

Design 101 for Physicists

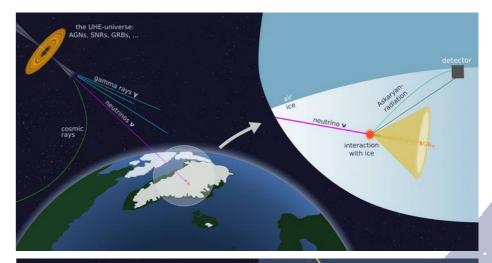
Karen Terveer

School for Astroparticle Physics 2025 Sept. 11, 2025

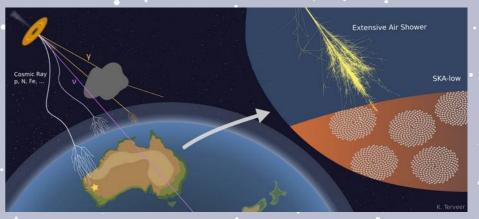
Plots, Posters, Presentations & Concept Graphics

Speaker Introduction

- PhD Student @ ECAP since May 2023
- working on Bayesian CR reconstruction for LOFAR & SKAO
- Went to art school!
 - → was trained in graphic design







Speaker Introduction

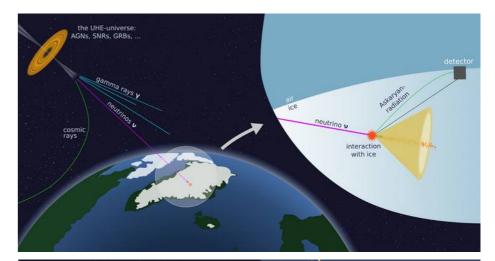
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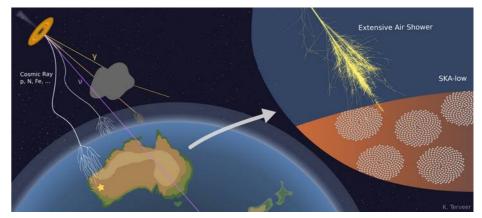
Why should we care?

With clear and cohesive visuals you will do your work justice:

- Less misunderstandings → less revisions → less work
- You will be percieved as more professional
- You are more likely to stand out and be remembered
 - People might even be more likely to use your figures or graphics!





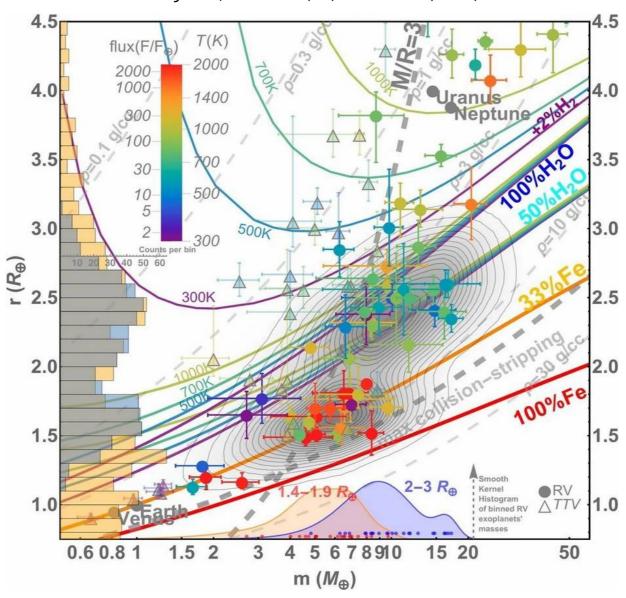


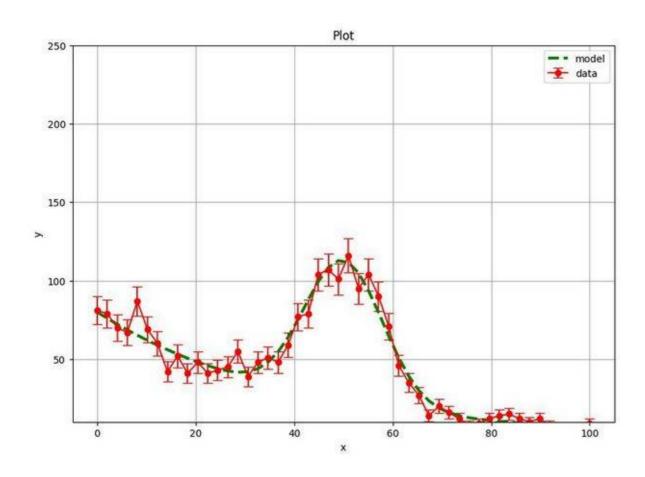
Good design isn't about making things "pretty."

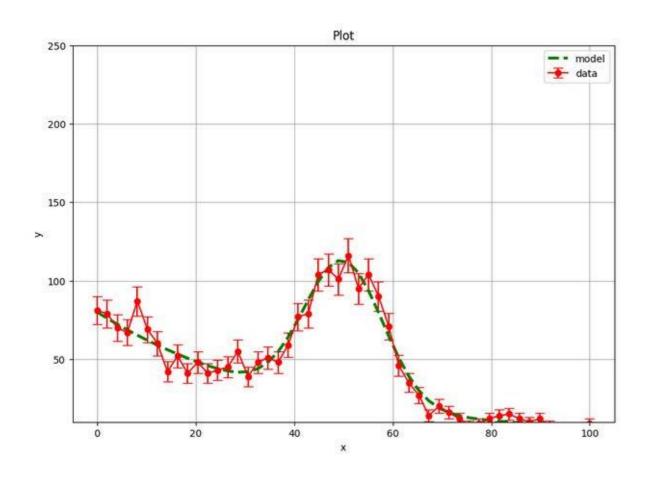
It's about making your research understood, remembered, and trusted.



Zeng et al., *PNAS* 116 (20) 9723-9728 (2019)



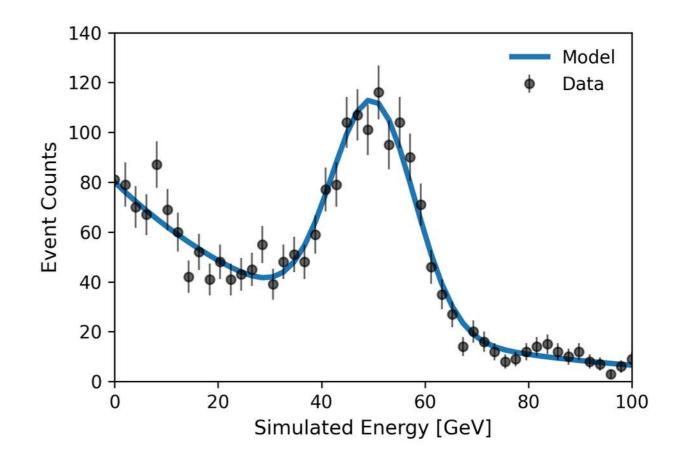


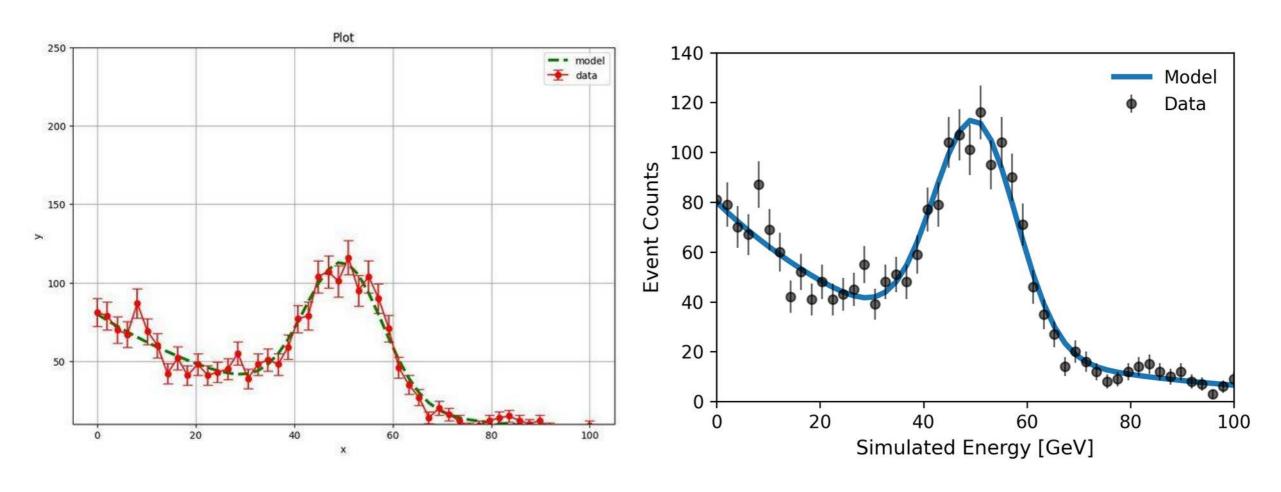


Avoid to...

- Use too small axes or legend labels
- Use non-colorblind friendly colors
- Connect noisy data points
- Use grid lines where not necessary
- Use busy linestyle/color combinations
- Use low resolution
- Use plot titles where not necessary
- Use misleading/unfitting axes limits

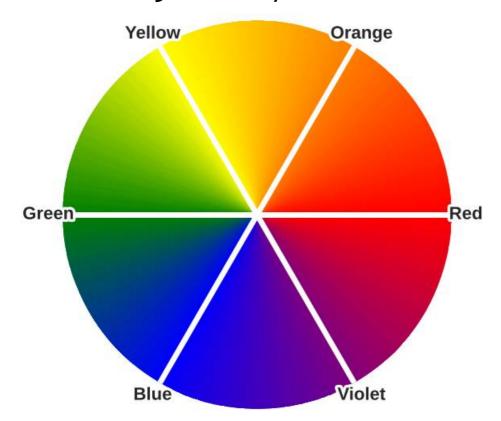
- Ensure labels are readable
- Use distinct colours
- Avoid clutter by displaying only necessary information
- Export as .pdf or .eps with a resolution of 300dpi
- Add units to axes labels
- Center the important data

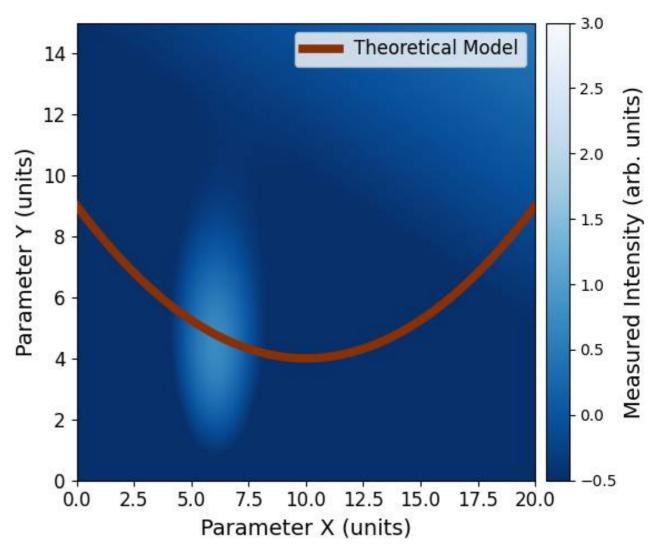




More...

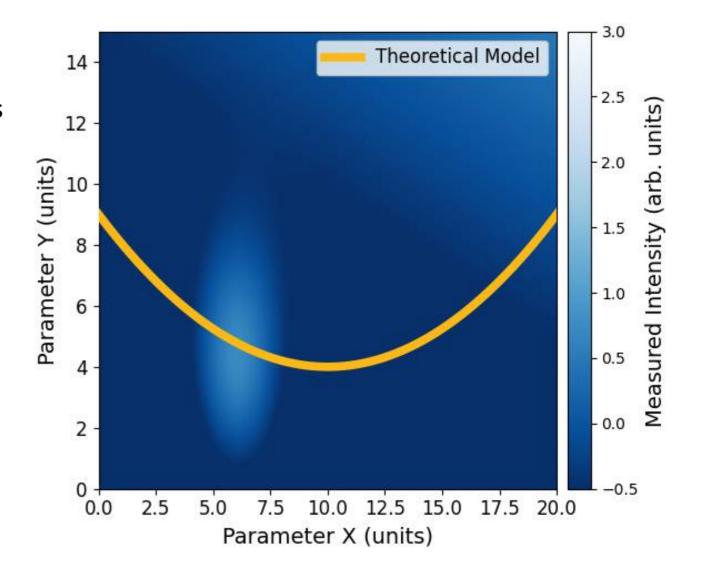
- Learn about complementary colours!
- On a complementary background, lines are straining on the eye



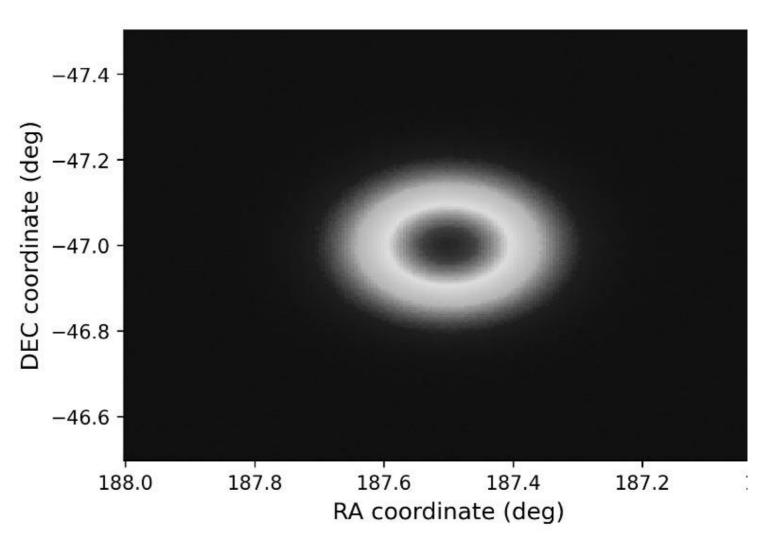


More...

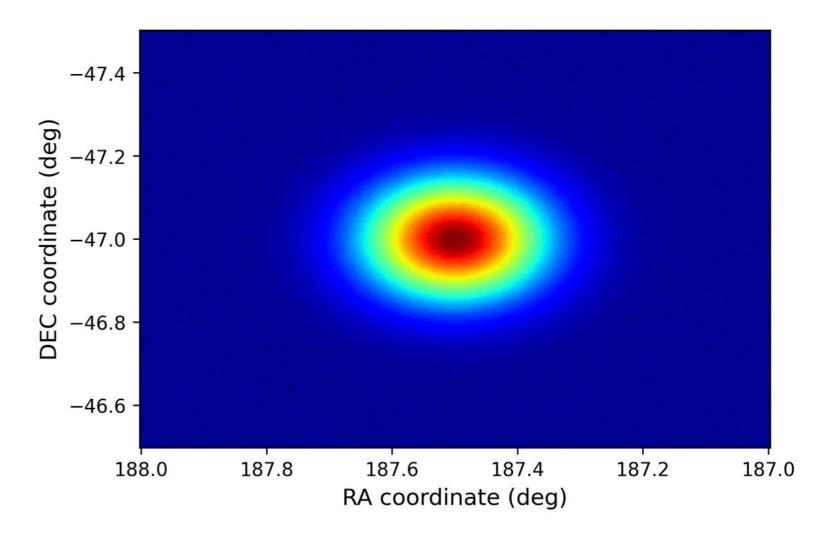
- Learn about complementary colours!
- On a complementary background, lines are straining on the eye
- Fix: increase luminance contrast



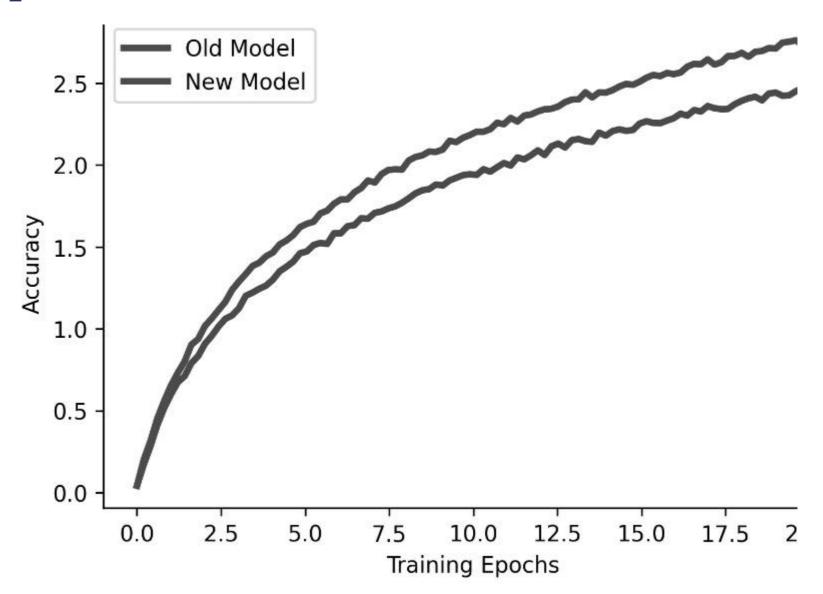
Describe the plot!



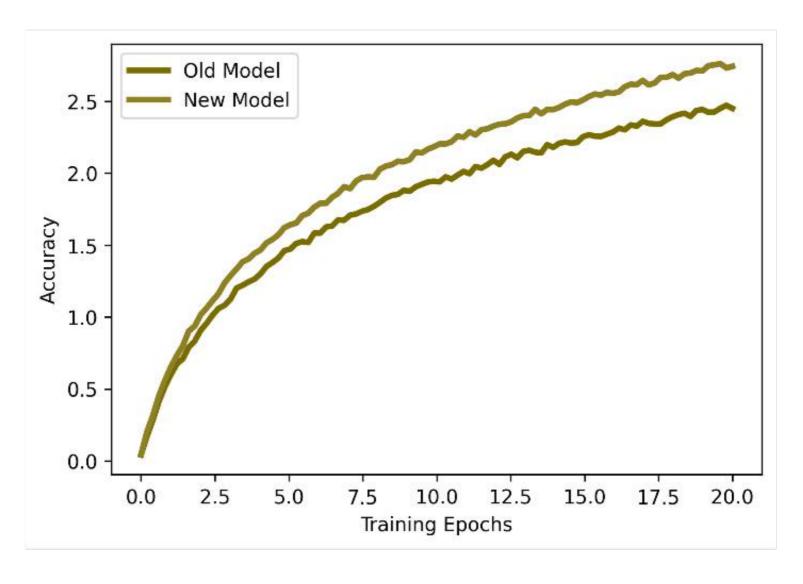
The "real" plot



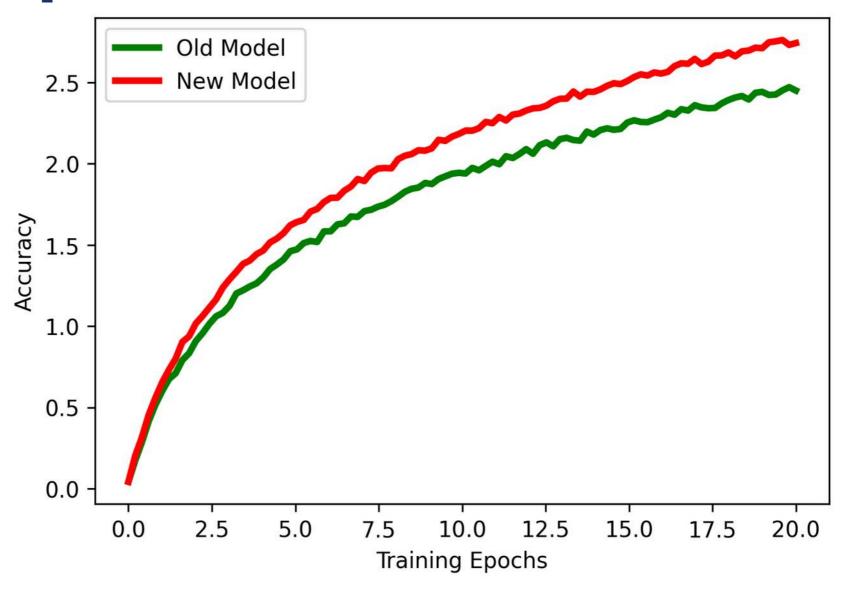
What do you see here?



How about this?



The true plot

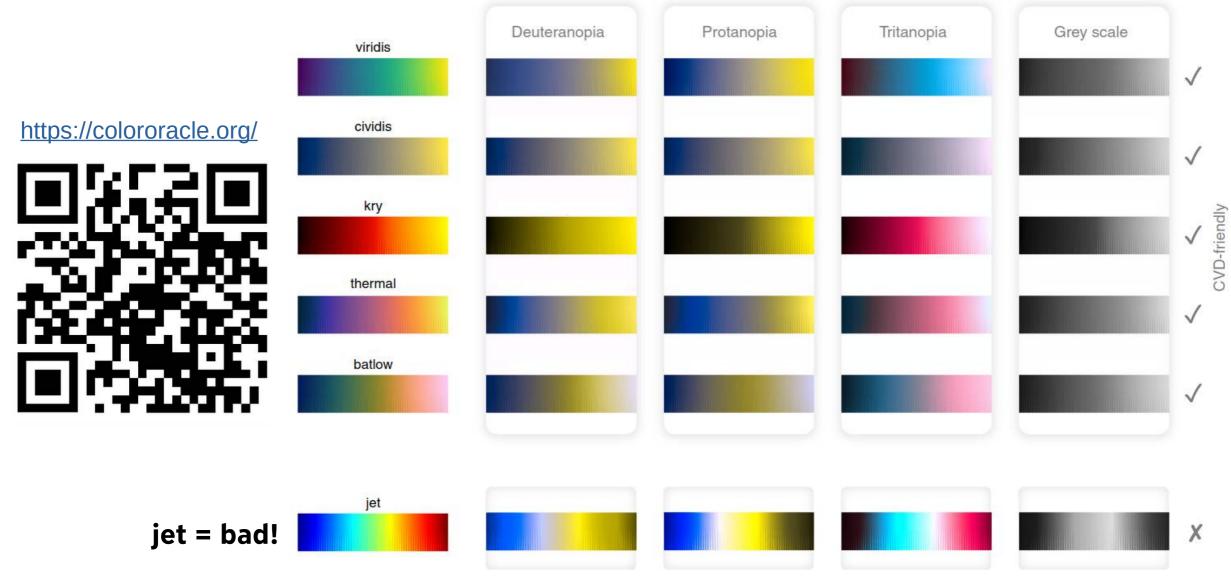


On CVD

- In a room of 30 people (15 men and 15 women in the field of physics unrealistic), the probability that at least one person is colourblind is around **75%**!
- Various types of colourblindness exist, not just red-green
- Ensuring your plots are understandable for all types of colourblindness is good practice
- If you need to use a lot of colours, try different markers/linestyles to set apart your data
- Use perceptually uniform colourmaps

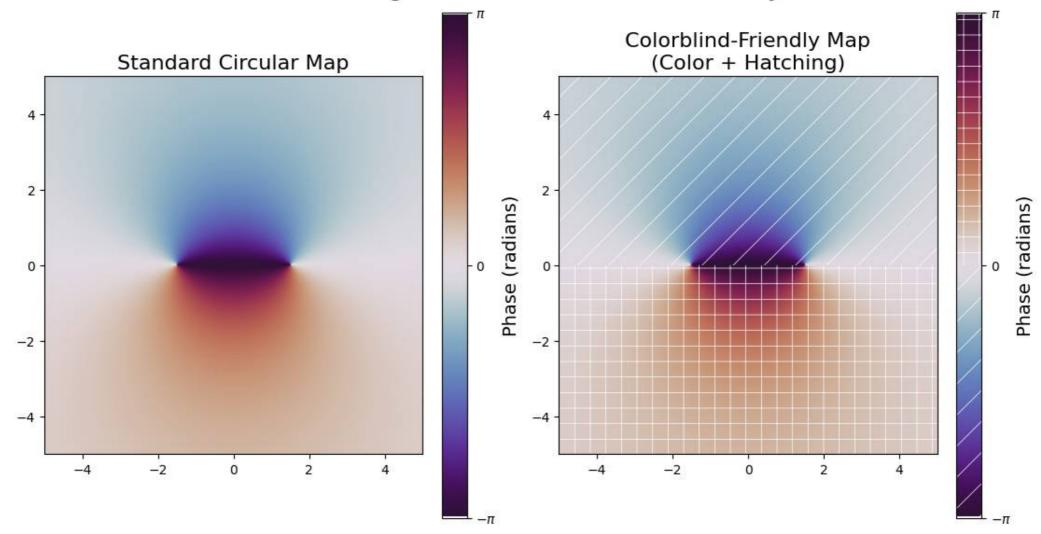
CVD-friendly colormaps

Crameri et al., Nat Commun 11, 5444 (2020)



On colormaps

Enhancing a Phase Plot for Accessibility



PRESENTATIONS

Presentations

What they are

- A Structured, Live Communication Event: At its core, a presentation is a deliberate and organized delivery of
 information, ideas, arguments, or proposals by an individual or group to a specific audience, typically in a live
 setting. It's not merely talking; it's a performed act designed with a clear beginning, middle, and end, often
 meticulously planned to guide the listeners through a particular topic or narrative with intentional pacing and
 emphasis.
- A Multi-Sensory Engagement Tool: While often associated with a speaker and their voice, a
 presentation intrinsically leverages multiple sensory channels to convey its message effectively. This
 commonly involves visual aids such as slides (PowerPoint, Keynote, Google Slides), charts, graphs,
 images, videos, physical props, or even demonstrations, all designed to enhance understanding,
 maintain attention, and reinforce spoken words, creating a richer, more memorable experience for
 the audience than text alone.
- A Dynamic Interaction Between Speaker and Audience: Despite appearing as a one-to-many communication, a presentation is fundamentally a dynamic interaction. The speaker is not just broadcasting information but actively working to connect with, engage, and often persuade their listeners. This involves maintaining eye contact, using body language, modulating voice, and reading the room to adjust delivery in real-time. Even without explicit Q&A, the speaker is constantly seeking to build rapport and ensure the audience is following along, aiming for a shared understanding or a desired response.

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Presentations

- Are your short chance for the full attention of an audience!
 - You will lose their attention if you overwhelm them with a wall of text

A cohesive design can help you bring your point across

Let's look at things to avoid

Do not overload your slides

Please, you are losing my attention



 $E = mc^2 + AI$

Source: AI Studio



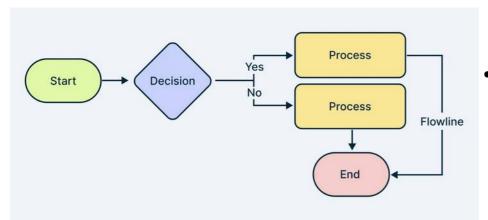
Erlangen Center for Astroparticel Physics



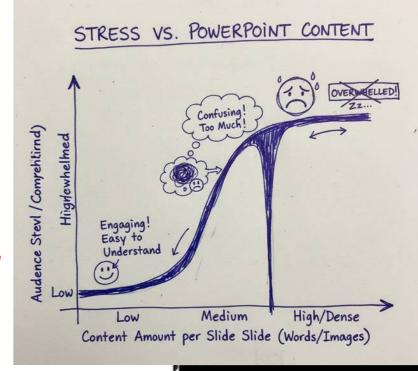
It can be tempting to maximise the amount of content on your slide, and sometimes it is hard to condense it because you really want to show things next to each other.

 But the viewer sometimes will not even know where to start

Source: The Office (US)



Or will start reading things on their own instead of listening to you!



Source: Benjamin

Schwab



Do not

 Instead, use top-down leftright principle to help the viewer naturally follow along

 Even with the help of arrows, not following the top-down left-right principle will cause confusion Do not make your viewer work for your information!

Guide the viewers eye in an unintuitive way

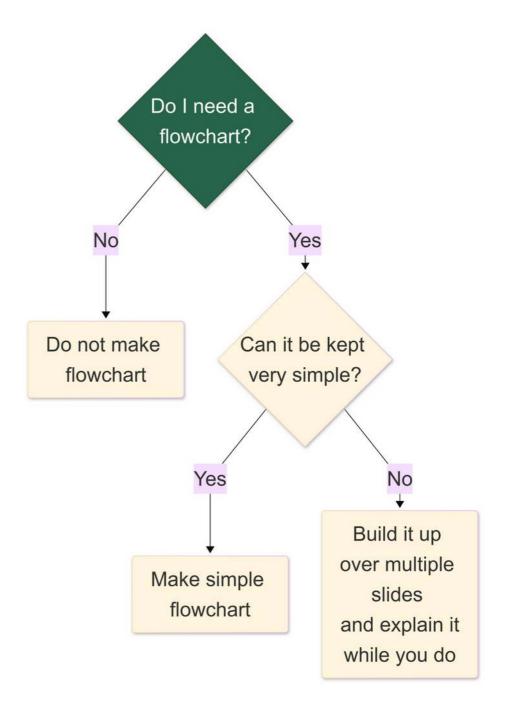
Do

- Keep things short and concise
- Stick to one font (ideally a sans serif font for readability)
- The sweet spot for one slide is 1 minute (+-)
- Show your main results again on your last slide. Ditch that "Thank you for your attention" slide!



Do

- Choose a large font size
- Use a 16:9 slide format
- Only use VERY simple flowcharts
- Opinions on memes are mixed
 - → know your audience!





- Imagine a poster session at a large conference
- 200 posters, 90 minutes
- You see two posters next to each other

Which one will you go to?

Your awesome science result, but with a very very long title that I already do not want to read any more, I know it can be hard to keep a title short, but seriously, it's not a competition

Your Name, Your Collarborators et al.

For whatever reason, an abstract! Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet.

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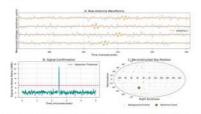
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Your awesome science result



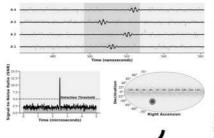




Your Name, Your Collaborators et al.

A short introduction to what is important for the work you are about to show. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliguyam erat, sed diam voluptua.

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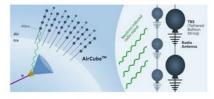


We found something!

A short introduction to what is important for the work you are about to show. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua.

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Maybe a subsection title

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- A poster is an ad for your paper/proceeding/result!
- Do not be afraid of whitespace!
 - Your poster is not a paper.
 - Stick to the important information
 - Show the money plot
 - Add a QR code to your paper/proceeding/further media

Your awesome science result



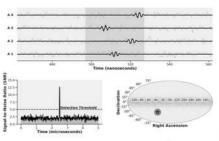




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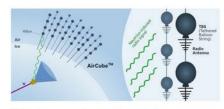


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36

- A high-contrast poster will draw more attention
 - → During a busy poster session this will give you an advantage
- Engage and discuss with people! Do not just let them read a wall of text

Your awesome science result



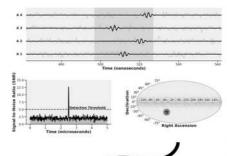




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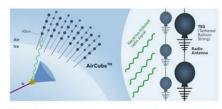


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- Keep your content large!
- Tip:
 - Print your poster on A4, hold it at arm's length. Anything that is not **easily** readable is way too small!



 Align text left or right, don't justify it. Justified will probably make your paragraph spacing weird, making it harder to read and look too monotone.

Your awesome science result



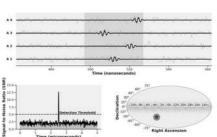




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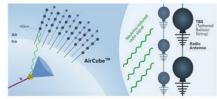


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- Try to shorten your title (I know, this can be hard!)
- Play with color schemes
- Use arrows to guide the viewers' eye (but do not overdo it)
- Switch image and text sides around

Your awesome science result



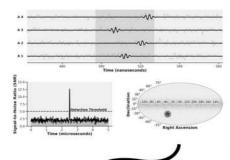




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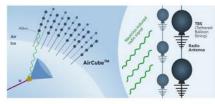


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- Follow the top-down left-right principle
- Use columns to avoid long lines of text
- Stick to one font
- Use **bold**, **larger** text for more important information
- Keep font size of equally important elements equal

Your awesome science result



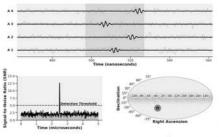




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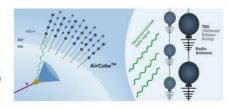


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41

Posters: Font size

- The usual poster size for conferences is AO
 - Title: 90-100 pt
 - Subsection titles: 50-60 pt
 - Body text & plot labels: 30-36 pt

Your awesome science result



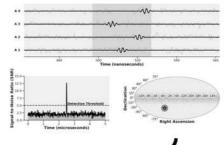




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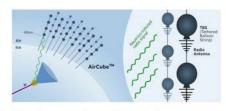


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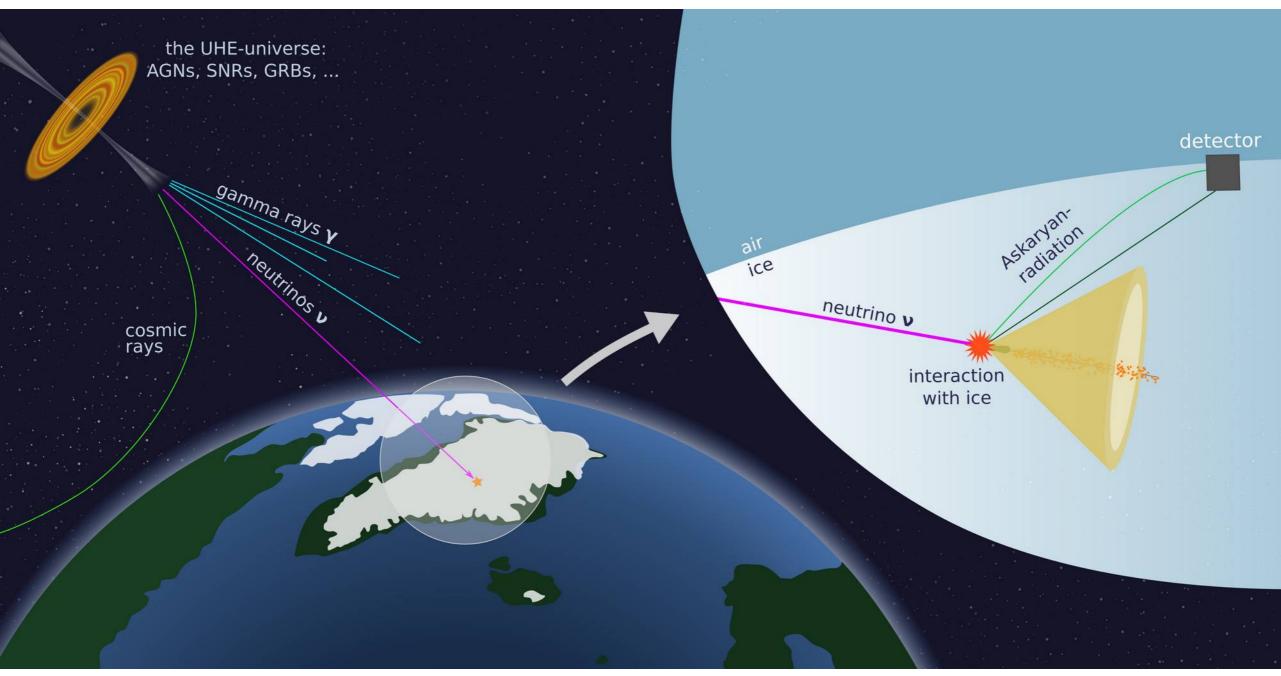
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42

- You do not have to reinvent the wheel
- Simple, straightforward designs can go a long way
- Often, adding a **concept graphic** will help you explain your work and add colour and contrast to your poster!

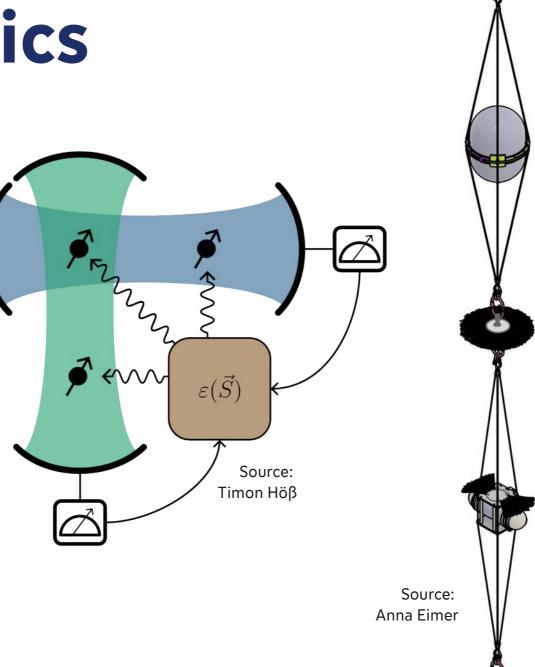


CONCEPT GRAPHICS



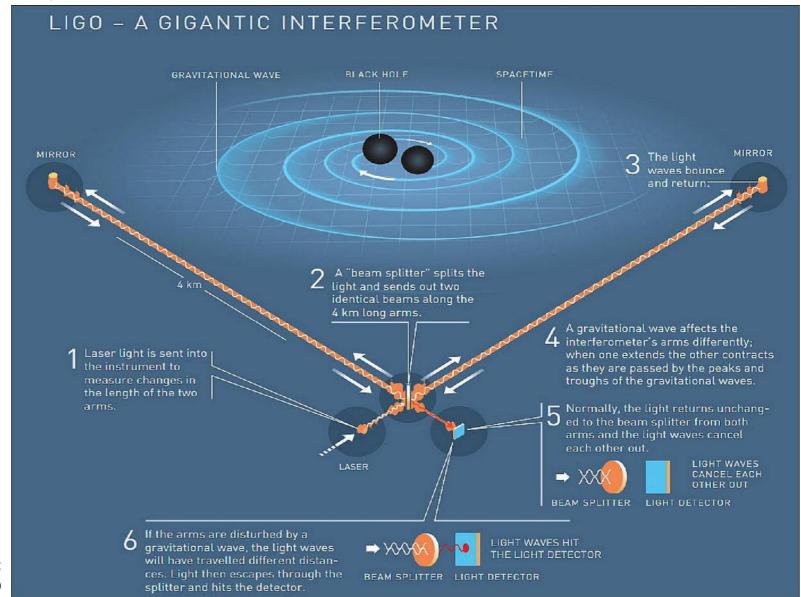
Can be anything:

Your own experiment setup



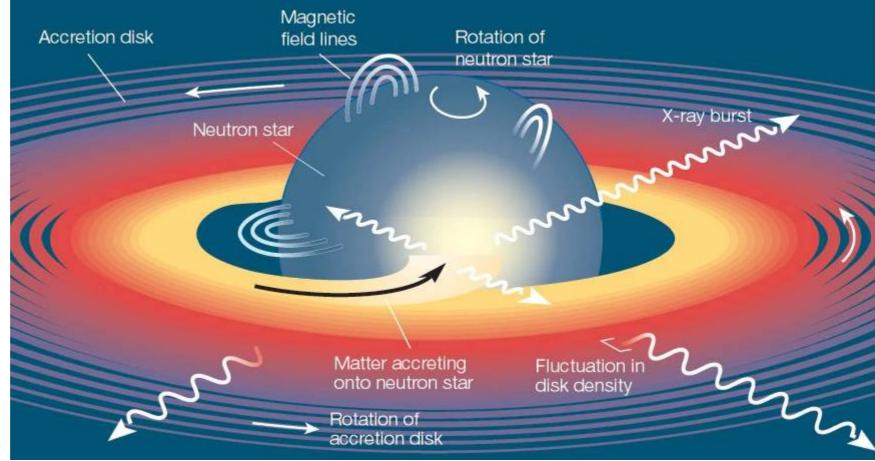
Can be anything:

 A schematic explaining a method



Can be anything:

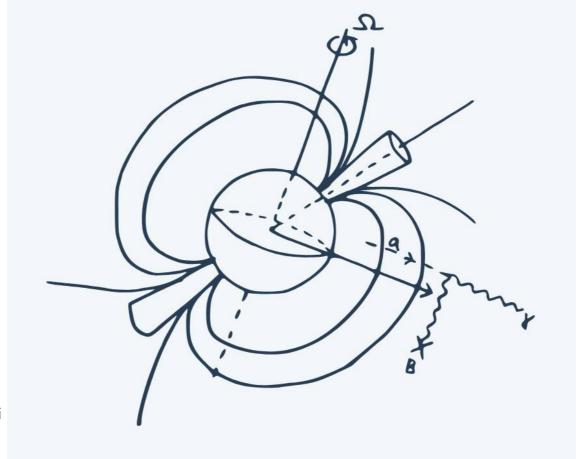
An illustration of what you want to measure (e.g. an astronomical object)



Robert V. Wagoner Nature volume 424, pages 27–28 (2003)

Can be anything:

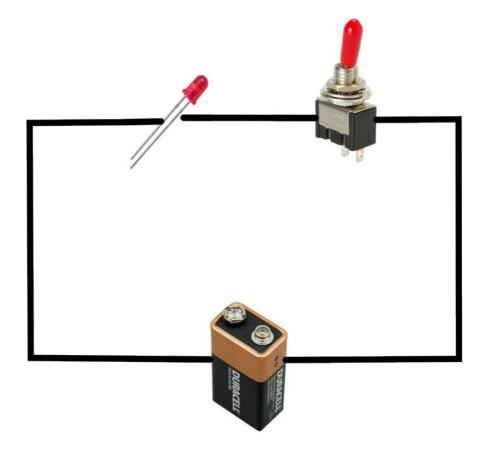
• An illustration of what you want to measure (e.g. an astronomical object)

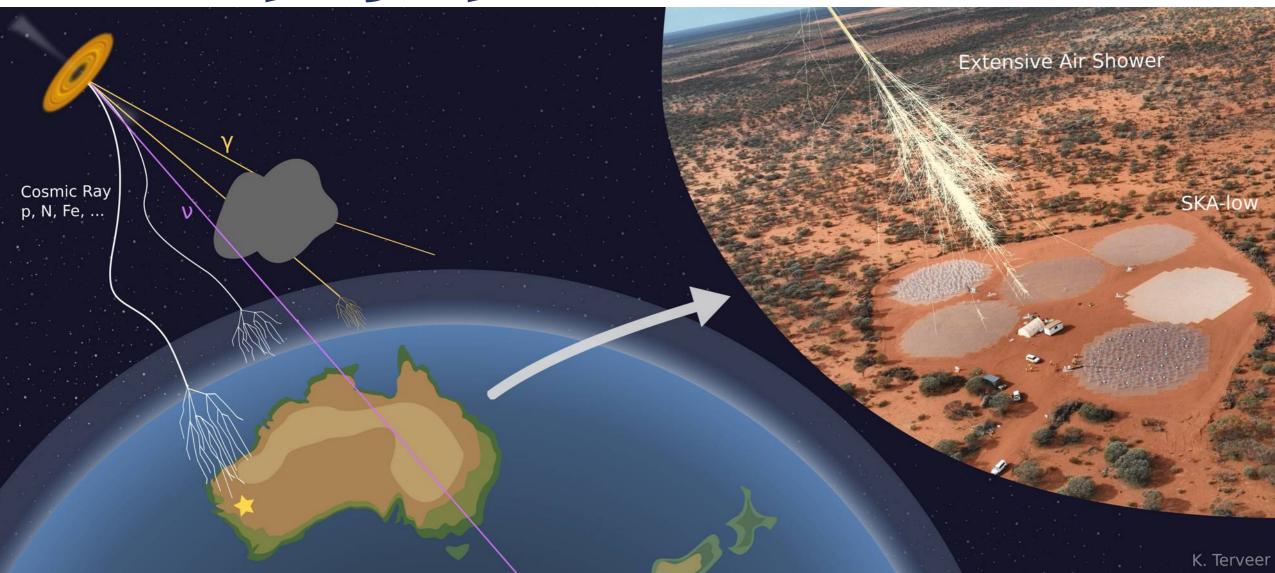


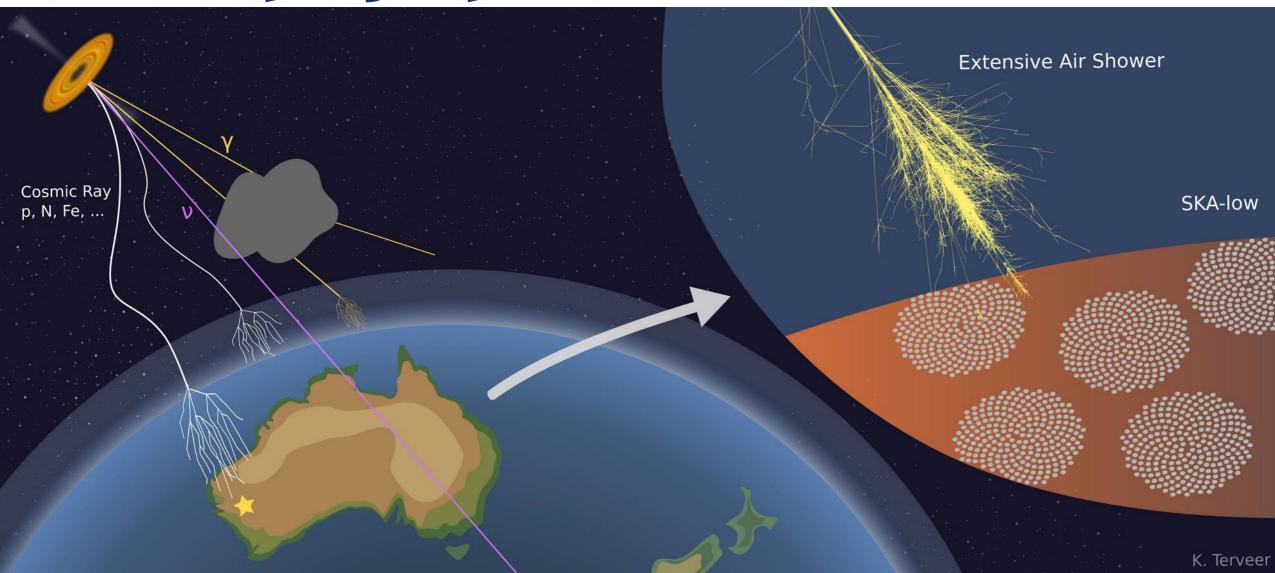
Source: Merle Gizinski

- Here we can be more creative: concept graphics do not show data, but serve to help visualize via simplified images
- Great for a poster or the beginning of a presentation:
- Suitable for outreach or proposals
 - → once created, you can use a concept graphic everywhere!

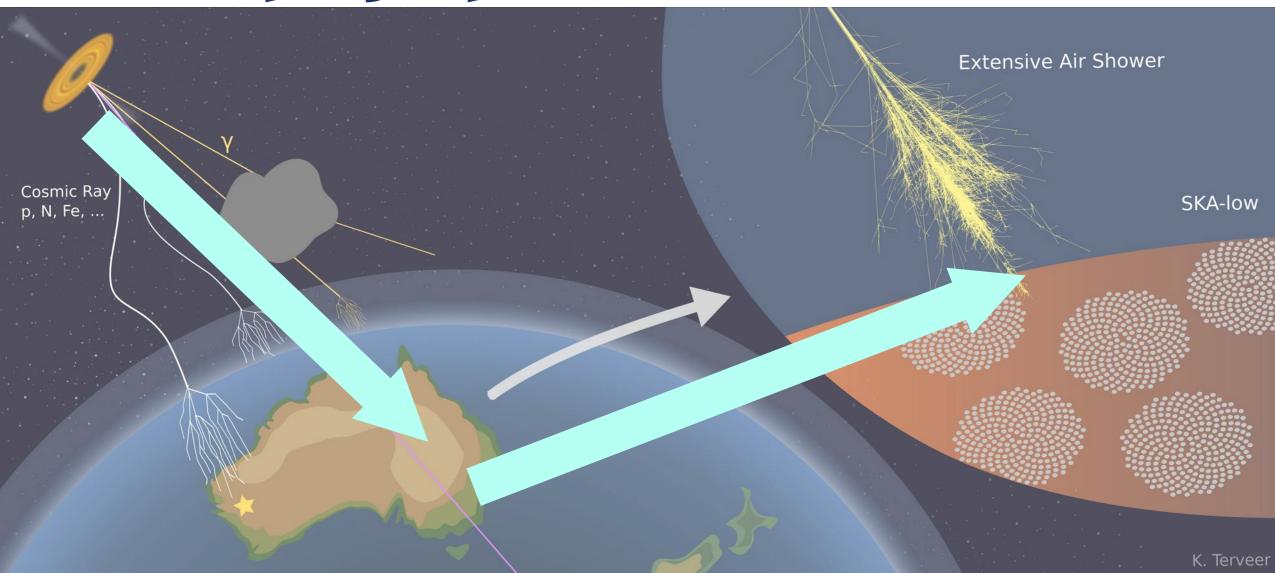
- There are no do's or dont's! But these are things I try to stick to:
 - Use simple shapes, avoid too many details
 - Avoid using real photos
 - → Iconising elements enhances recognisability:







- Guide the viewers eye in a reasonable way:
 - Average viewer follows top-down left-right
 - Circular designs can be confusing if there is no clear starting point
 - Arrows can aid the eye
 - Connect the graphic: reappearing elements



Let's make our own!

Experiment: Balloon array in Antarctica for neutrino detection (**AirCube**)

- → Strings of tethered balloons equipped with radio antennas in ~40km height
- → Measure radio signals of upgoing neutrinos that interacted in ice



Let's make our own!

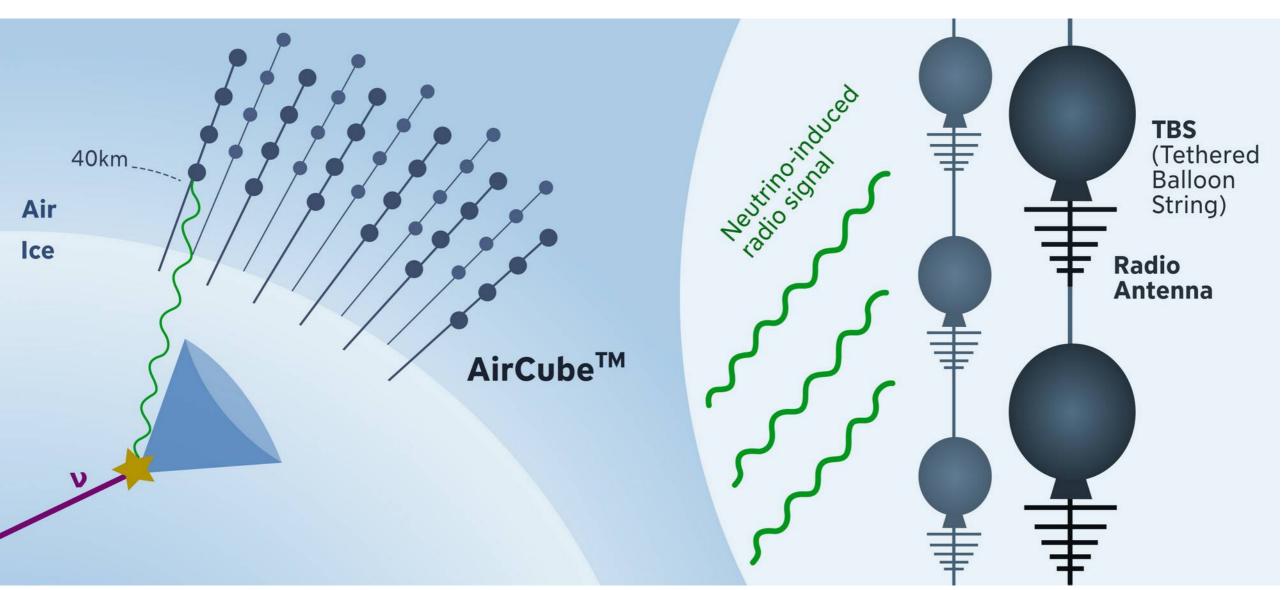
Start with a sketch:

- What is our format?
- What do we want the viewer to see first? (Top-down, left-right)
- What information is important for us?
- What can we leave out without losing the message?

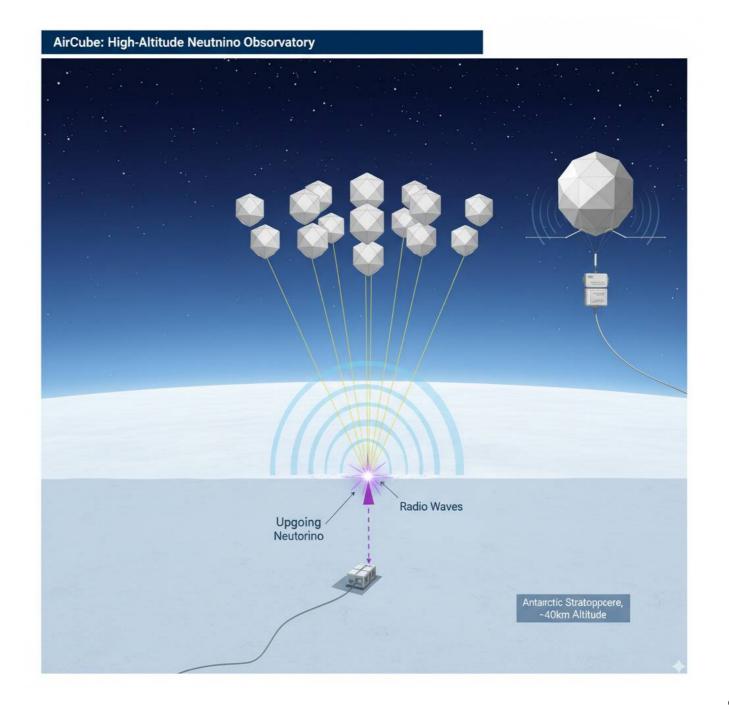
Let's make our own! Tips

- Build up information:
 - Ideally the viewer should see information with increasing complexity (general things first, details later)
- Stick to a colour scheme to make things more cohesive and less messy
- Important things can be highlighted by increasing size or contrast
- It is okay to simplify things for clarity!

Let's make our own!



Let's ask Al!



- Vector graphics!
 - Makes your design scalable without loss of quality

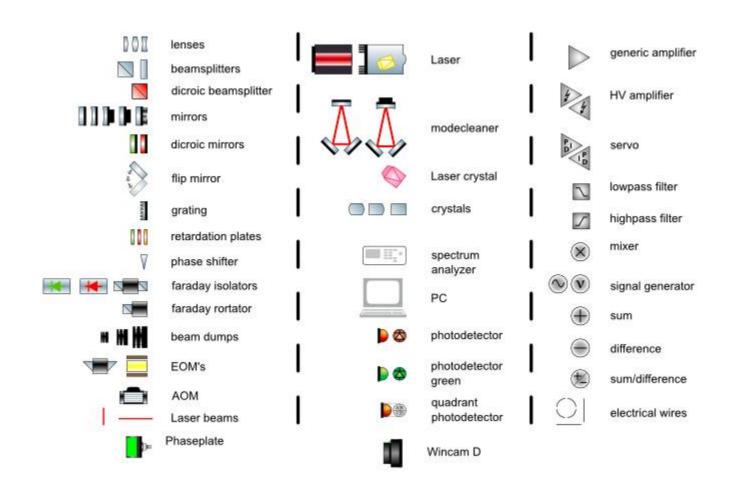
Free vector software: InkScape
 https://inkscape.org/



- Crash course now feel free to install and join, or just watch!
- If you already know InkScape, maybe try to create a concept graphic about your own work!

You do not have to create everything on your own:

- Vector graphic libraries can be found online:
 - Search for ".svg icons"
- Example: www.gwoptics.org/ComponentLibrary/
- Keep copyright in mind!



Now it's your turn:

- Make a sketch (either by hand or using InkScape) for a concept graphic about your work, to use as an intro/overview slide in a presentation
- Feel free to discuss among each other. I am available for questions/input, ...

When unsure, ask your colleagues:

- Let them describe it
- Ask whether anything is unclear
- Constructive criticism is very helpful!

me: I'm great at taking constructive criticism

also me after constructive critisism:



THANK YOU FOR YOUR ATTENTION!

... just kidding

... my main points

- Whether we like it or not, the way we present our work matters
- Design does not need to be a lot of work
 - → Unless you want it to more power to you!
- Unfortunately, less is more!
- Top-Down, Left-Right!
- Yes, you too can design your own graphics!

Thank you!

