Explaining Science to a "General Audience"

https://www.jou.ufl.edu/insights/audience-analytics-101/

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1

Structure of talk/paper

- Decide on 2-3 key points you want to explain.

What do you want audience to remember??

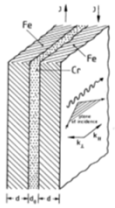
- Arrange entire document/presentation around explaining these points.

(this helps determine level of detail and background)

PHYSICAL REVIEW B VOLUME 39, NUMBER 7 1 MARCH 1989

Enhanced magnetoresistance in layered magnetic structures with antiferromagnetic interlayer exchange

G. Binasch, P. Grünberg, F. Saurenbach, and W. Zinn



1. Layering of magnetic materials can lead to different, unexpected magnetic behavior
2. This behavior can be useful in new types of read/write devices

2

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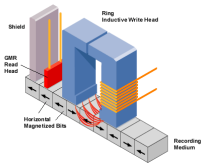
Drawing in your audience

Start with motivation that interest your audience.

Connect to something they might care about (can be fundamental questions, useful applications, current-interest topic, etc)

Zinn paper → importance of GMR read/write head to the public



Or question: Ferromagnets and antiferromagnets are well known. But what is physics behind tunable FM→AFM materials?

General talk on "Quantum Devices"

-Quantum in the News

-$1.2b National Quantum Initiative

-Asked question, "What is quantum, why is it in the news, and how may quantum devices change your future"

Remember to circle back to this in the conclusion – How were the questions answered? What is the impact of the topic you are explaining?

3

Explanations should start at the very beginning …

What does a "general audience" understand already? Much less than you think …

Whys Guys: How is your laptop like a toaster?

Example: to explain resistive heating, I had to start by saying, "All materials are composed of atoms, which contain particles called electrons. What we call an electrical current in a material is the flow of these electrons …"

You need to start easy and build up to more complicated topics.

Simplify, condense, and skip information as necessary.

Eg, in Zinn paper, does reader need to know what MOKE is? Does reader need to know about Fermi level mismatch? (maybe mentioning role of scattering (or "electrons hitting atoms") is enough).

4

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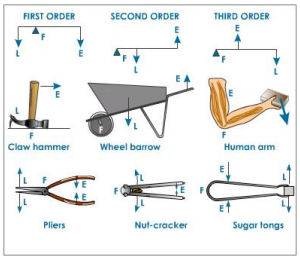
Start with physical, intuitive examples …

Start with examples that a nonscientist is familiar with.
Then by analogy explain the physics concept.

Particles

Wave interference

Levers



https://imgur.com/gallery/ISH6I

Is there no physical analogy? It's ok to explain this also.

5

Quantum Mechanics

Theory that describes nature at the smallest scales

"If you are not completely confused by quantum mechanics, you do not understand it."

-John Wheeler

"I do not like it, and I am sorry I ever had anything to do with it."

-Erwin Schrodinger

6

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Use non-technical terms

Use only terms that a non-scientist understands.

Words like “orthogonal,” “asymptotic,” “first-order” are jargon to a non-physicist.

Be careful assuming people know what an “electric field” or “massless string” are, for example.

Write short sentences and short paragraphs

Avoid phrases such as “as you know” or “as I’m sure you’ve heard of.” People know less than you imagine and will be turned off by such a statement.

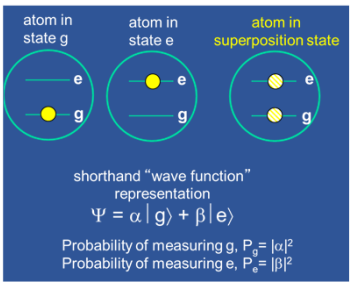
7

Limit Use of Equations

If you must use equations, use them after you’ve used analogies and explained the concept in basic terms.

Do NOT rely on math beyond basic algebra (so no integrals).

Every formula/equation should serve a purpose and be explained. Consider replacing numbers and symbols with words.



8

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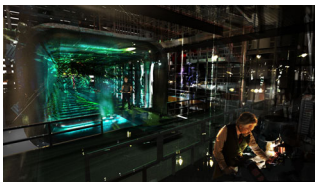
Adding Fun and Personality

It's ok to have limited "fun" slides or information, especially to break up a talk or even document.

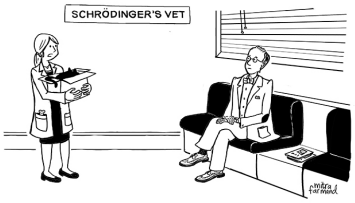
Cartoons, videos, funny comments, interesting analogies are ok – depending on context.

In a talk, personal stories and insight can add connection.

Engaging the audience is important.



Video of "The quantum tunnel" in Antman and the Wasp



"I have good news and bad news"

9

Check that your work is non-technical

Have a friend who is NOT in the sciences read the article and see what they understand.

Do they understand your main points and find it interesting (even if they only fully understand 75%)?

Is this non-technical? …

"Topological insulators (TIs) are a new type of material which have an insulating band gap in the bulk and conducting states along the surface. These materials were first discovered in two dimensions[1] and have since been expanded to three dimensions. They have generated a lot of excitement about their possible applications to spintronics and quantum computing.

Two-dimensional TIs were predicted based on the quantum spin Hall effect. This effect is caused by the intrinsic magnetic field of a material coupling with the spin of the conduction electrons, inducing quantum Hall states.[2] The normal quantum Hall state, however, differed in the experimentally observed in HgTe quantum wells. The next step in evolution of TIs was to increase dimensionality."

10

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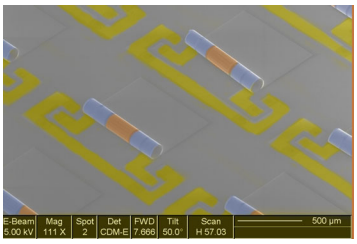
Campus news story on manuscript “Monolithic heterogeneous integration of 3D microwave L-C elements by self-rolled-up membrane nanotechnology” …

CHAMPAIGN, Ill. — Electronic filters are part of the inner workings of our phones and other wireless devices. They eliminate or enhance specific input signals to achieve the desired output signals. They are essential, but take up space on the chips that researchers are on a constant quest to make smaller. A new study demonstrates the successful integration of the individual elements that make up electronic filters onto a single component, significantly reducing the amount of space taken up by the device.
Researchers at the University of Illinois, Urbana-Champaign have ditched the conventional 2D on-chip lumped or distributed filter network design – composed of separate inductors and capacitors – for a single, space-saving 3D rolled membrane that contains both independently designed elements.
The results of the study, led by electrical and computer engineering professor Xiuling Li, are published in the journal Advanced Functional Materials.



https://news.illinois.edu/view/6367/200932628#image-1

11

Summary:

- Decide on 2-3 key points you want audience to remember
- Organize your paper around making these points clear
- Start by drawing audience in with something likely personally motivating to them
- Begin explanations with intuitive examples, easy metaphors
- Use non-technical terms and limit equations
- Check with a non-technical friend that they got your main points and understood > 75% of what you wrote

12

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