



MIRO
Millennium Institute for
Research in Optics

Hands on
**Science
communication**

Carla Hermann Avigliano
IV School on Light and Cold Atoms 2025



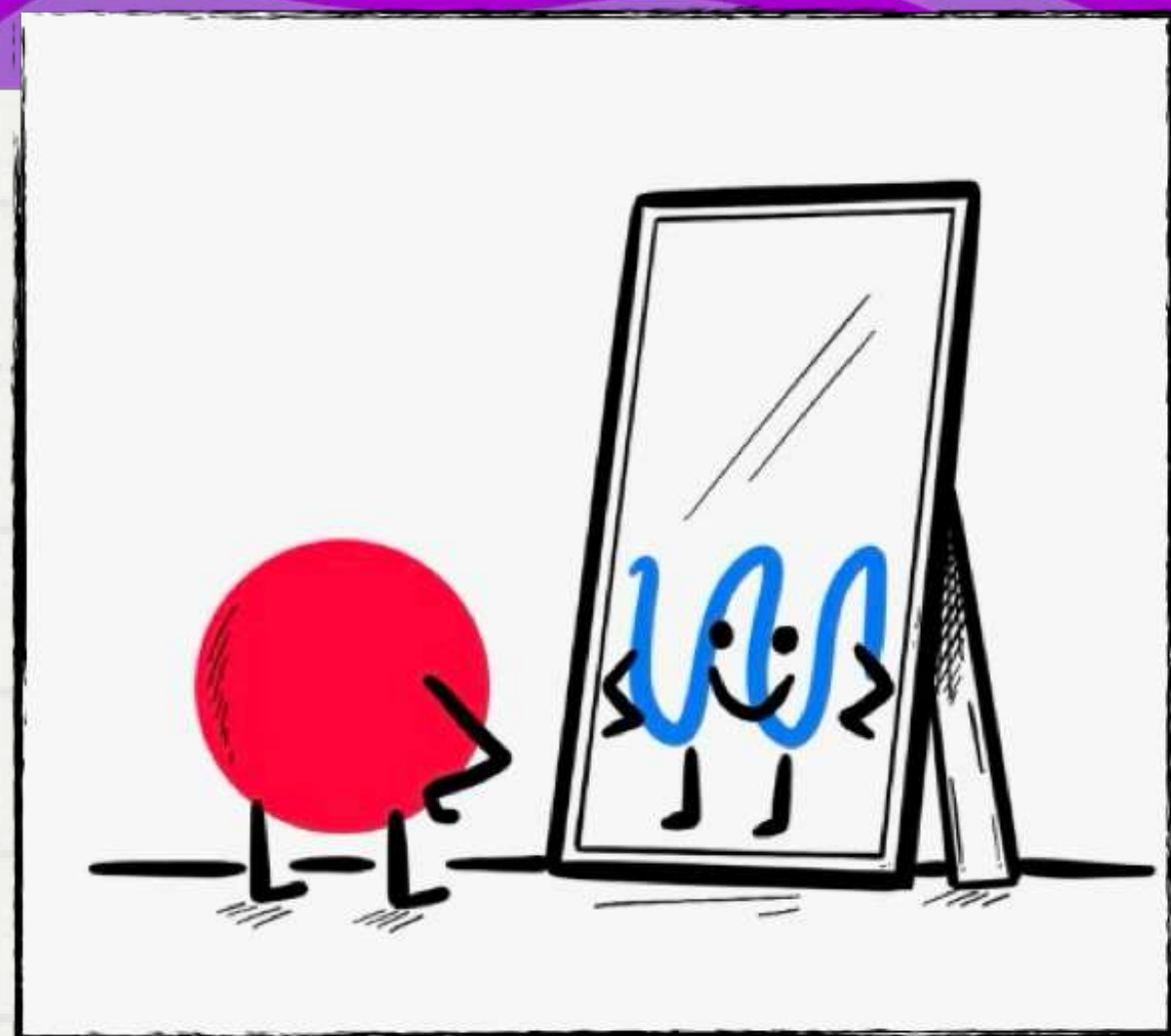
Professor/researcher



"Academic influencer"



Let's Get PHYSICAL



CUÁNTICA ASOMBROSA
 DRA CARLA HERMANN AVIGUANO 30 OCT 2023
 MÁS ALLÁ DE LA CIENCIA FICCIÓN CÍCLO CHARLAS SOPHIA

LAS GRANDES REVOLUCIONES CIENTÍFICAS NALEN DE...
PENSAR lo IMPENSABLE
CUESTIONARSE
 LA REALIDAD ES DINÁMICA

¿CÓMO OBSERVAMOS EL UNIVERSO?
 ¿QUÉ PASA SI...?
 LOS SENTIDOS INFLUYEN EN LA PERCEPCIÓN DE LA REALIDAD

ATREVERSE A PENSAR DIFERENTE
 SU MECÁNICA MODIFICABA NUESTRO MUNDO
NEWTON
HELIOCENTRISMO

ELECTROMAGNETISMO
 HASTA 1800 LA ELECTRICIDAD Y EL MAGNETISMO SE DESARROLLARON DE MANERA INDEPENDIENTE

LA LUZ REVELA TODO
EINSTEIN
 POSTULA LA TEORÍA DE LA RELATIVIDAD ESPECIAL Y GENERAL

DUALIDAD ONDA-PARTÍCULA
SON REALES AL MISMO TIEMPO
 LA LUZ ES ONDA Y PARTÍCULA AL MISMO TIEMPO

CUÁNTICA
AL MEDIR CAMBIAMOS LA REALIDAD
EL FOTÓN SABE QUE LO MIRAMOS!

1 SUPERPOSICIÓN

$$|a\rangle + |b\rangle$$

 FUNDAMENTAL EN COMPUTACIÓN E INFORMACIÓN CUÁNTICA

2 ENTRELAZAMIENTO
CHILE TIENE POTENCIAL DE UNIRSE AL DESAFO
 REQUIERE INVERSIÓN POLÍTICA, INTEGRACIÓN CON OTRAS DISCIPLINAS

3 PRINCIPIO DE INCERTEZA

$$\Delta x \Delta p \geq \frac{\hbar}{2}$$

 LÍMITE FUNDAMENTAL EN LA PRECISIÓN AL MEDIR

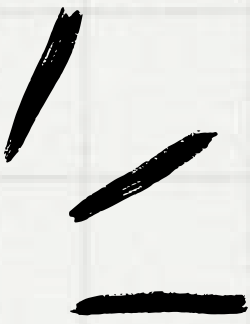
LAS GRANDES POTENCIAS ESTÁN PREPARÁNDOSE PARA EL Q-DAY
 2022 BIDEN FIRMA EL QUANTUM LAW
 CHINA 176 QUBIT COMUNICACIÓN CUÁNTICA

¿CÓMO CONECTAR CIENCIA-INDUSTRIA?
DEBEMOS GENERAR DIÁLOGOS
 PRIVADO-PÚBLICO ACADÉMICO

REGISTRO CUÁNTICO APROX. MEC. HERMANN - KESCHENDEL



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



C. Hermann

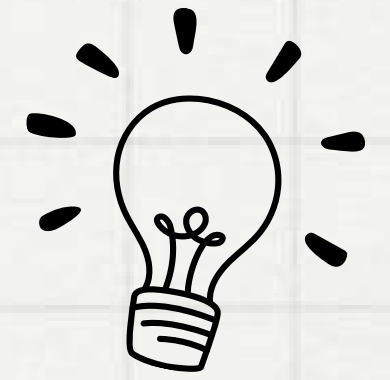


**"Science is
done in broken
English"**



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

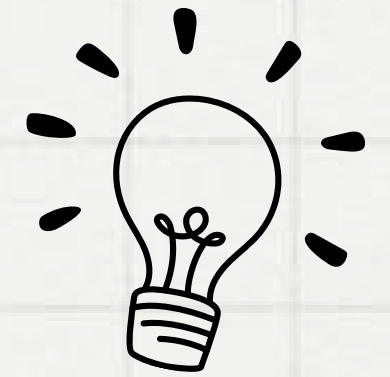
Overview of the importance of scientific communication.



Definition and Purpose:

- Scientific communication refers to the **sharing of research findings**, methodologies, and theories within the scientific community and to the broader public.
- It serves as the foundation for advancing science, as new discoveries are built upon previous research.

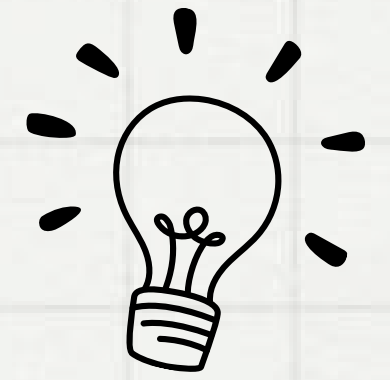
Clear and Effective communication



Avoiding Misinterpretation:

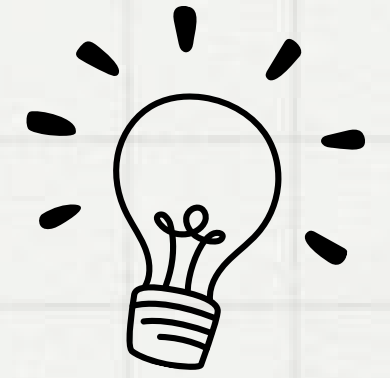
- Ambiguous communication (writing/oral) can lead to **misunderstandings and misinterpretations**. Clear communication ensures that research findings are understood as intended, maintaining the integrity of the results.
- Clear communication also means using the **right words — not hype**
- **Avoid sensationalism**

Sensationalism in Science



- Sensationalism: The act of **presenting news or information in a way that provokes strong interest** or excitement, **often at the expense of accuracy or truth.**
- Highlighting the current age of rapid information dissemination, where attention-grabbing headlines can **become viral.**

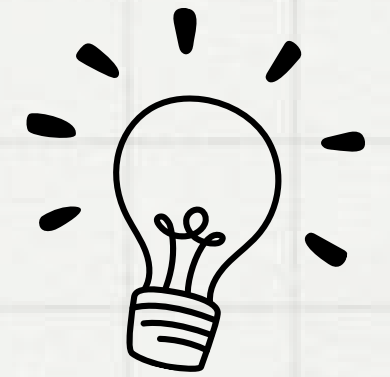
Sensationalism in Science



The Impact of Sensationalism on Scientific Discoveries:

- **Misrepresentation:** How exaggerated claims can distort the actual findings of a study.
- **Public Mistrust:** When sensationalized news is debunked, it can lead to a lack of trust in genuine scientific discoveries.
- **Hindered Progress:** Overhyped results can misguide research priorities and funding allocations.

Sensationalism in Science



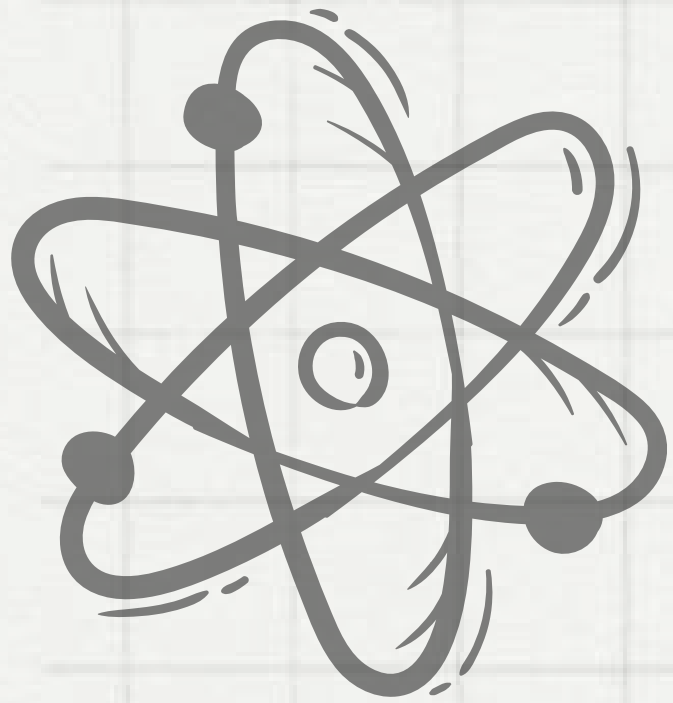
The Importance of Accurate Science Communication:

- While sensationalism may grab attention in the short term, **accurate and clear communication benefits society in the long run**. It upholds the integrity of science and fosters an informed public.
- In the long term we **truly help educating the community**

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

Part 1:

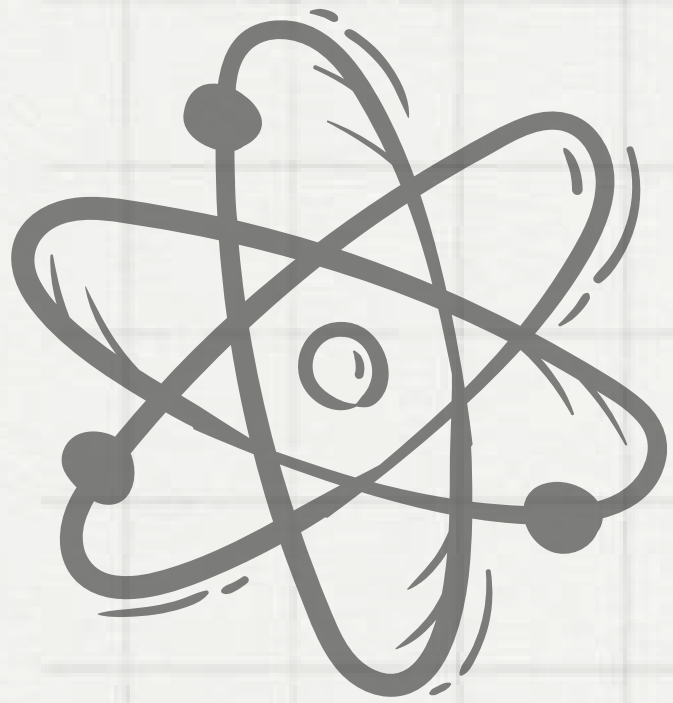
Writing to Communicate Science



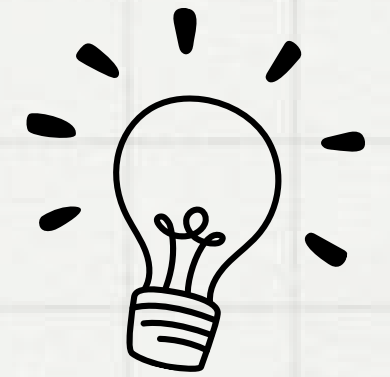
$$E=m.c^2$$

Ideas about writing that are good to get rid of:

- Writing is a basic skill
- You learn to write in school or university
- You write to communicate your ideas/thoughts

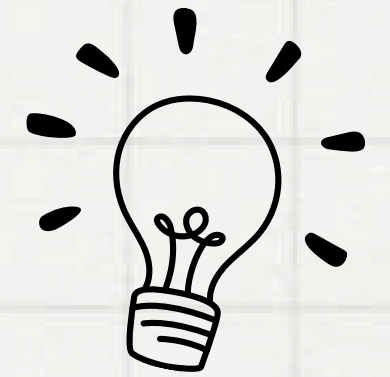


Characteristics of good writing



- Organized / clear
- Persuasive
- Valuable

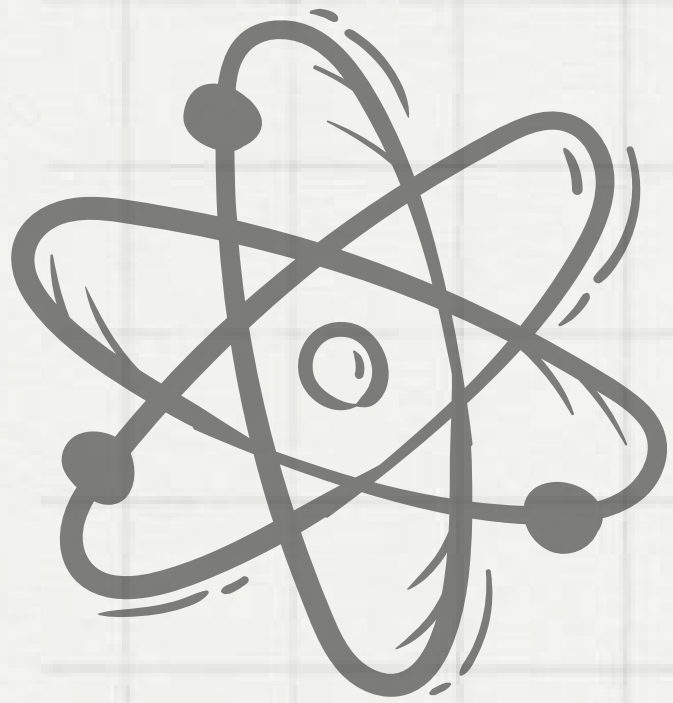
Bad practices



- Using writing only to help ourselves think
- Just describing your work

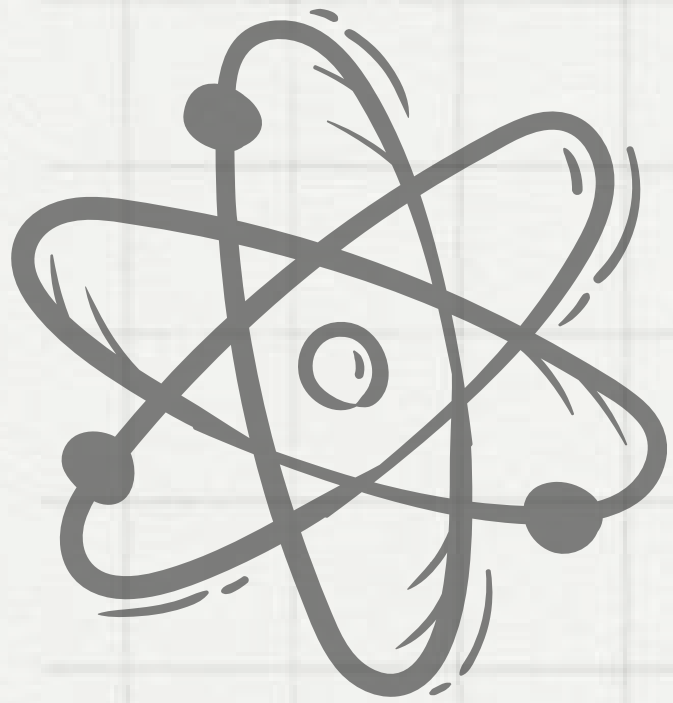
$$E=mc^2$$

General scientific writing

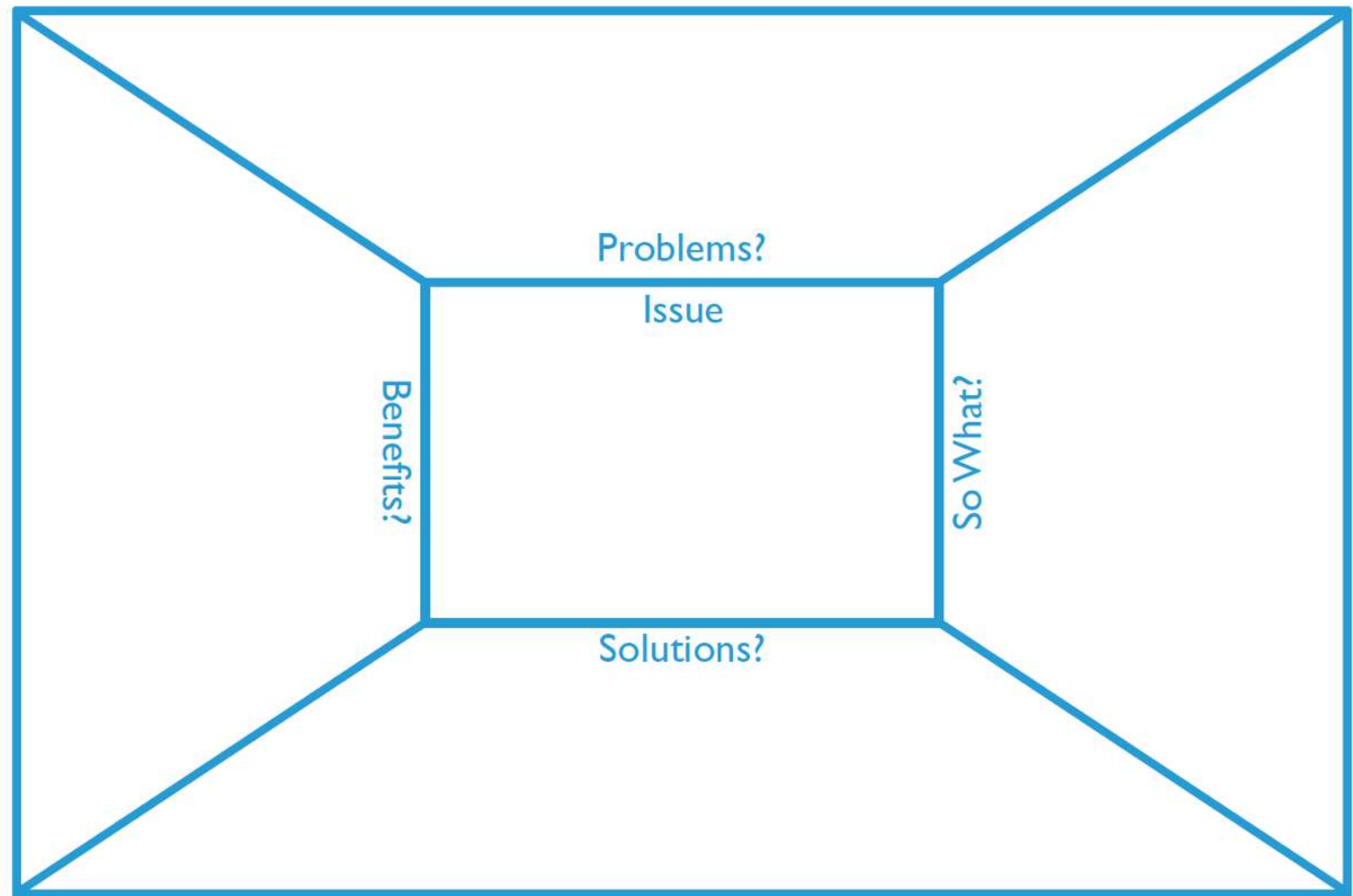


Know your audience

$$E=m.c^2$$



Audience:



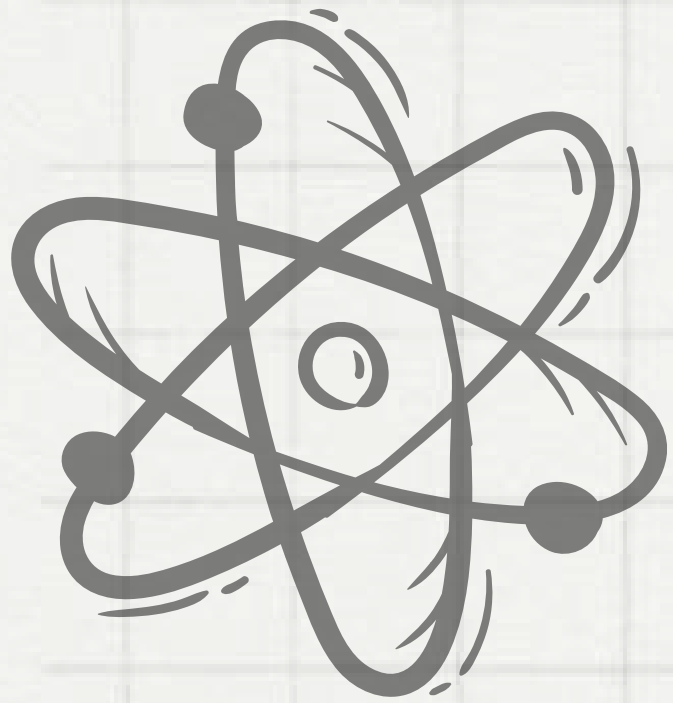
Tips for “creating value”

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

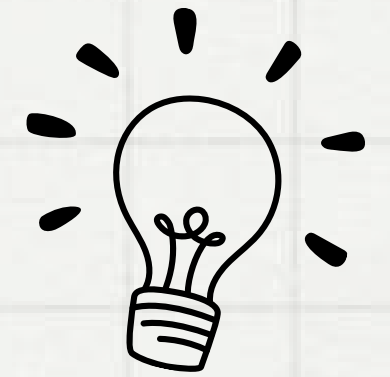
No matter where the reader stops reading, they should walk away with a clear idea of your work.

$$E=mc^2$$

Scientific writing for papers

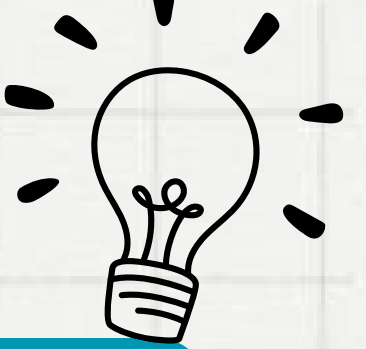


Tips for presenting ideas



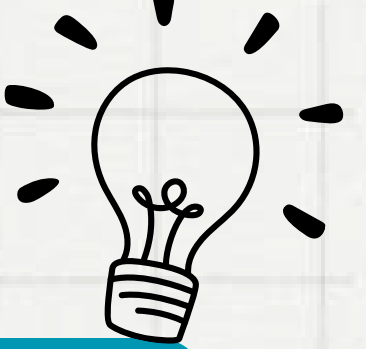
1. Broad Problem – What it's about
2. Narrow Problem – What needs to be solved
3. Central Message – What your contribution is
4. Key Findings – What your results are
5. Key Implications – Why they matter / what their implications are

Tips for writing concisely



- Keep sentences short: one sentence, one idea.
- Eliminate unnecessary words: focus on what truly adds value.
- Avoid jargon: choose simple, precise language your readers will understand.
- Use consistent terminology: don't change terms for the same concept.
- Avoid redundancy: don't repeat information the reader already knows.

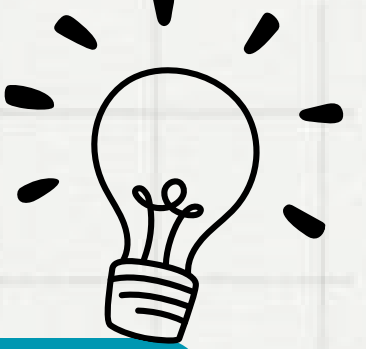
Tips for writing concisely



- Prefer verbs over nouns: “we analyzed” is clearer than “an analysis was performed.”
- Limit transitions: use connectors only when they improve flow.
- Read aloud for clarity: if it sounds tangled, hard to say, it probably reads that way too.

The flow of reading takes priority over everything else!

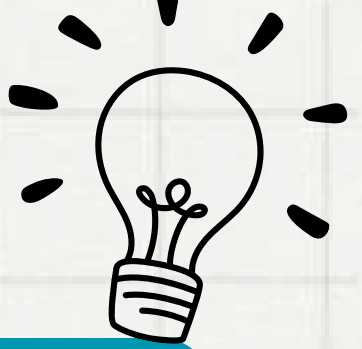
Formatting Guidelines



- Write in active voice (not passive).
- Write in first-person plural (we).
- Use present tense for general statements or ongoing work.
- Write results in past tense.
- Use future tense in the outlook or discussion of future work.

The flow of reading takes priority over everything else!

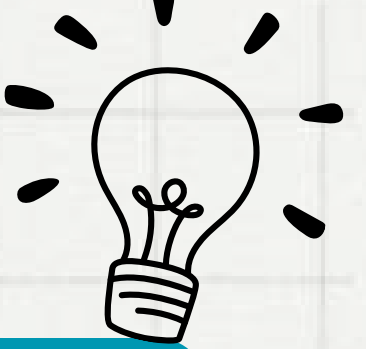
Tips for Structuring a Paragraph



- Each paragraph should have one central idea.
- Aim for 100–200 words per paragraph.
- The first and last sentences are the most important.
- Ensure logical flow: move from old (known) information to new information.

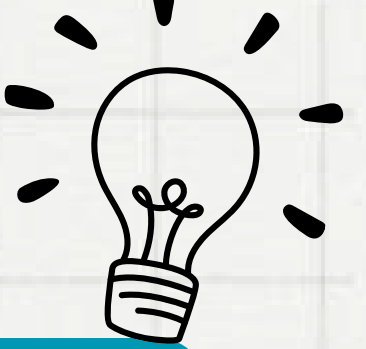
The flow of reading takes priority over everything else!

Tips for Editing



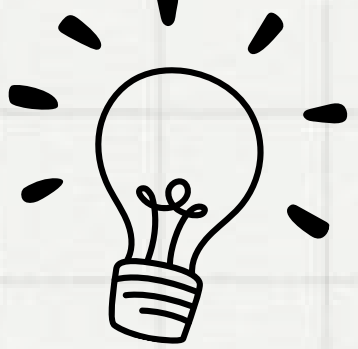
- *“The first draft of anything is shit.”* — Ernest Hemingway
- *“The most essential gift for a good writer is a built-in shit detector.”* — Ernest Hemingway
- Leave time between writing and editing: distance gives perspective.
- Change the format: switch fonts, colors, or print it out to see it with fresh eyes.
- Ask for feedback: another reader will spot what you’ve missed.

Words to Avoid



- Too informal: contractions (isn't, don't), a bit / a lot, kind of / sort of.
- Too vague: things, stuff, a while, and so on.
- Too exaggerated: always, never, must, really, so, super, novel, new.
- Too subjective: obviously, straightforward, and adjectives in general that express opinion rather than fact.
- Overused intensifiers: very, extremely, highly.

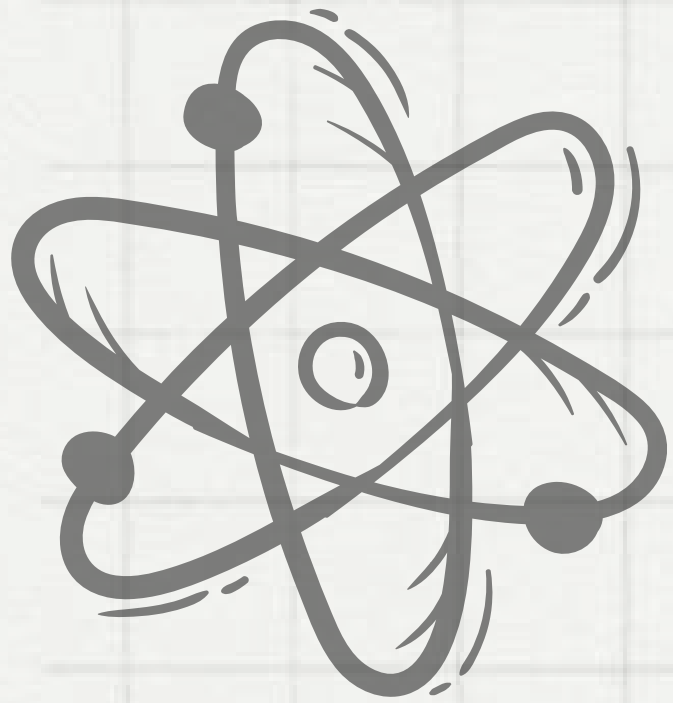
WORDS TO USE INSTEAD OF "VERY" -1



✗ Very bad	✓ Awful	✗ Very good	✓ Excellent
✗ Very smart	✓ Intelligent	✗ Very stupid	✓ Idiotic
✗ Very sad	✓ Sorrowful	✗ Very happy	✓ Ecstatic
✗ Very upset	✓ Distraught	✗ Very exciting	✓ Exhilarating
✗ Very cold	✓ Freezing	✗ Very warm	✓ Hot
✗ Very strong	✓ Forceful	✗ Very weak	✓ Frail
✗ Very bright	✓ Luminous	✗ Very hungry	✓ Starving
✗ Very busy	✓ Swamped	✗ Very hurt	✓ Battered
✗ Very careful	✓ Cautious	✗ Very large	✓ Huge
✗ Very clear	✓ Obvious	✗ Very lazy	✓ Indolent
✗ Very colorful	✓ Vibrant	✗ Very long	✓ Extensive
✗ Very confused	✓ Perplexed	✗ Very loose	✓ Slack
✗ Very mean	✓ Cruel	✗ Very skinny	✓ Skeletal
✗ Very messy	✓ Slovenly	✗ Very smooth	✓ Sleek
✗ Very nice	✓ Kind	✗ Very soft	✓ Downy
✗ Very often	✓ Frequently	✗ Very sorry	✓ Apologetic
✗ Very old	✓ Ancient	✗ Very special	✓ Exceptional
✗ Very open	✓ Transparent	✗ Very sure	✓ Certain

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

I could go on with
endless lists of tips...



Ejemplos

Annotated example taken from *Nature* 435, 114–118 (5 May 2005).

One or two sentences providing a basic introduction to the field, comprehensible to a scientist in any discipline.

Two to three sentences of more detailed background, comprehensible to scientists in related disciplines.

One sentence clearly stating the general problem being addressed by this particular study.

One sentence summarizing the main result (with the words “here we show” or their equivalent).

Two or three sentences explaining what the main result reveals in direct comparison to what was thought to be the case previously, or how the main result adds to previous knowledge.

One or two sentences to put the results into a more general context.

Two or three sentences to provide a broader perspective, readily comprehensible to a scientist in any discipline, may be included in the first paragraph if the editor considers that the accessibility of the paper is significantly enhanced by their inclusion. Under these circumstances, the length of the paragraph can be up to 300 words. (This example is 190 words without the final section, and 250 words with it).

During cell division, mitotic spindles are assembled by microtubule-based motor proteins^{1,2}. The bipolar organization of spindles is essential for proper segregation of chromosomes, and requires plus-end-directed homotetrameric motor proteins of the widely conserved kinesin-5 (BimC) family³. Hypotheses for bipolar spindle formation include the ‘push–pull mitotic muscle’ model, in which kinesin-5 and opposing motor proteins act between overlapping microtubules^{2,4,5}. However, the precise roles of kinesin-5 during this process are unknown. Here we show that the vertebrate kinesin-5 Eg5 drives the sliding of microtubules depending on their relative orientation. We found in controlled *in vitro* assays that Eg5 has the remarkable capability of simultaneously moving at $\sim 20 \text{ nm s}^{-1}$ towards the plus-ends of each of the two microtubules it crosslinks. For anti-parallel microtubules, this results in relative sliding at $\sim 40 \text{ nm s}^{-1}$, comparable to spindle pole separation rates *in vivo*⁶. Furthermore, we found that Eg5 can tether microtubule plus-ends, suggesting an additional microtubule-binding mode for Eg5. Our results demonstrate how members of the kinesin-5 family are likely to function in mitosis, pushing apart interpolar microtubules as well as recruiting microtubules into bundles that are subsequently polarized by relative sliding. We anticipate our assay to be a starting point for more sophisticated *in vitro* models of mitotic spindles. For example, the individual and combined action of multiple mitotic motors could be tested, including minus-end-directed motors opposing Eg5 motility. Furthermore, Eg5 inhibition is a major target of anti-cancer drug development, and a well-defined and quantitative assay for motor function will be relevant for such developments.

Kinetic drop friction

[Xiaomei Li](#), [Francisco Bodziony](#), [Mariana Yin](#), [Holger Marschall](#), [Rüdiger Berger](#) & [Hans-Jürgen Butt](#) 

Abstract

Liquid drops sliding on tilted surfaces is an everyday phenomenon and is important for many industrial applications. Still, it is impossible to predict the drop's sliding velocity. To make a step forward in quantitative understanding, we measured the velocity (U), contact width (w), contact length (L), advancing (θ_a), and receding contact angle (θ_r) of liquid drops sliding down inclined flat surfaces made of different materials. We find the friction force acting on sliding drops of polar and non-polar liquids with viscosities (η) ranging from 10^{-3} to $1 \text{ Pa} \cdot \text{s}$ can empirically be described by $F_f(U) = F_0 + \beta w \eta U$ for a velocity range up to 0.7 ms^{-1} . The dimensionless friction coefficient (β) defined here varies from 20 to 200. It is a material parameter, specific for a liquid/surface combination. While static wetting is fully described by θ_a and θ_r , for dynamic wetting the friction coefficient is additionally necessary.

Physics of Beer Tapping

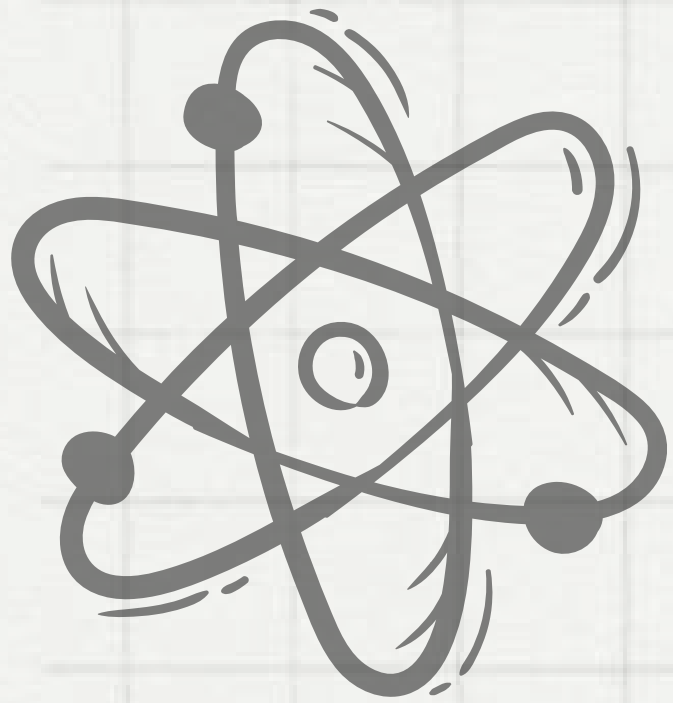
Javier Rodríguez-Rodríguez, Almudena Casado-Chacón, and Daniel Fuster
Phys. Rev. Lett. **113**, 214501 – Published 20 November 2014

ABSTRACT

The popular bar prank known in colloquial English as beer tapping consists in hitting the top of a beer bottle with a solid object, usually another bottle, to trigger the foaming over of the former within a few seconds. Despite the trick being known for a long time, to the best of our knowledge, the phenomenon still lacks scientific explanation. Although it seems natural to think that shock-induced cavitation enhances the diffusion of CO_2 from the supersaturated bulk liquid into the bubbles by breaking them up, the subtle mechanism by which this happens remains unknown. Here, we show that the overall foaming-over process can be divided into three stages where different physical phenomena take place in different time scales: namely, the bubble-collapse (or cavitation) stage, the diffusion-driven stage, and the buoyancy-driven stage. In the bubble-collapse stage, the impact generates a train of expansion-compression waves in the liquid that leads to the fragmentation of preexisting gas cavities. Upon bubble fragmentation, the sudden increase of the interface-area-to-volume ratio enhances mass transfer significantly, which makes the bubble volume grow by a large factor until CO_2 is locally depleted. At that point buoyancy takes over, making the bubble clouds rise and eventually form buoyant vortex rings whose volume grows fast due to the feedback between the buoyancy-induced rising speed and the advection-enhanced CO_2 transport from the bulk liquid to the bubble. The physics behind this explosive process sheds insight into the dynamics of geological phenomena such as limnic eruptions.

$$E=mc^2$$

Doing science means taking
part in a conversation



Now what?

The idea is to apply these tips and create effective presentations

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

Questions?

