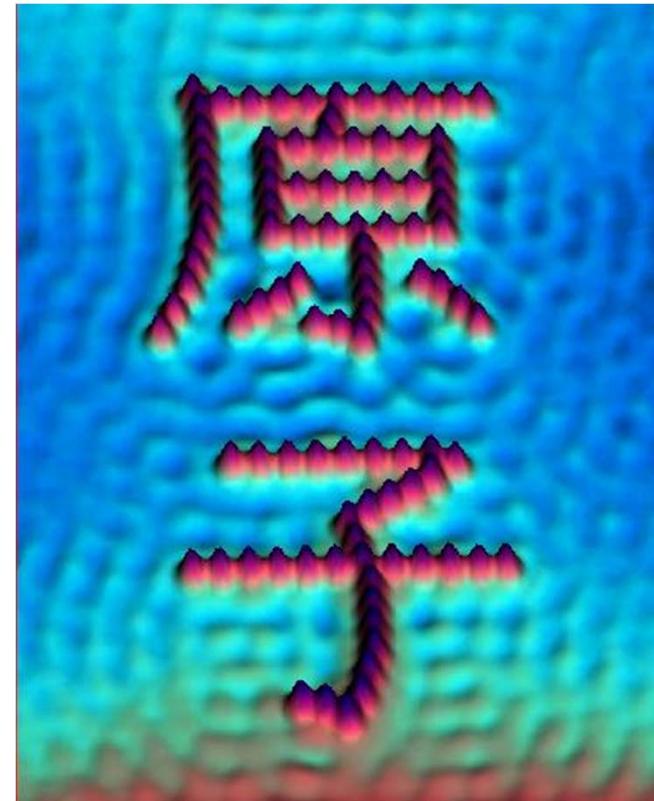
# Some more examples of data

A photograph, which reveals the detail



10 nm wires: AuPd on DNA

A photograph, which reveals the detail



Make sure you provide something to show scale, and include a short caption to explain what the audience is looking at

# Use equations sparingly

Use equations only when necessary

If you use equations

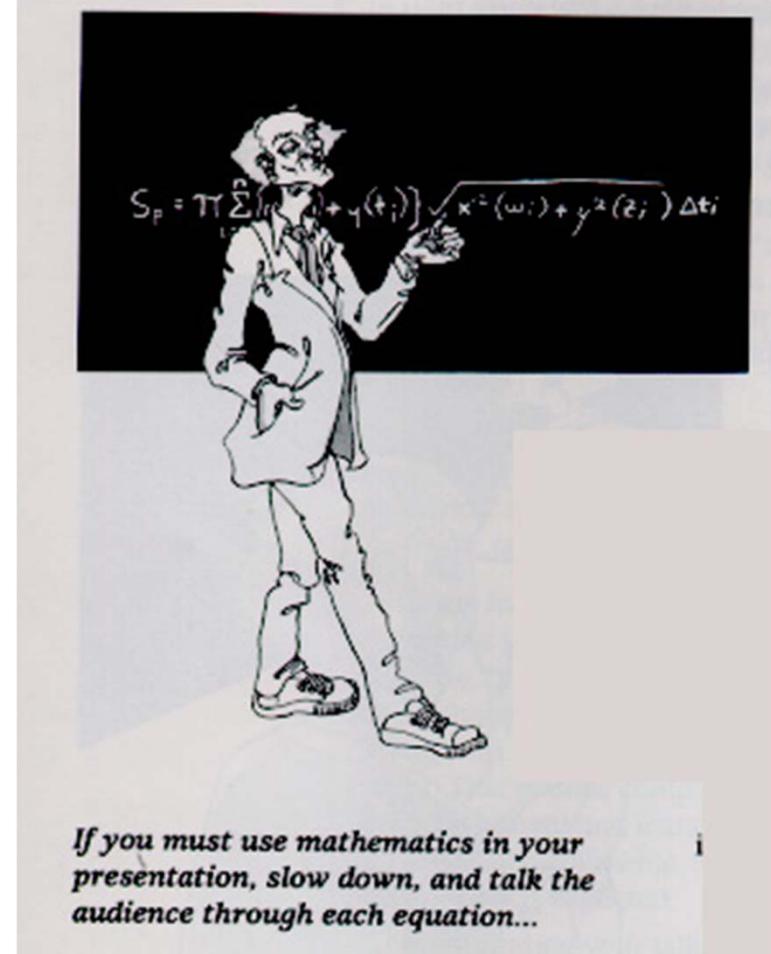
Slow down

Talk through step by step

Explain relevance

Combine with a picture

that illustrates the physical principle involved



I think this is a great and effective example of introducing an equation from one of our students

# The Radiative Transfer Equation

$$\frac{dI}{ds} = -In(q_a + q_s) + \mathfrak{S}$$

Number of Photons  
Distance Traveled  
Absorption Coefficient  
(from geometry and composition of dust grains)  
Density of Dust Grains  
Scattering Coefficient  
Source Function

The diagram illustrates the components of the Radiative Transfer Equation. The equation is  $\frac{dI}{ds} = -In(q_a + q_s) + \mathfrak{S}$ . Red arrows point from labels to specific terms: 'Number of Photons' points to  $-In$ ; 'Distance Traveled' points to  $dI/ds$ ; 'Absorption Coefficient' points to  $q_a$ ; 'Scattering Coefficient' points to  $q_s$ ; 'Density of Dust Grains' points to the plus sign before  $\mathfrak{S}$ ; and 'Source Function' points to  $\mathfrak{S}$ .

Requirements to solve analytically:

- $n$  is a constant
- $q_a = 0$  or  $q_s = 0$

We want turbulent clouds.  $n$  is not a constant

# Bad equation example:

Disaster ?

$$\frac{\Delta T}{T} = \frac{T(hv, F_o) - T(hv, 0)}{T(hv, 0)}$$

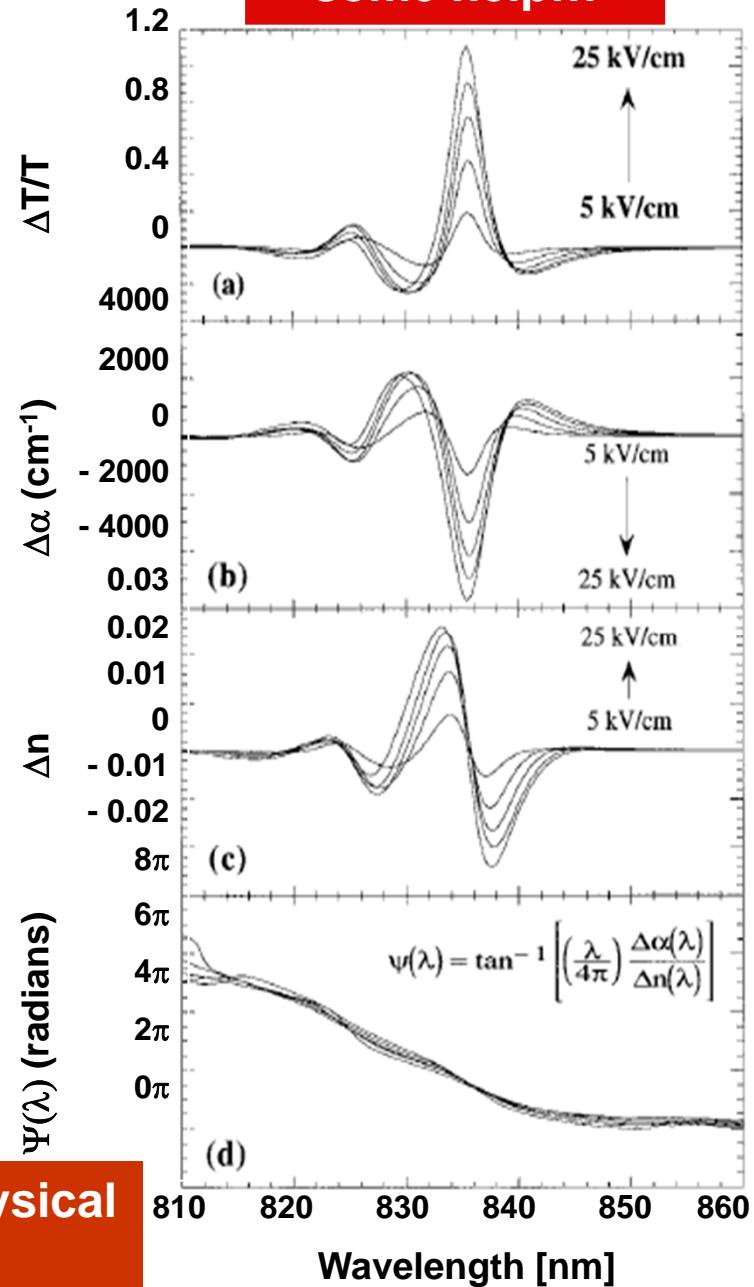
$$\Delta\alpha(hv, F_o) = -\frac{1}{L} \ln\left(1 + \frac{\Delta T}{T}\right)$$

$$\Delta n(\lambda) = \frac{\lambda^2}{2\pi^2} P \int_0^\infty \frac{\Delta\alpha(\lambda') d\lambda'}{\lambda^2 - \lambda'^2}$$

$$\psi(\lambda) = \tan^{-1} \left[ \left( \frac{\lambda}{4\pi} \right) \frac{\Delta\alpha(\lambda)}{\Delta n(\lambda)} \right]$$

What does this mean? Better to provide a physical interpretation in words next to equations

Data provides some help...



# Remember, your goal is to convey your ideas, so avoid distracting text and effects!

## Don't overuse PowerPoint animations and sounds!

Make sure there is good contrast between text and background

## Use simple (or no) backgrounds on slides

CP

- Parity invariance fails, combine it with charge conjugation to create a new invariant
- Converts the right-handed anti-neutrino into a left-handed neutrino- exactly what we observe in nature
- Neutral kaon experiment

The diagram illustrates two Feynman processes. On the left, a  $K^0$  meson decays into a  $\pi^-$  and a  $\bar{d}$  quark. This decay is mediated by a virtual  $W^\pm$  boson, which originates from the annihilation of a  $u$  quark and a  $d$  quark. On the right, a  $K^+$  meson decays into a  $\pi^+$  and a  $\bar{u}$  quark. This decay is also mediated by a virtual  $W^\pm$  boson, originating from the annihilation of a  $u$  quark and a  $d$  quark.



# Eschew weird fonts

Don't use *calligraphy*  
or serif fonts

**USE THE SAME FONT  
THROUGHOUT THE TALK**

Make all text at least 20 pt



# Use San Serif Fonts

Use San Aarif font (e.g., Arial)

O

Not Sarif font (e.g., Times New Roman)

O

Skinny parts disappear when projected

# Use “normal” colors

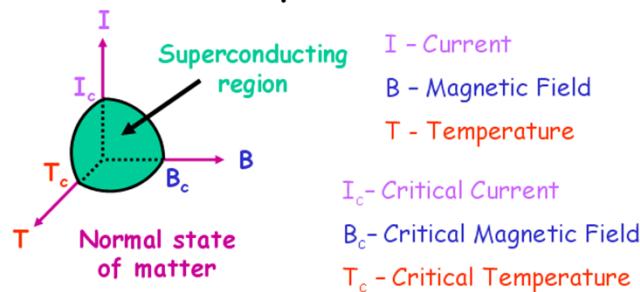
DON'T use red/green or red/blue as contrasting colors

Make sure colors looks the way you expect using an LCD projector!

Avoid neon colors and pastels

Don't use many random colors; people expect color to *mean* something

Superconductivity is an electronic state of matter that exists below certain currents, magnetic fields, and temperatures.



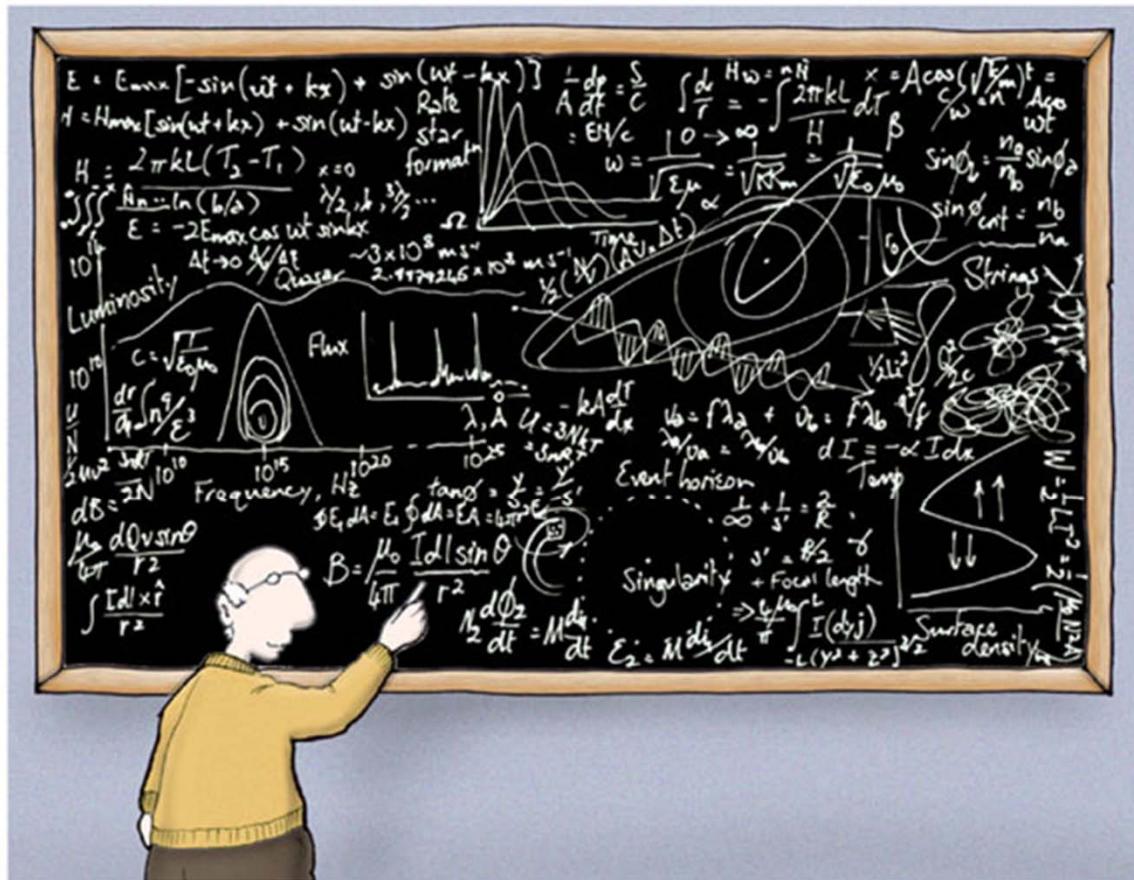
Strive for easy reading

Strive for easy reading

Strive for easy reading



# Tips for giving a scientific presentation



Astrophysics made simple



# **Pointers for giving the best possible talk:**

## **Maintain eye contact with audience**

Don't stare at screen or monitor

## **Do not read your talk!**

## **Avoid nervous mannerisms**

Pacing, bobbing, waving arms, jingling coins

## **Use laser pointer or stick directed at screen**

Don't point directly at overhead on projector

Don't block the screen

## **Train yourself to speak slowly and distinctly— practice!**

## **Avoid “fillers”: “uh”, “like”, “um”, “okay”**

## **Be enthusiastic!**

If you don't act excited by your results,  
don't expect the audience to be!



# Pointers for giving the best possible talk:

**Don't show any material on slides (e.g., figures, equations, text, etc.) you can't explain!!**

## Rehearse how you'll end your talk

Don't end with "Well, I guess  
that's it..."

Don't just stop and let the committee guess that you're  
done

Thank the audience!



# **The best way to prepare for a talk is to Know Your Material**

**Practice, practice, practice**

**Focus on communicating,  
not performing**

Humor is good, but don't overdo it

*It takes three weeks to prepare a good ad-lib speech*

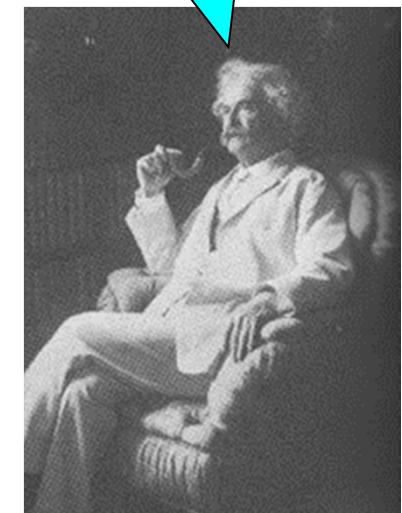
**Keep it simple**

**Prepare key phrases**

It's okay to write out material first

Write the key point to make for each slide

If the slide doesn't have a point, eliminate it!!!



**Stay on track**

Small (planned) digressions fine if motivated, but get back on track (shows you are paying attention to audience)



# More advice...

Bring a copy of your slides if giving a  
PowerPoint talk

- this will help you practice
- you can distribute these to interested people

Make appropriate use of the screen:

don't underfill the screen, and don't put key  
information at the edges of the screen.



# Rehearse Your Talk!

## A few days before

Practice in front of friends  
and check timing

Rehearse likely questions

Solicit feedback about  
logic and clarity

Revise (*shorten*)

## The night before

Go over one more time

Put all materials *in order*  
(number your slides!)



Prof. Per Ahlberg delivering the Presentation Speech for the 2001 Nobel Prize in Chemistry at the Stockholm Concert Hall.

# **Check *everything* just before your talk**

## **Check the projector**

Make sure you know how to turn it on

See that it is plugged in

Check which way to position your slides

Adjust the focus

## **Check microphones, pointer, other tools**

## **Arrange your slides, notes, and other materials**

Be able to reach everything without moving

Be able to go through your slides without fumbling

## **Have a watch handy to check the time**



# **“Stage Fright”? Be Prepared!**

## **Know your subject thoroughly**

Practice in a big room in front of real people

Have all your materials in order

Arrive early

Familiarize yourself with the equipment

## **Ask a friend to sit in the middle of the audience and speak primarily to him or her**

Tell him to look interested and nod frequently

Ask her to smile and nod encouragingly whenever she catches your eye



## **For Talks To an Inexpert Audience:**

Do not use slang or ‘laboratory’ terms

Choose the simplest word

Don’t use acronyms

Speak slowly and distinctly

Present less information than in a talk to an “expert” audience, go into more detail.



# **Handling questions is an essential part of giving a talk**

**As part of preparing your talk, try to anticipate questions you might get**

In each slide, try to identify what the weak points are, what questions you might ask, etc.

**Be prepared to repeat simple derivations of equations or estimates presented on your slides**

**If you don't know the answer?**

Say "That's an excellent question. I'm not sure; I'll have to look into it" or "Let's talk about it afterward"



# Express your thanks

## At the beginning of your talk

Acknowledge colleagues and  
collaborators who contributed to  
the work

## At the end of the talk

Thank your committee for  
their attention

