

# Phys3113: Discovering Modern Physics

## Talking Physics: How to Give Effective Informal Talks

Michael A. Morrison  
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### INTRODUCTION

Here's a situation you're going to find yourself in very frequently throughout the rest of your career. You've got to get up in front of a group and talk about your work or some research you've done. You've only got about 10 minutes to talk. What do you do?

No, no. "Panic" isn't the right answer. The art of giving interesting talks without excessive nerves can be learned by following a few simple guidelines. Most of these are pretty obvious (be prepared, rehearse); others appear here as a result of my having seen a *lot* of talks in which easily avoided mistakes undermined the speaker.

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### The Three Most Important Rules of Giving Talks of Any Sort of any Length on Any Subject.

1. As you prepare your talk, think carefully about the nature of your audience—their background, their interests—and make sure that your talk is appropriate for your audience.
2. Practice—a lot.
3. Never, under any circumstances, talk beyond you allotted time.

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### How do I plan an effective short talk?

The structure of a good short talk (on any subject) is, at the broadest scale, the same as the structure of a short paper:

1. **Introduction** (~2 min).
2. **Body of the talk**(~7 min).
3. **Conclusion**(~1 min).

The trick to constructing an effective, engaging, interesting short talk is to develop it “from the inside out”: body first, then conclusion, then introduction. The first thing you need to decide upon is your **talking point**. Ten minutes is not enough time to give a (good) talk which discusses in any detail or depth more than one point. So you need to decide—before you do anything else—what *single* point you want your audience to take away from your talk.<sup>1</sup> This point will be the thing you explain most carefully and thoroughly, so it should be the thing you consider the most *interesting and important* about the topic of your talk. For example, in a short technical talk (e.g., for an audience of engineers or physicists), good talking points are the nature and purpose of *a single* device; the general idea, key result, and implications of *one* experiment; the highlights and consequences of *one* particular discovery or idea; etc. The talking point you choose is crucial because from it will grow your entire talk—including your visual aids, which should reinforce and reiterate your talking point.<sup>2</sup>

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<sup>1</sup>A useful (rough) rule of thumb for a longer talk is: don't try to make more than one point per 10-minute block of time. So if you're brainstorming a 30-minute talk, ask yourself, What *three things* do I want my listeners to remember from my talk?

<sup>2</sup>**Never** actually say “My talking point is . . . .” Your job is to use your knowledge of the topic and the structure of the talk to make crystal clear to your audience what your talking point is. For example, you state it in a single sentence in the introduction. You build up to it in the body of the talk. You reiterate it in the conclusion. And you put it on at least a few of your transparencies—most importantly and prominently on your concluding transparency.

1. **You set up your talking point in the Introduction.** Somewhere in this part of the talk, you state your talking point, describe a context for it, and make connections to things your audience already knows that are related to it.
2. **You explain your talking point in the body.** Here you take your audience (in steps that flow together logically) from their state of knowledge before your talk to an understanding of your key point. Here's where you use most of your transparencies (or other aids).
3. **You recap your talking point in the Conclusion.** Here you "back your audience" out of the more detailed focus of the body of your talk, remind them what you've explained to them, and (ideally) leave them with a provocative question or tid-bit of information beyond what you've told them already.

### How do I Get Started?

The very first thing you should do is to **brainstorm your talk!** *A brainstorming session will only take about 10 minutes. Not only will doing so markedly improve the quality of your talk, it will also save you a great deal of time as you prepare it. Don't skip this step!* Just sit down somewhere quiet with your research notes and, on paper, write a bit about each of the following questions:

1. How much time do I have?
2. To what kind of audience am I addressing my talk? What is their background? How can I connect what I want to talk about with their background? What about my topic is most likely to interest them?
3. What are some possible **talking points**? At this stage you need to jot down a few alternatives. Then you can play around with each one to decide which of your potential talking points don't work for some reason (too advanced, too intricate, too unimportant, too boring, etc.). Strike those out and choose one from what's left.
4. What must I tell my listeners about the overall **topic** so they will be able to understand my discussion of my talking point.
5. How can I engage the interest of my listeners so they will pay attention to my talk and not doze off?

The "scratch notes" you construct by answering these questions will guide you as you prepare your talk. Before you start practicing, your notes to ensure that you've included everything you need and that you can proceed logically from beginning to end.

### Practice!

The best way to minimize stage fright and ensure a more effective presentation is to practice. Practice as many times as you can stand to. (My rule of thumb for a 10 minute talk is to run through it at least six times, then at least once in front of a sympathetic audience that will give me constructive criticism.<sup>3</sup>) Initially, practice in a quiet room, with and without your transparencies. Then find a room with an overhead projector and practice there. (Best of all, if you can possibly get the room where you'll actually give the talk for a while, practice it once or twice there.) Run through your talk enough times that you're sure you can deliver it in the allotted time, that you know how it "feels" to say the words, and that you're comfortable manipulating your transparencies. As you practice by yourself, cut, add, or revise material (as necessary) to make the talk the way you want it. *Then* practice in front of others. Revise further based on their constructive comments. (If their comments aren't constructive, seek another practice audience.)

- **Time your practice talks.** If your practice talk takes more than the time allocated to you, *cut stuff* (removing the corresponding transparencies) and try again.
- **Never talk beyond your allotted time.**

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<sup>3</sup>While you should definitely practice in front of your other group members, you also need to practice in front of people who know little or nothing about your topic. Those people are your audience; not your other group members (or me).

- **Don't look at the overhead projector.** As you practice, train yourself to look either at your audience or, if that makes you nervous, at the projection screen.
- **Don't block your audience's view of the screen.** All that work you put into preparing your transparencies is worthless if you block your audience's view of them. One reason to practice with a projector (preferably in the room where you're going to give the talk) is to get comfortable manipulating your transparencies and moving around the projector. A tip: If most of the time you stand near the screen, you're unlikely to get in their way.

### What elements absolutely must be in a talk?

As noted above, every talk, no matter how short, must have an introduction and a conclusion. The worst talks are those that start in the middle, chug along for a while, then merely cease. Here's a little more about these key elements.

1. **The Introduction: Orient your audience (~2 min).** Ease them into your topic. Lay some foundation. Remind them of things they already know that will help them understand the body of your talk. End by focusing their attention on your talking point.
2. **The Body of the Talk: Explain and discuss your talking point (~7 min).** As you develop this part of your talk, figure out ways to *help your listeners stay focused on your talking point*. Above all, while preparing this, the heart of your talk, *be selective*. Include *only* background, details, and illustrations you absolutely must discuss in order to develop and clarify your point.
3. **The Conclusion: Ease your audience "out" of your talk (~1 min).** *Briefly* remind your listeners of the context of your talk, review the things you consider most important, and highlight your talking point. Then leave them with something interesting: a new insight, an unanswered question, etc.

### How can I prepare effective transparencies?

Why are transparencies so important in a technical talk? Among other things, they give you and your audience a "crutch." You will be less nervous because the key elements of your talk are on transparencies. Your audience will more easily follow your talk because your transparencies reinforce and orient what you say. To prepare effective transparencies, follow these three guidelines:

1. Keep them simple, clear, and readable.
2. Avoid clutter.
3. Eliminate *anything* that might distract your audience from what *you* want them to focus on.

Transparencies need not be fancy. [Except in unusual circumstances (e.g., you've received a Nobel Prize) they shouldn't be fancy. Elaborate drawings or fancy fonts or (especially) *too much color* just distract your audience from whatever you're trying to explain to them.<sup>4</sup>] The easiest way to prepare a transparency—if you can print legibly!—is to print directly on it, using pens you can get at the campus store.<sup>5</sup> If your transparency involves a figure, Xerox the figure onto the transparency first, then print on it.

### Should I include graphs and/or tables on my transparencies?

Whenever possible, show results graphically. Never show a table unless you absolutely have to. (Tables take a long time to explain, are hard to read, and make your point *far less effectively* than a graph.) If you can't avoid showing a table, remember that your transparency must be readable by everyone in the room: this means that when projected, the numbers in your table should be about 1/2 inches high.

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<sup>4</sup>Color is good—but only if used thoughtfully. You can use color to link related items, to highlight *a few* points, and to make your transparencies less drab. But beware! Unless used in this way, color distracts. **Never use color just for decoration or in a random way, disconnected from the logic of the transparency.** And don't use light colors like yellow and brown; they don't show up well when projected.

<sup>5</sup>I recommend water-soluble rather than permanent ink pens for transparencies. Don't buy pens marked "superfine"; they can't be seen clearly. Instead use "medium" pens.

### Can I make a transparency of a figure or photo from a book or paper?

Sure. But don't just make the transparency directly from the page on which the figure appears. If you do so, the figure, caption, and labels will be too small to read; moreover, the transparency will be cluttered with extraneous stuff (everything else on the page). Instead, first Xerox the page, then cut out the figure and, if you wish, the caption. Tape these to the center of a separate piece of paper and *enlarge the figure as much as possible* (i.e., don't exceed the 8"×8" square that will be visible when you project your transparency). Finally, make your transparency from the enlarged Xerox. (If you want to add or remove labels, you can easily do so on the enlarged piece of paper before you make your transparency.) This approach ensures meeting the two vital criteria of all transparencies:

1. They must be large enough and clear enough so that everyone in your audience can read them.
2. *They must not contain any material other than what you want your audience to pay attention to.*

### How can I effectively use the transparencies I've prepared?

Lousy transparencies abound in physics talks. Lousy transparencies are worse than no transparencies at all. Here are some important pointers:<sup>6</sup>

- **Limit the number of transparencies.** Plan on about 2–3 minutes to explain each transparency. To estimate the number of transparencies you should use in a short talk, take the number of minutes you're allocated to speak, divide by 2, and add 1. (For a long talk, take the number of minutes, divide by 4, and subtract 2.)
- **Don't write out your talk on transparencies and read it to you audience!** There are few surer ways to bore your listeners silly. Moreover, it violates the next rule, which is even more important.
- **Limit the amount of information you put on a given transparency.** To do their job, your transparencies *must* be clean, logical, and simple. Use phrases, not complete sentences. Avoid equations if possible. Avoid tables. Avoid unnecessary or elaborate graphs. As a general rule of thumb: **no transparency should contain more than 10 separate items of information.**
- **Never put anything on a transparency that you're not going to talk about.**
- **If you show graphs (or, if absolutely unavoidable, a table), be sure each graph is labeled clearly, completely, and legibly.** Use words, rather than symbols in axes and graph labels. For instance, if you're plotting momentum versus wavenumber, label the horizontal axis "wavenumber" (not  $k$ ), and the vertical axis "momentum" (not  $p$ ).
- **Print large.** Your transparencies *must* be readable by your audience, no matter where in the room they're seated. For a fairly large room, a good rule of thumb is that each letter or number *when projected on the screen* should be about 4 inches high. This means that each letter or number on your transparency should be about 1/2 inch high.
- **Avoid Transparency Cutoff.** You want your transparencies to be readable and your manipulation of them to be as comfortable and smooth as possible. So you need to know that **the dimensions of the region of your transparency projected onto the screen are not 8 1/2" × 11"**. Nearly all overhead projectors show a region about 8"×8". This means that if your transparency contains *anything* (information, header, title, your name) outside an 8"×8" square, then either your audience will be unable to read it or you'll have to move it around so they can. Either way, you wind up distracting them and yourself.

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<sup>6</sup>Another time saver: don't waste time preparing your final transparencies until you've practiced your talk enough to be sure you know what will stay in it when you actually give it. It's too easy to waste lots of time preparing stuff you later have to toss out. Instead, for your early practice sessions (no projector) just lay out each transparency (including whatever words, equations, sketches, etc. you think you'll use) *on a piece of paper* and use those. For practice talks in which you want to try out your transparencies, just print the information on each transparency (legibly enough so your practice audience can read them). Revise each transparency (as necessary) according to the feedback you get and your evolving sense of what should be on it. *Then and only then* do them up right.

### How can I effectively use equations on transparencies?

With considerable difficulty. The best strategy is to *avoid equations unless absolutely necessary*. The fewer equations, the better. If you can get your point across without showing any equations, that's great! If you must use equations, here are some suggestions.

- No more than one equation per transparency.
- **Emphasize concepts and results, not details and mathematics.**
- **Never show a derivation.** If you absolutely must discuss a derivation, summarize it in words.
- **Replace equations with “word pictures.”** For instance, you could replace the de Broglie relation  $E = h\nu$  with

$$\text{energy} = \text{Planck's constant} \times \text{frequency}$$

Even better, if the point is to emphasize the relationship between energy and frequency, write

$$\text{energy} \propto \text{frequency}$$

- **In your talk, describe every equation in words, including the reason you're showing it.** (If you can't think of a good reason, drop the equation!) For instance, in a talk about Rutherford scattering, you might show a transparency which contains the key equation and, as your audience looks at it, say something like. “This equation gives the differential cross section as a function of angle. It shows that this cross section depends inversely on the fourth power of half the scattering angle.”
- **Define every symbol in every equation aloud and on your transparency.**
- **Don't clutter symbols with unnecessary superscripts and subscripts.**

### How can I effectively describe experiments on transparencies?

Transparencies are essential if you're describing an experiment or an application.

- **Keep it simple!** Your transparency should contain a *simple* sketch or diagram that describes the *major components* of the apparatus.
- **On a separate transparency, summarize the physics that underlies the experiment.** When you state the underlying physics, you don't want your audience distracted by sketches, diagrams, picture, or equations.

### Relax.

Perhaps the most important way to avoid stage fright is to remind yourself of a few truths. If you've followed the guidelines on this sheet, then the following are true:

- Since you've practiced your talk several times, you know how it feels to give it and that you can give it in the allotted time.
- You know (far) more about your topic than your audience.
- Since you've tried out your transparencies on a practice audience, you know they are readable. Moreover, you can rely on them as “mental triggers” in the unlikely event that you forget something.<sup>7</sup>

Lighten up. Have fun. Enjoy sharing what you've learned with your audience. That way you (and they) will have more fun.

**Never, under any circumstances, talk beyond you allotted time.**

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<sup>7</sup>If you're still nervous, here's an old debater's trick. Print (in large letters) the first few sentences of your talk on an index card. This will get you started. Then you can switch to notes or transparencies. It's also a good idea to write out a sentence or two of your conclusion, just to have on hand.