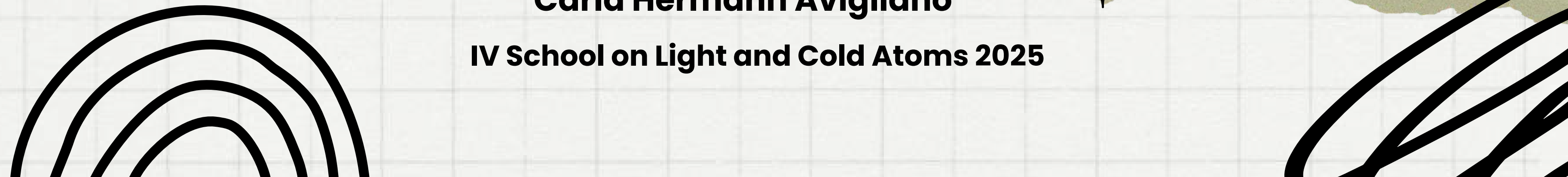




MIRO
Millennium Institute for
Research in Optics

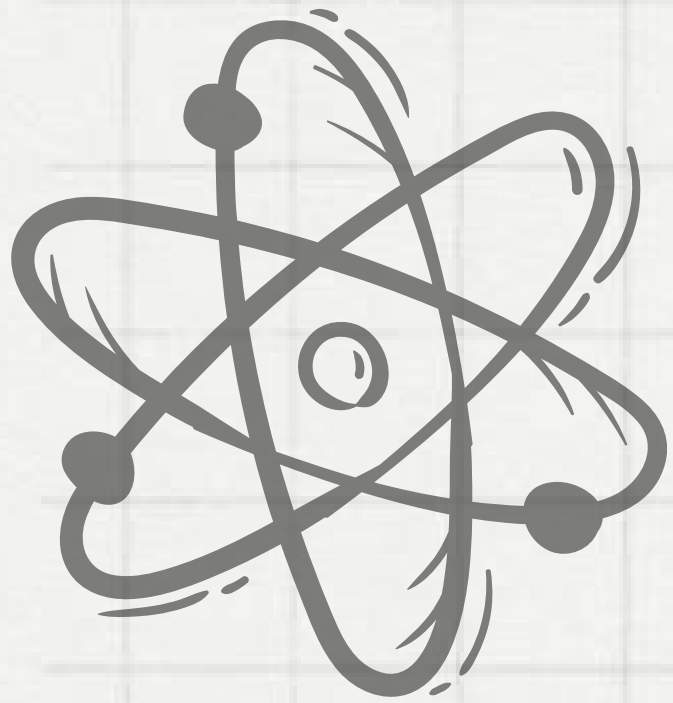
Hands on
**Science
communication**

Carla Hermann Avigliano
IV School on Light and Cold Atoms 2025



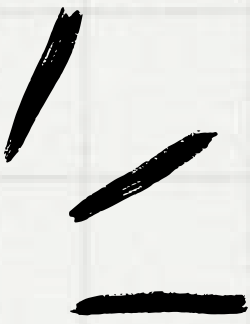
$$E = m \cdot c^2$$

Previously on Hands-On
Science Communication....





**"Science that is not shared does
not build bridges, does not inspire
minds, and does not generate
change"**



C. Hermann



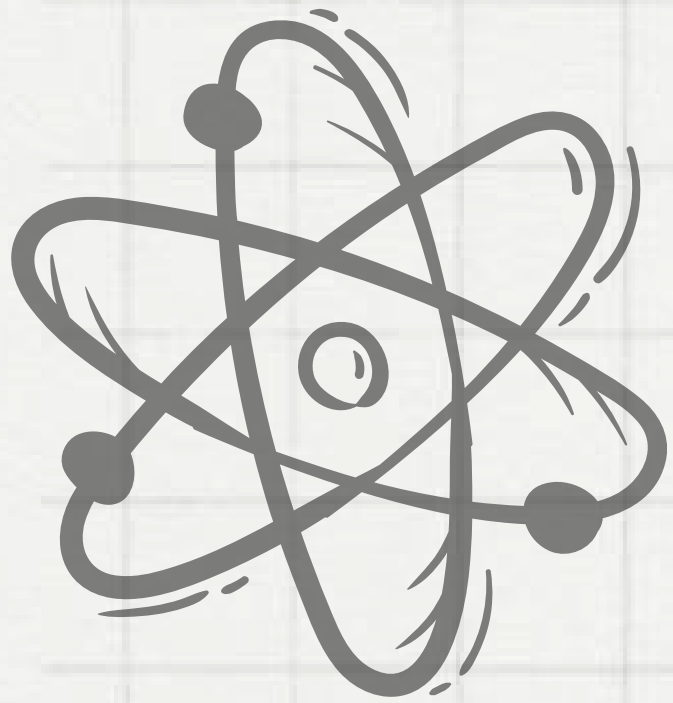
**"Science is
done in broken
English"**



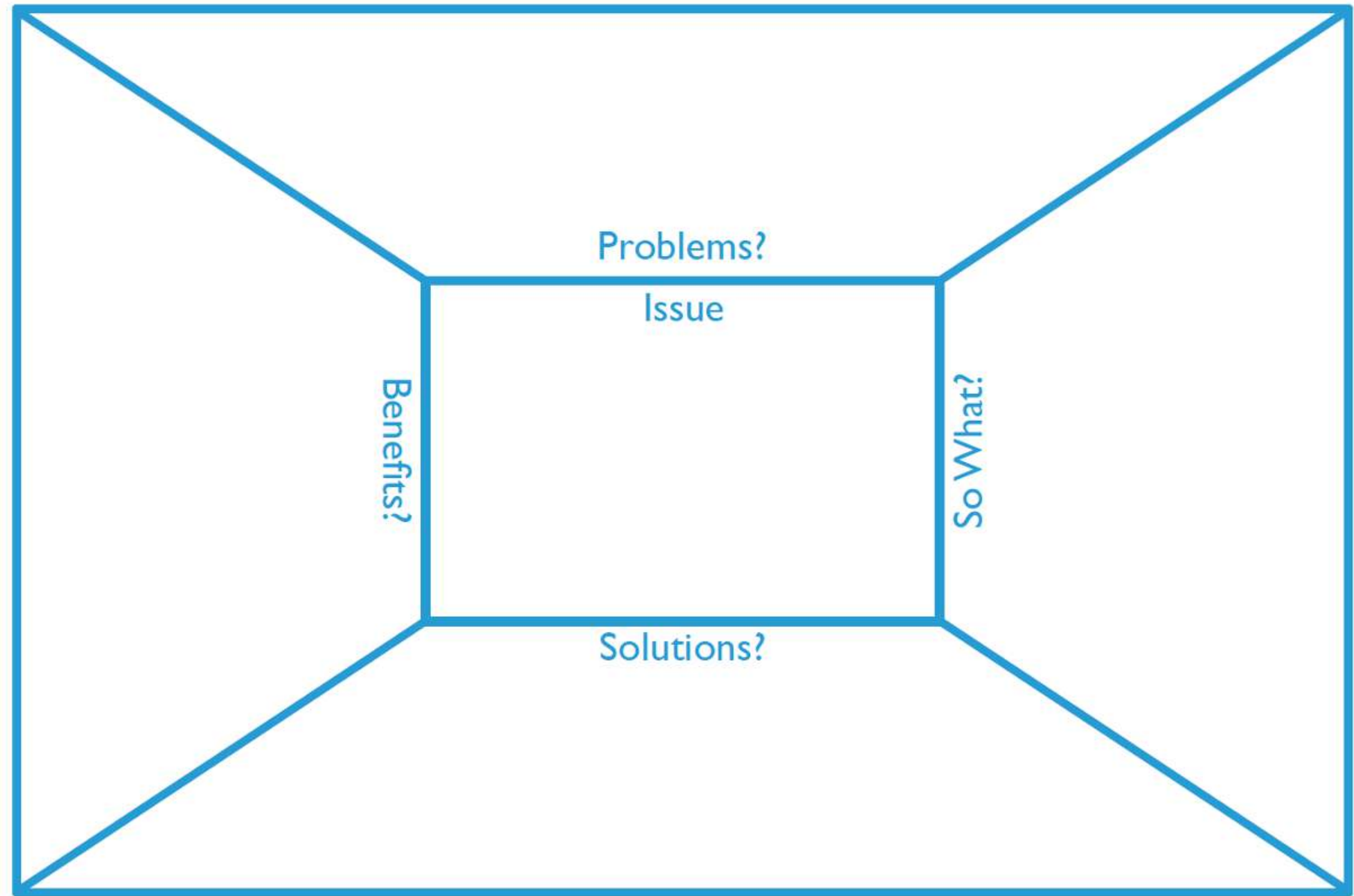
I heard it from P. Solano, who
heard it from L. Orozco, and so
on...

Know your audience

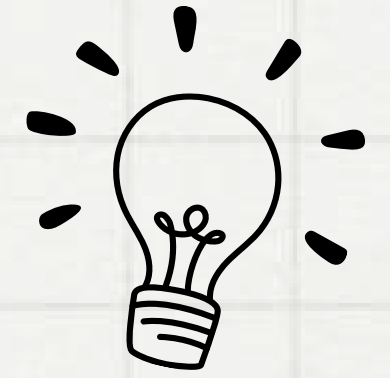
$$E=mc^2$$



Audience:

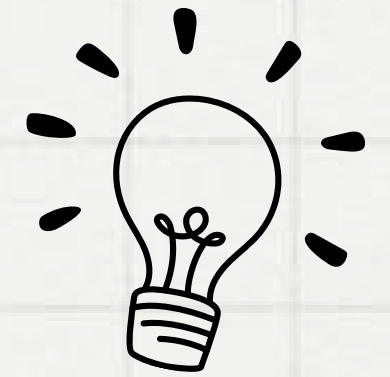


creating value



- Acknowledge the reader community: **“I know what you think...”**
- Show the conflict/challenge/problem: **“...and you are wrong...”**
- Show the cost/benefit of (not) solving the issue: **“...and that’s why it should matter to you.”**
- Use a triangular structure to tell the story.

Tips for presenting ideas

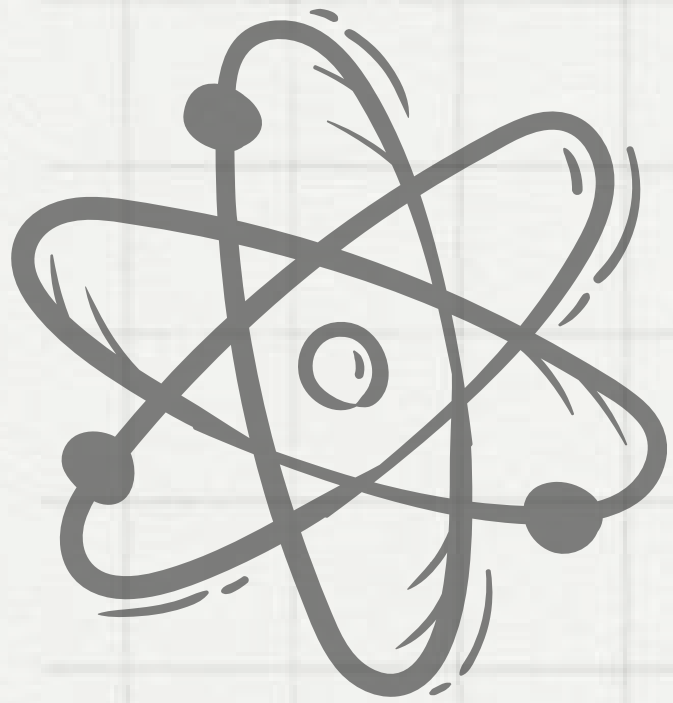


1. Broad Problem – What it's about
2. Narrow Problem – What needs to be solved
3. Central Message – What your contribution is
4. Key Findings – What your results are
5. Key Implications – Why they matter / what their implications are

$$E=m.c^2$$

Oral communication

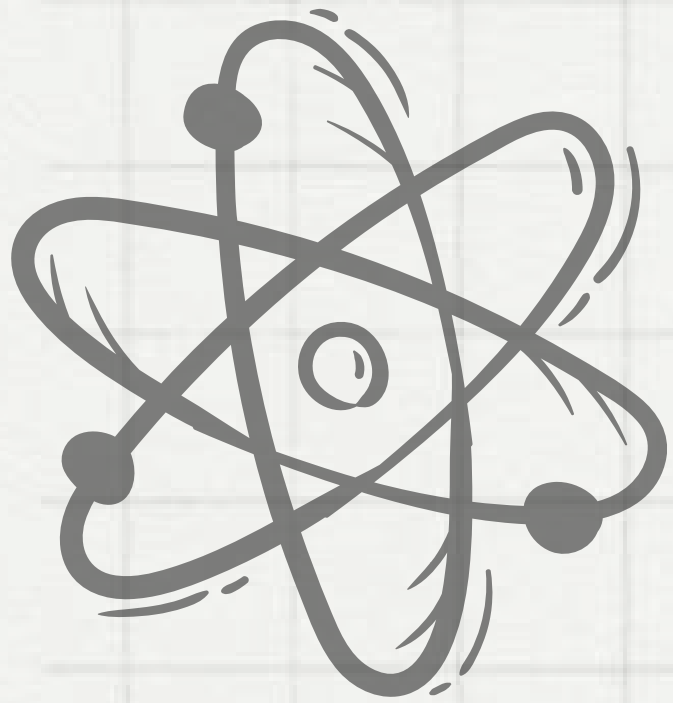
- **Throughline**
- **Adjust** message to the audience
- **Voice, body, rhythm, movement**
- **High-impact slides:** minimal, well-chosen information, you need to know your graphics!
- **Practice efficiently + prepare Q&A**



$$E = m \cdot c^2$$

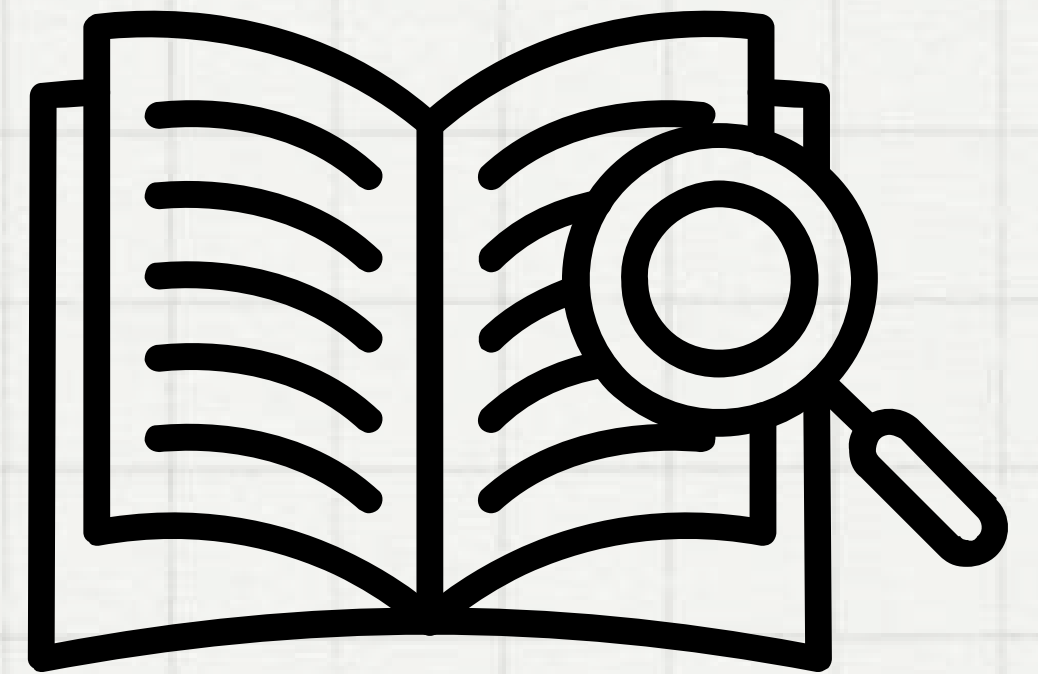
Part 3:

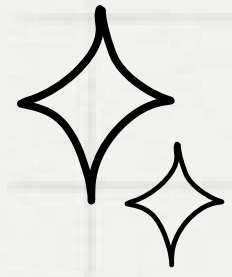
Resources and structure



✧✧ How to search for scientific articles, and how to check citation paths

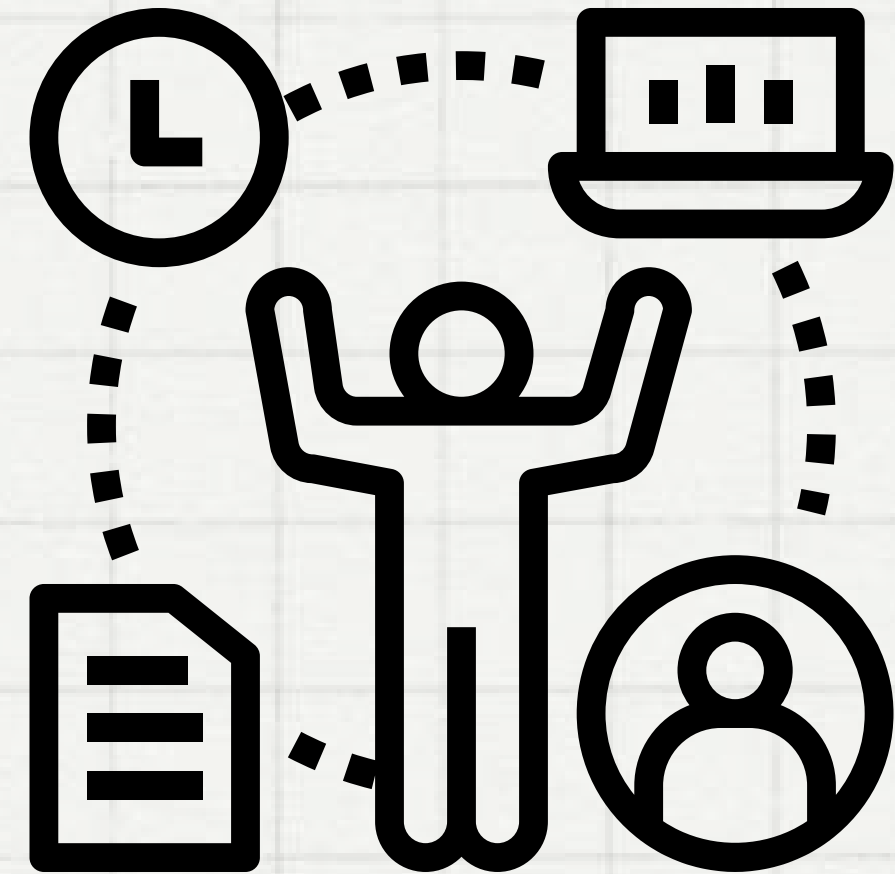
- Google scholar
- arXiv
- Paper scape
- Web of Science





Other useful resources

- Academic phrase bank
- Grammarly
- chat GPT
- <https://notebooklm.google/>



✧ Is it OK for AI to help writing science papers?

nature

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NEWS FEATURE | 14 May 2025

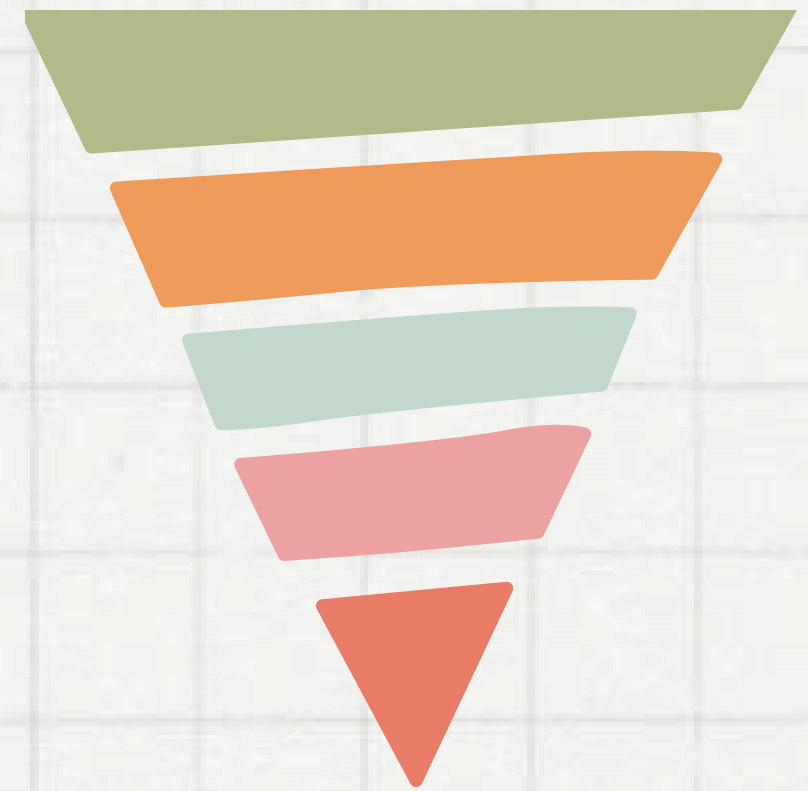
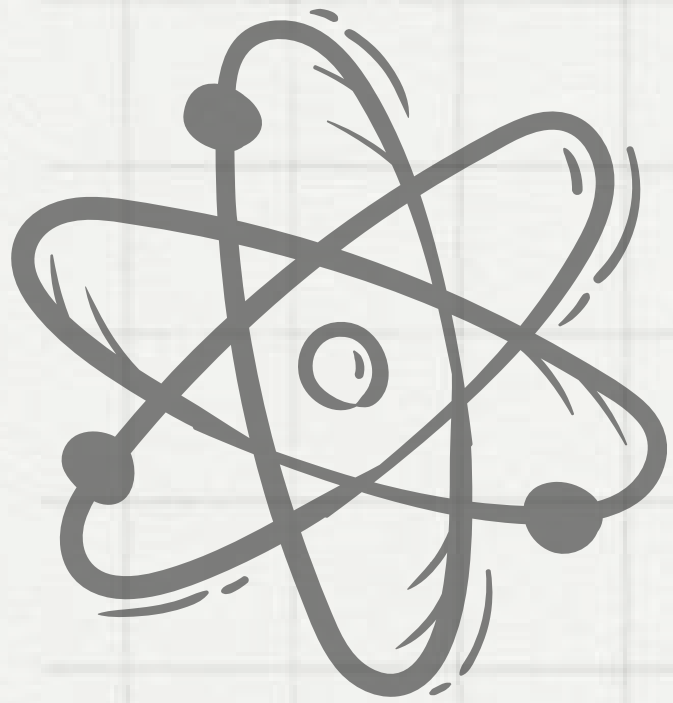
Is it OK for AI to write science papers? *Nature* survey shows researchers are split

Poll of 5,000 researchers finds contrasting views on when it's acceptable to involve AI and what needs to be disclosed.

By [Diana Kwon](#)

$$E=mc^2$$

Structure of a Scientific Paper



Title, Abstract, and Keywords:

PHYSICAL REVIEW LETTERS **125**, 093603 (2020)

Deterministic Generation of Large Fock States

M. Uria¹,[✉] P. Solano,^{2,3} and C. Hermann-Avigliano^{1,*}

¹*Departamento de Física and Millennium Institute for Research in Optics (MIRO), Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, Santiago 8370448, Chile*

²*Department of Physics, MIT-Harvard Center for Ultracold Atoms, and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA*

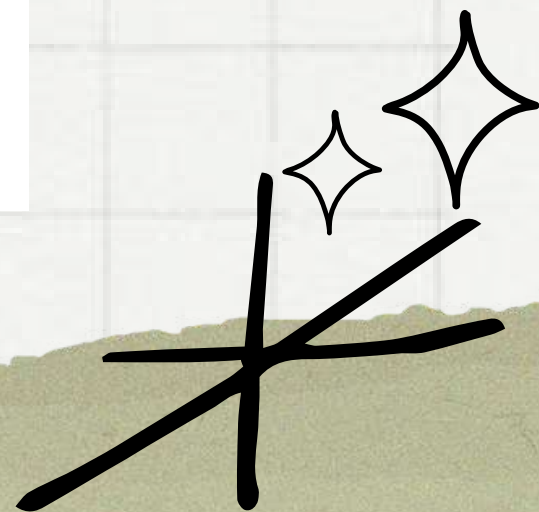
³*Departamento de Física, Facultad de Ciencias Físicas y Matemáticas, Universidad de Concepción, Concepción 160-C, Chile*



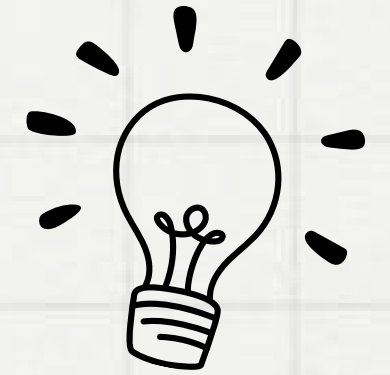
(Received 10 March 2020; accepted 4 August 2020; published 28 August 2020)

We present a protocol to deterministically prepare the electromagnetic field in a large photon number state. The field starts in a coherent state and, through resonant interaction with one or few two-level systems, it evolves into a coherently displaced Fock state without any postselection. We show the feasibility of the scheme under realistic parameters. The presented method opens a door to reach Fock states, with $n \sim 100$ and optimal fidelities above 70%, blurring the line between macroscopic and quantum states of the field.

DOI: [10.1103/PhysRevLett.125.093603](https://doi.org/10.1103/PhysRevLett.125.093603)



Title



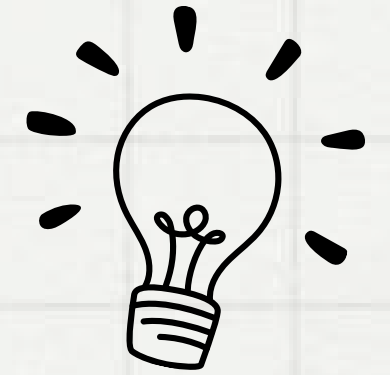
Purpose: The title provides the first impression of your research. It's the primary way readers decide if they should delve deeper into your work.

Importance:

1. **Grabbing Attention:** A compelling title can engage potential readers, inviting them to learn more.
2. **Conveying Content:** It should offer a snapshot of the research's main theme.

Often people read only the title, abstract and figures!

Title

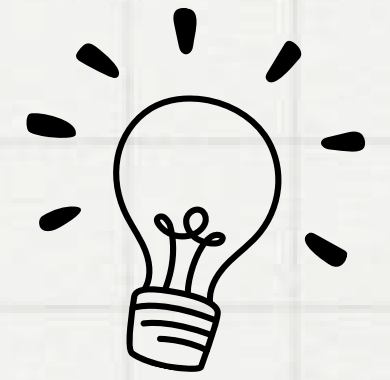


Tips for Crafting a Compelling Title:

- **Be Clear and Concise:** Avoid jargon and ensure that researchers outside of your niche can understand the topic.
- **Make It Informative:** The title should give insight into the research's main findings or methodology.
- **Keep It Engaging:** While clarity is key, a touch of creativity can make your title stand out.

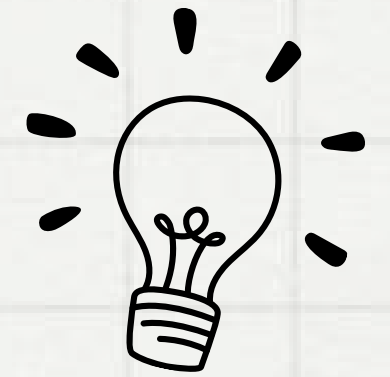
Avoid Sensationalism!

the Title, abstract...



the paper

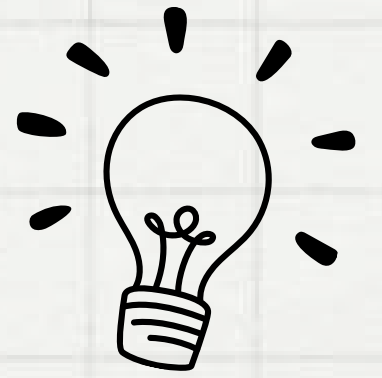
Abstract



- **Purpose:** The abstract provides a brief summary of the entire research paper, including somehow the problem, methodology, results, and conclusions.
- **Importance:**
 - a. **First Glimpse:** Readers often scan the abstract to decide if they should read the full paper.
 - b. **Research Navigation:** Helps researchers determine the paper's relevance to their own work.

The most important take home message that you want to highlight should be here!

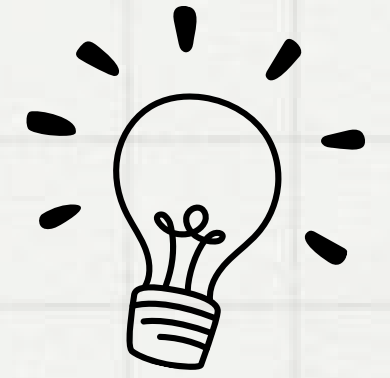
Abstract



Tips for Writing an Effective Abstract:

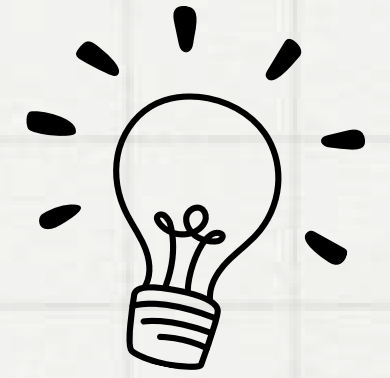
1. **Stay Within Word Limit:** Typically, journals have a word limit for abstracts. Ensure your content fits within this, while remaining clear.
2. **Highlight Key Points:** Summarize the problem, methodology, major results, and main conclusions.
3. **Avoid Unnecessary Details:** Don't delve into deep specifics, especially in methodology. Think on your take home message!
4. **Write Clearly:** Ensure that a broader audience, not just specialists in your field, can understand the abstract (depends on the journal).

Organizing ideas



1. Broad Problem – What it is about
2. Narrow Problem – What needs to be solved
3. Central Message – What your contribution is
4. Key Findings – What your results are
5. Key Implications – Why they matter / what their implications are

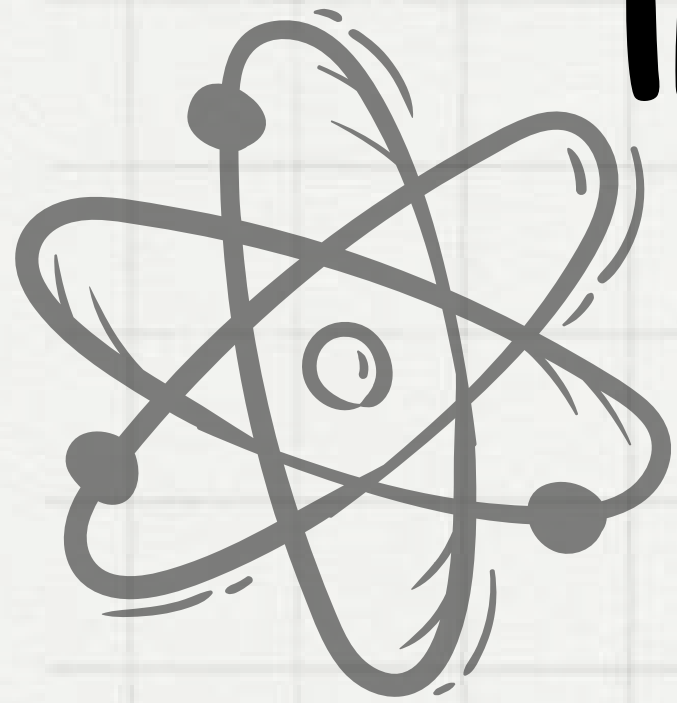
Key words



- **Purpose:** Keywords are specific words or phrases that **encapsulate the primary themes** of your paper.
- **Importance:**
 - a. **Searchability:** In digital databases, keywords ensure that your paper appears in relevant searches.
 - b. **Discoverability:** Proper keywords help your paper reach a wider audience and increase its citations.
 - c. **Help referrers to accept or not to review your work!**

$$E = m \cdot c^2$$

Structure of a Scientific Paper



IMRAD(c) →

Introduction

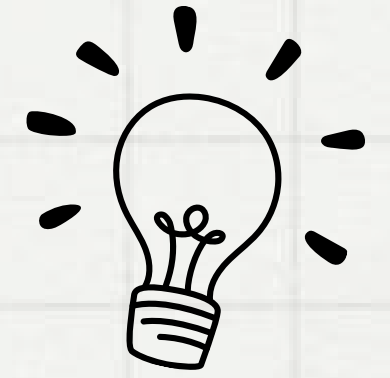
Methods

Results

Discussion

Conclusions

Introduction



Purpose: Introduces the background and context of the research.

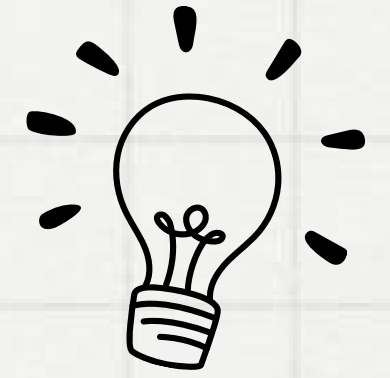


From the most general



... to the most specific

Introduction

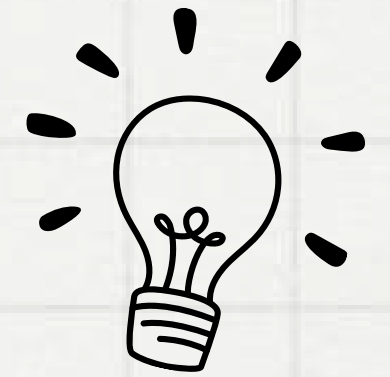


Components:

- **Background:** Overview of existing literature or the current state of the topic.
- **Problem Statement:** Identifies gaps or issues in the current knowledge.
- **Objective:** Clearly states the purpose of the study or the research question being addressed.

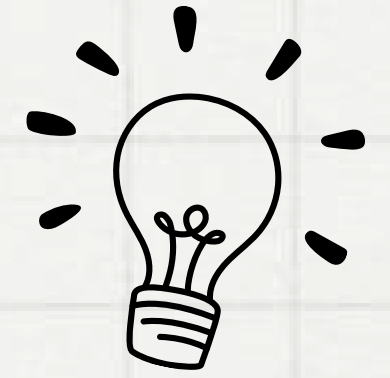
Guidance: Be concise, avoiding overly technical jargon. Establish the relevance of your research to engage your audience

and again...



1. Broad Problem – What it's about
2. Narrow Problem – What needs to be solved
3. Central Message – What your contribution is
4. Key Findings – What your results are
5. Key Implications – Why they matter / what their implications are

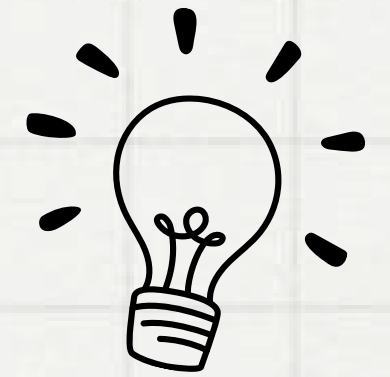
Introduction



Tip:

The introduction summarizes the state of the art and gives the context of why this research is relevant and worth publishing

Methodology



Purpose: Describes how the research was conducted.

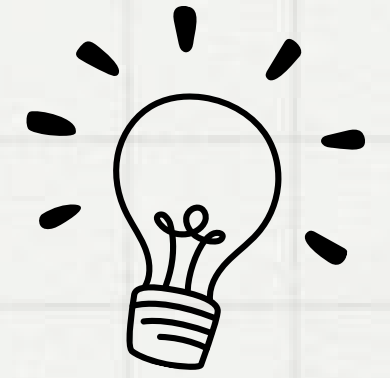


From the
known



... to the
unknown and
new

Methodology

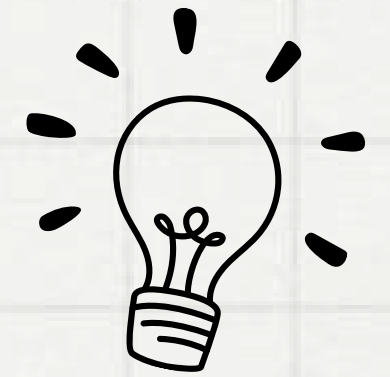


Components:

- **Participants/Subjects:** Details about the study group or sample.
- **Equipment/Tools:** Instruments or tools used in the research.
- **Procedure:** Step-by-step process of the study.
- **Data Analysis (not the discussion!):** How data was processed and analyzed.

Guidance: Ensure clarity, as this section allows others to replicate your study. Avoid unnecessary details (**keep the flow flowing!**), but provide enough information for reproducibility.

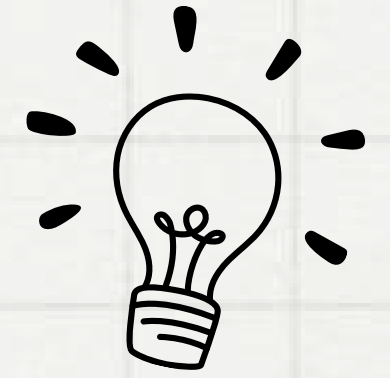
Methodology



Tip:

It's like the recipe of the article:
you have to give everything so
that the results can be
replicated and verified.
It should not read too heavy, (use
the appendices).

Results



Purpose: Presents the findings of the research.

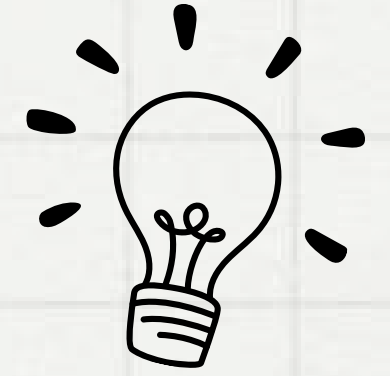


They must be presented clearly



Consider people's disabilities and black and white printed!

Results

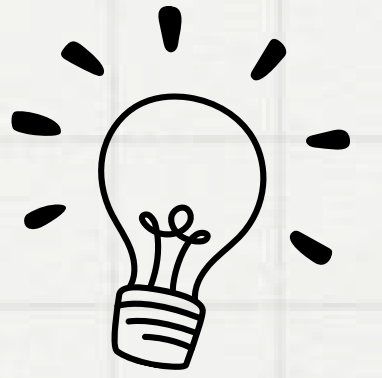


Components:

- **Data Presentation:** Using figures, tables, and descriptive text.
- **Statistical Analysis:** Details of statistical tests and results.

Guidance: Be objective. Present the results as they are without inferring meanings or reasons. Visual aids like graphs and tables can be effective but ensure they are clear and well-labeled.

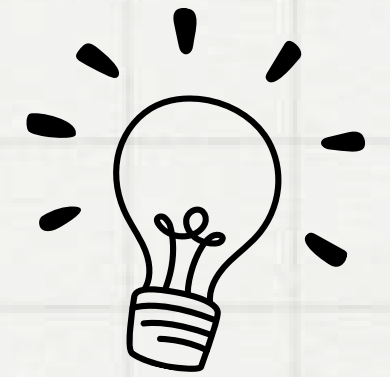
Results



Tip:

Data in figures are the most relevant part of the paper! Many people read only the title, abstracts and figures. The caption must be self-contained.

Discussion



Purpose: Interprets the results and places them in the context of existing knowledge.

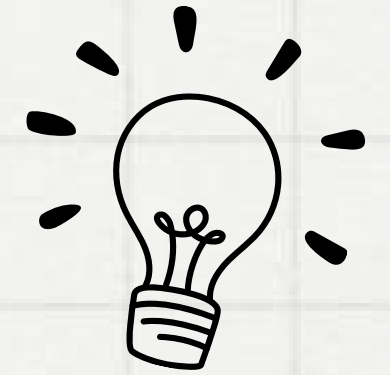


Encompass
what is
already
known



explain how the
new is
understood

Discussion

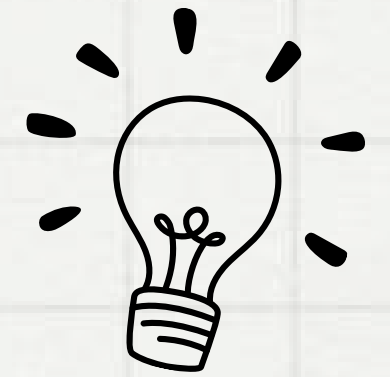


Components:

- **Interpretation:** Explains the implications of the results.
- **Comparison:** Relates findings to previous research.
- **Limitations:** Acknowledges any shortcomings of the study.
- **Recommendations:** Suggests further research or practical implications.

Guidance: While interpretations and opinions are allowed, they should be based on the results. **Be cautious about overgeneralizing or making unsupported claims, and be careful with the word “analogous”.**

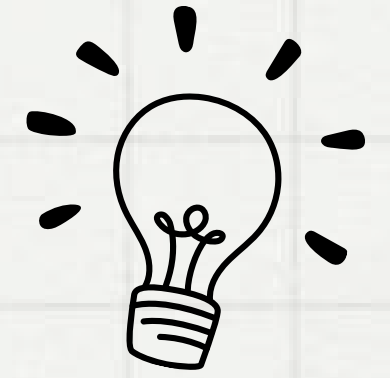
Discussion



Tip:

To understand the new, it is necessary to encompass the old, to show how our findings reduce to the old, where the new and the old differ, what is the new that is learned, and the relevance!

Conclusions



Purpose: it ties together the various threads of the research, summarizing the main findings and discussing their significance within the broader context of physics.

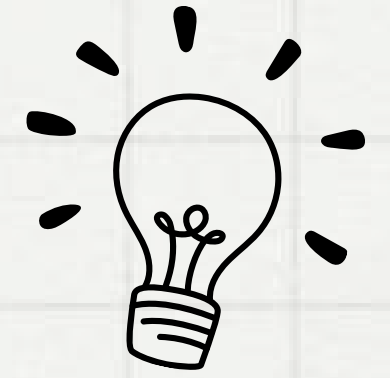


highlights the take home message



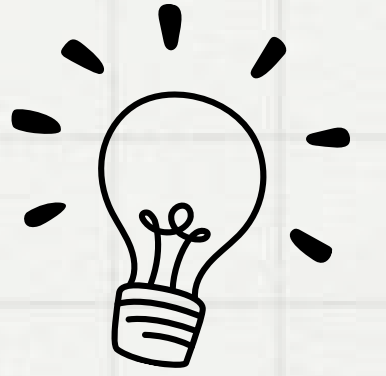
show the doors that are opened with your findings

Conclusions



- **Synthesizing Key Findings:** After presenting data and discussing it, the conclusion serves to remind readers of the main results and their importance.
- **Broader Implications:** Physics often deals with fundamental truths about the universe. A conclusion can discuss how a new finding fits within the existing knowledge or reshapes our understanding.
- **Direction for Future Work: Physics is ever-evolving.** Conclusions often hint at or explicitly suggest avenues for future research, be it experimental, theoretical, or applied.

Conclusions

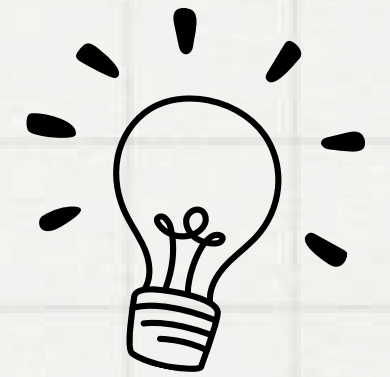


Tip:

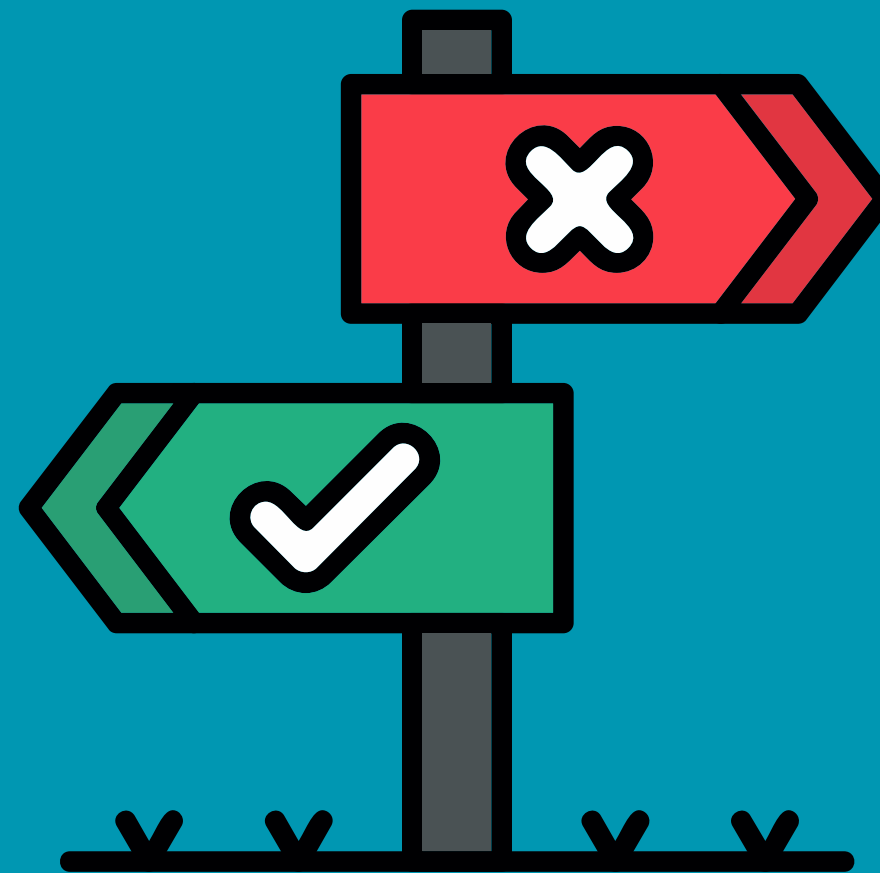
Conclusion should always goes
back to the beginning!

Make sure that the most
important message of the paper is
highlighted, and show how this
expands the horizon of knowledge.

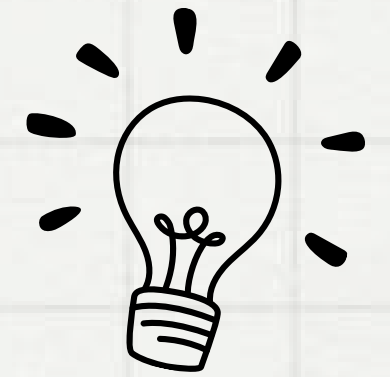
Ethical Considerations



Purpose: To ensure the integrity, honesty, and responsibility of researchers when conducting and publishing their work.



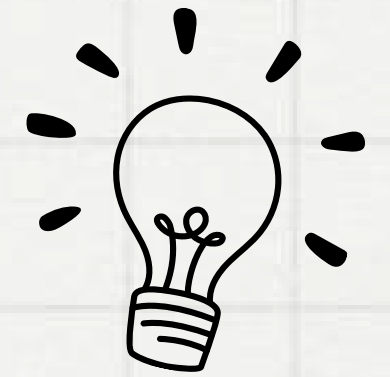
Ethical Considerations



Key Ethical Considerations:

- **Data Integrity and Authenticity:** Avoid fabricating, falsifying, or modifying data. Represent data as collected, and acknowledge its limitations (**do not cheat!**).
- **Authorship:** Grant authorship only to individuals who have made significant contributions to the research. Also, **acknowledge** contributors who don't meet the criteria for authorship.
- **Plagiarism:** Always credit original sources. Never present someone else's work as your own.

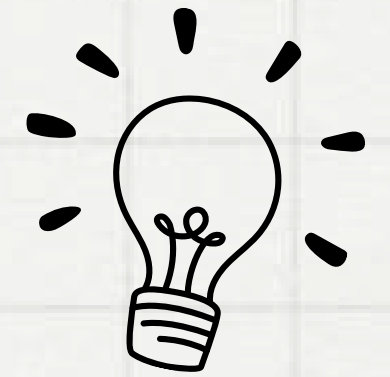
Ethical Considerations



Key Ethical Considerations:

- **Duplicate Publication:** Avoid publishing the same research in multiple journals without proper citation or indication.
- **Conflict of Interest:** Declare any financial, personal, or other relationships that could bias your research.
- **Treatment of Subjects:** If your research involves human or animal subjects, ensure their humane treatment and obtain necessary permissions.

Ethical Considerations

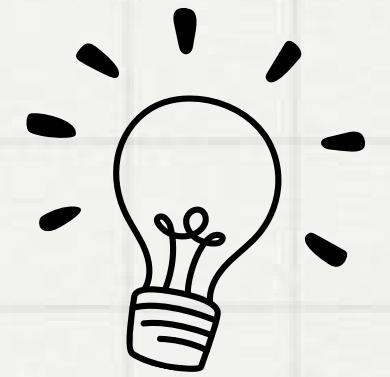


Key Ethical Considerations:

- **Mental health of the team:** think about the training role. We cannot take advantage of the people who work **WITH us (and not FOR us)**. We must serve them and help in their development.

Everyone should learn about healthy
Leadership

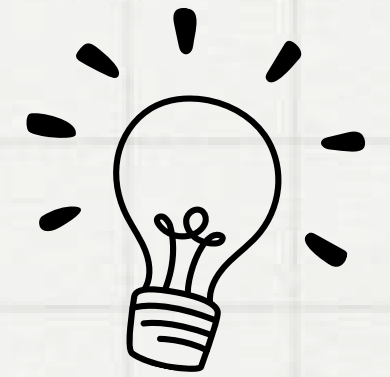
Ethical Considerations



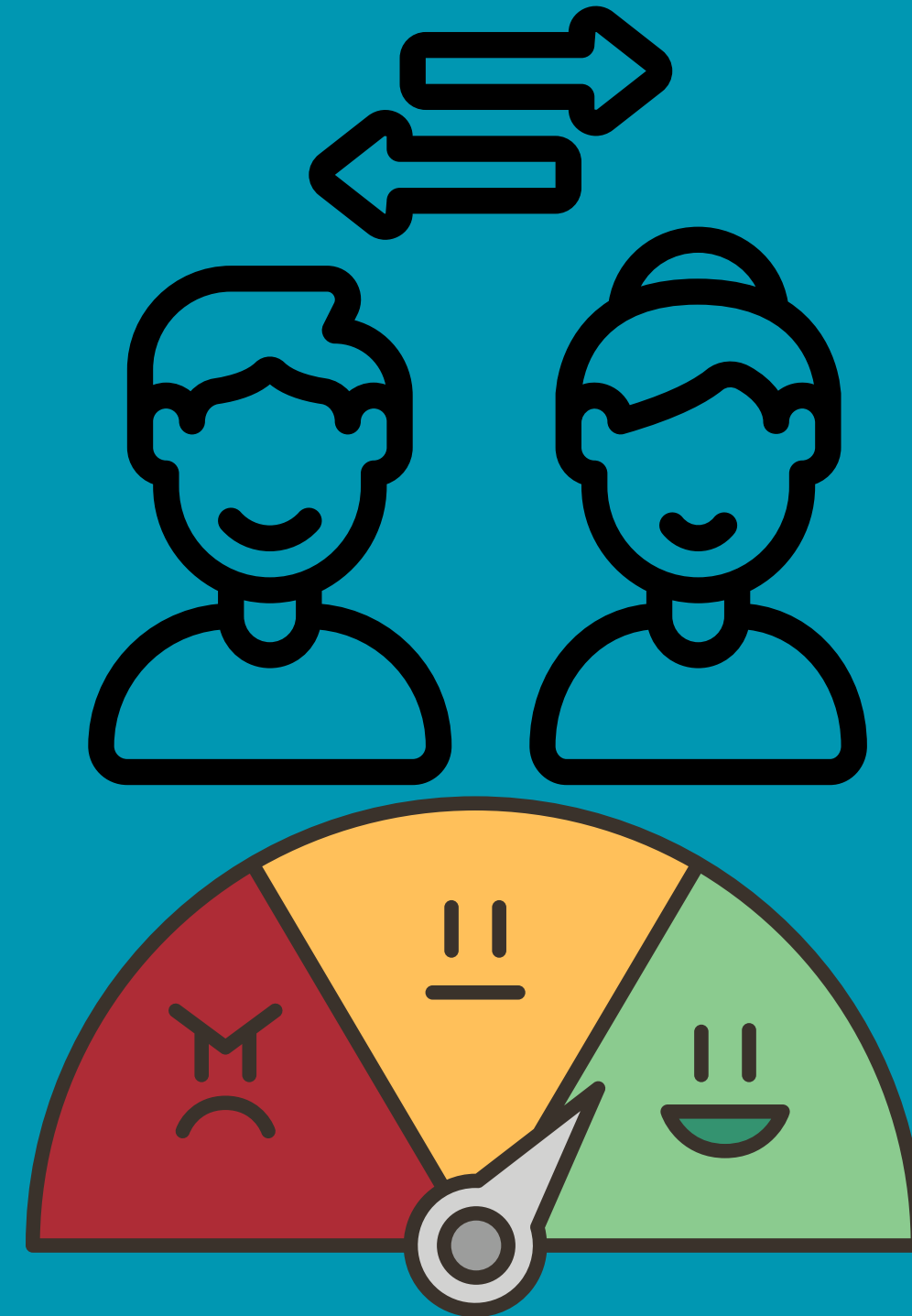
Tip:

Think about the common good and the training process.

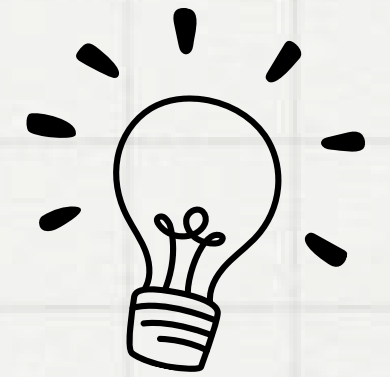
The Peer Review Process



Purpose: To evaluate and validate the quality, validity, and relevance of scientific papers before they are published



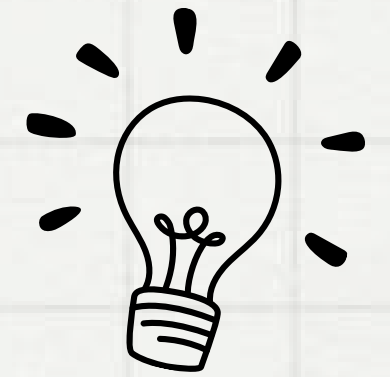
The Peer Review Process



Importance:

1. **Quality Control:** Peer review ensures the work meets the scientific community's standards.
2. **Credibility:** A peer-reviewed paper has undergone evaluation by experts in the field, lending it credibility.
3. **Feedback for Improvement:** Reviewers often provide constructive feedback, helping authors improve their work.

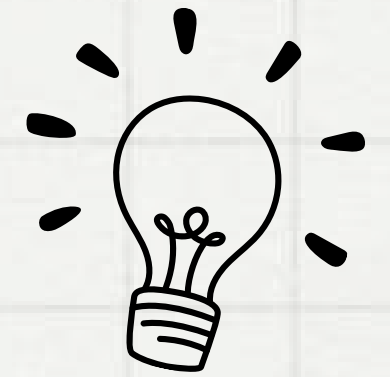
The Peer Review Process



Stages of Peer Review:

1. **Submission:** The researcher submits the paper to a journal.
2. **Preliminary Check:** The journal's editorial team checks the paper's format, scope, and basic quality.
3. **Reviewer Selection:** Editors select experts in the field to review the paper.
4. **Review:** Reviewers evaluate the paper's methodology, results, and conclusions. They recommend acceptance, revisions, or rejection.
5. **Decision:** Based on reviewers' feedback, the editor decides the paper's fate.
6. **Revision & Resubmission:** If required, authors revise their paper and resubmit. This can happen multiple times.
7. **Publication:** Once approved, the paper is published in the journal.

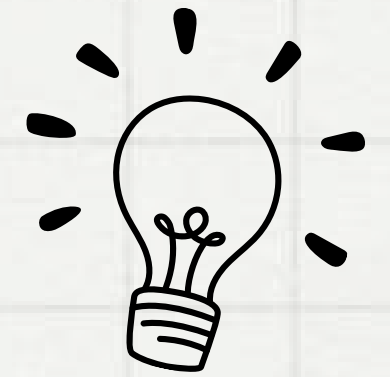
The Peer Review Process



Ethical Considerations in Peer Review:

1. **Impartiality:** Reviewers should assess a paper based on its scientific merit, free from personal or professional bias.
2. **Confidentiality:** Reviewers must treat manuscripts as confidential documents.
3. **Timeliness:** Reviewers should complete their evaluations promptly.
4. **Conflict of Interest:** If reviewers have any potential conflicts of interest (e.g., they're working on similar research), they should recuse themselves.
5. **Constructive Feedback:** Reviews should be constructive, offering clear feedback to help authors improve.

The Peer Review Process

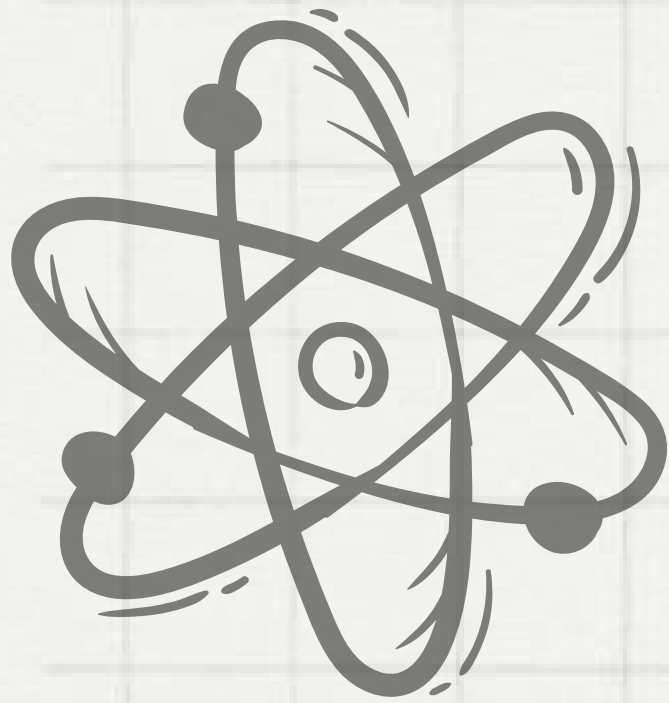


Tip:

Try to see the good! Notice how your feedback can actually help improve someone else's work.

$$E = m \cdot c^2$$

Questions?

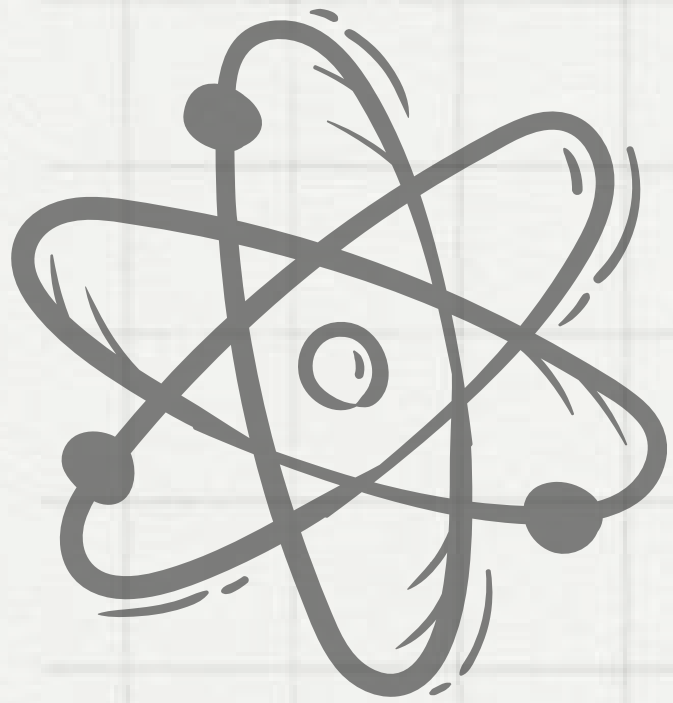


Flash talks

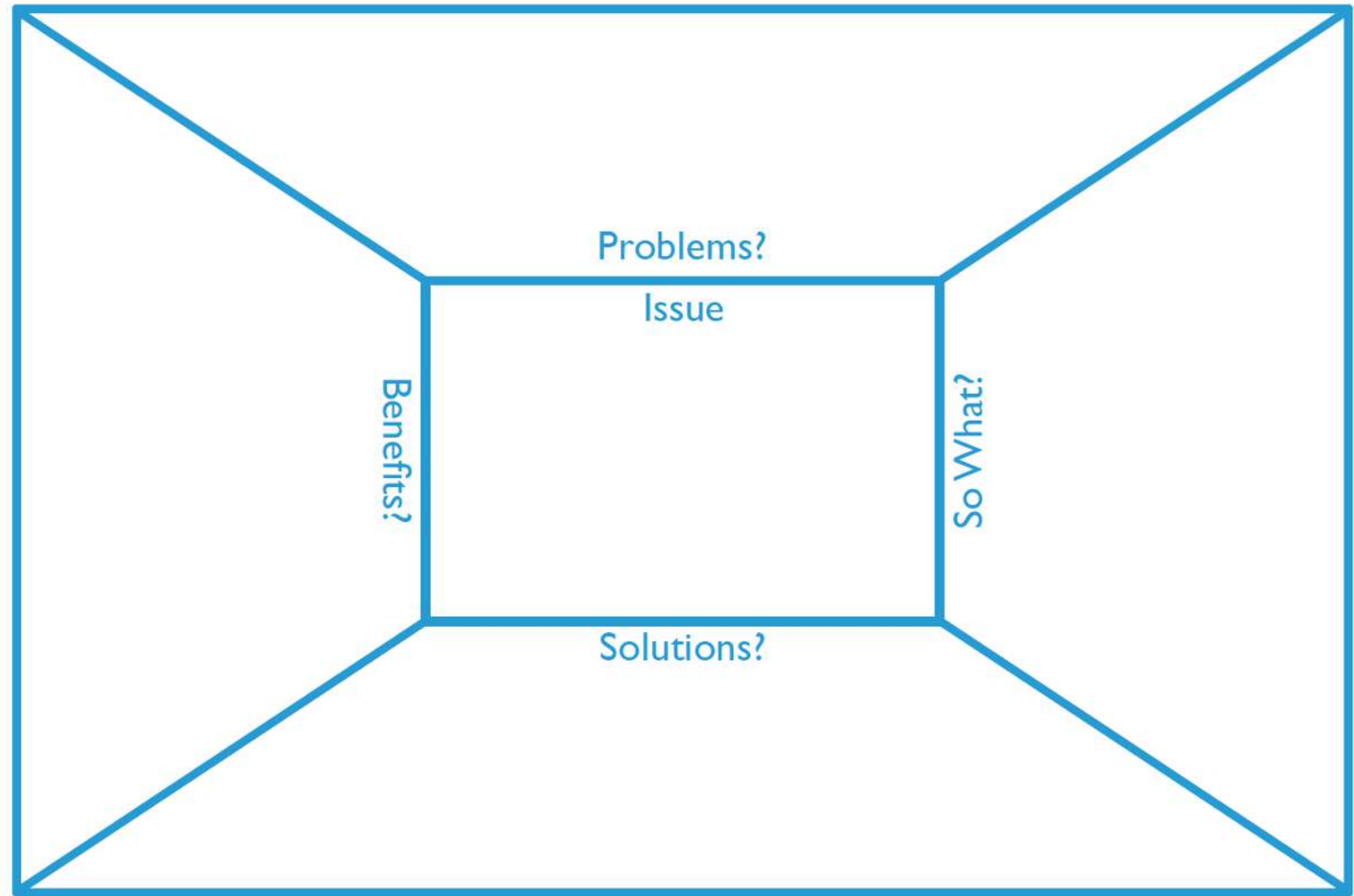
Work on 3 minutes
presentations and present
your work tomorrow!

Know your audience

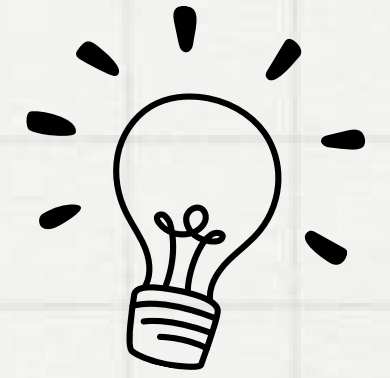
$$E=m.c^2$$



Audience:

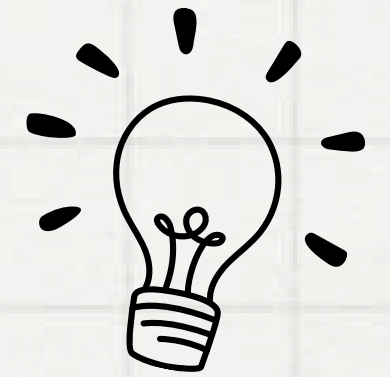


creating value



- Acknowledge the reader community: **“I know what you think...”**
- Show the conflict/challenge/problem: **“...and you are wrong...”**
- Show the cost/benefit of (not) solving the issue: **“...and that’s why it should matter to you.”**
- Use a triangular structure to tell the story.

Tips for presenting ideas



1. Broad Problem – What it's about
2. Narrow Problem – What needs to be solved
3. Central Message – What your contribution is
4. Key Findings – What your results are
5. Key Implications – Why they matter / what their implications are

$$E = m \cdot c^2$$

Oral communication

- **Throughline**
- **Adjust** message to the audience
- **Voice, body, rhythm, movement**
- **High-impact slides:** minimal, well-chosen information, you need to know your graphics!
- **Practice efficiently + prepare Q&A**

