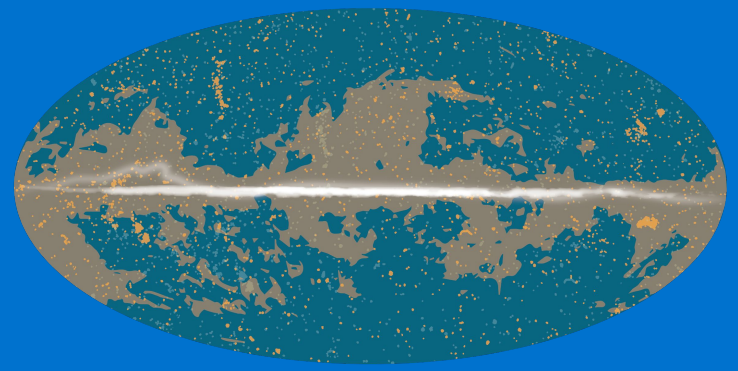
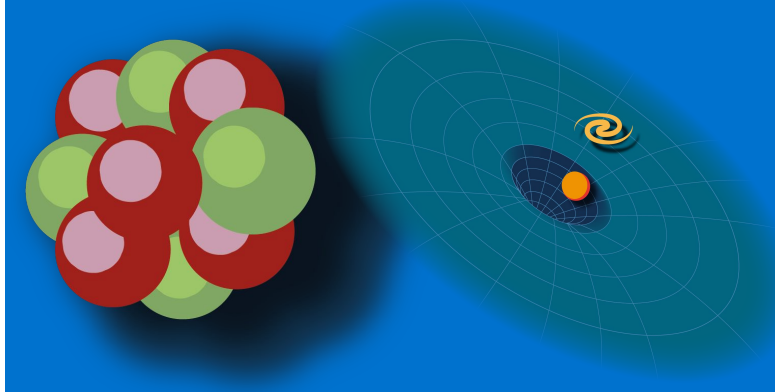
Welcome BIG at ICCUB

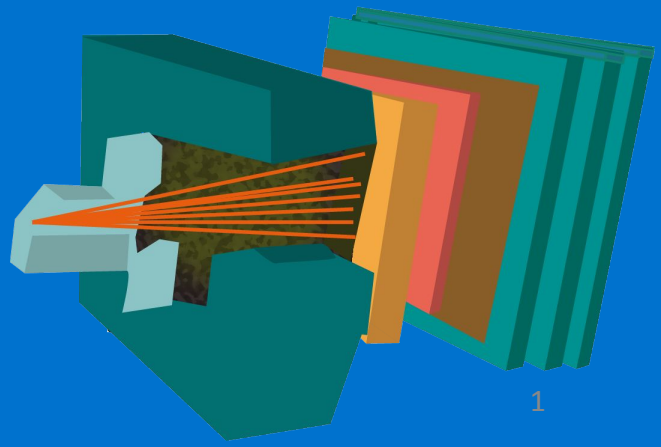
and reading papers in the LLM era

Licia Verde

ICREA, ICCUB scientific director







ICCUB complements UB mission with:

- **excellent** and **interdisciplinary high-impact** research
- **synergies** among groups, teams, nearby institutions (several UB dept., IEEC-space)
- **technology transfer** (ATU)
- development of i**nnovative technologies** and **technological support** to research
- strategic participation in large international collaborations
- attraction of global talent
- advanced training embedded in world-class research teams
- **global** and **international** perspective
- outreach

successes:

ICCUB represents 2.9% of UB personnel:

16% ERC grants of UB in the last decade

¼ of ICREAs of UB are at ICCUB

Maria de Maeztu: 2014, 2019, 2024

Prizes: Narcis Monturiol (x2), Jaume I, RSEF/BBVA, Breakthrough, …

mission:

To produce and enable excellent science, “from the quarks to the cosmos”, through theory, experiments and technology development, because the infinitely big and the infinitely small are intimately connected and ultimately ruled by the same laws of physics.

vision:

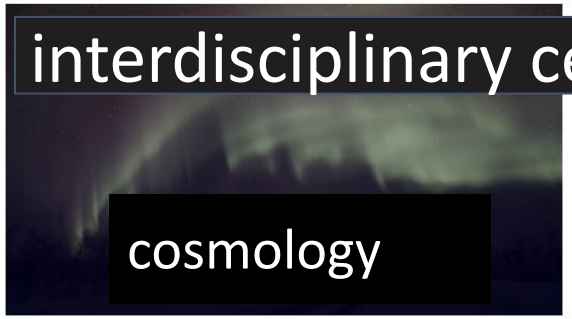
To discover the fundamental physics laws that govern the universe, for the benefit of society and future generations.

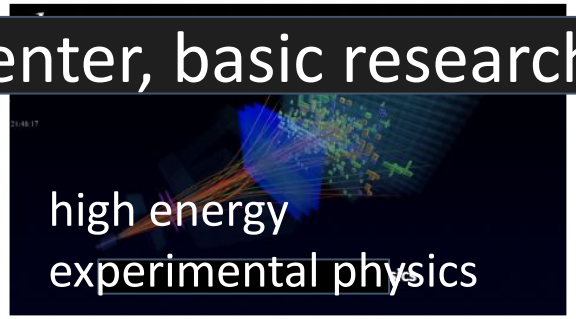
values:

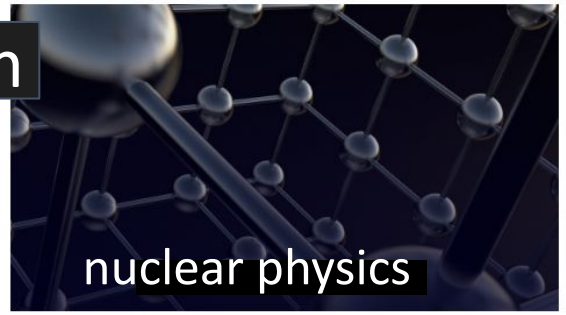
Excellence, integrity, flexibility and global perspective.

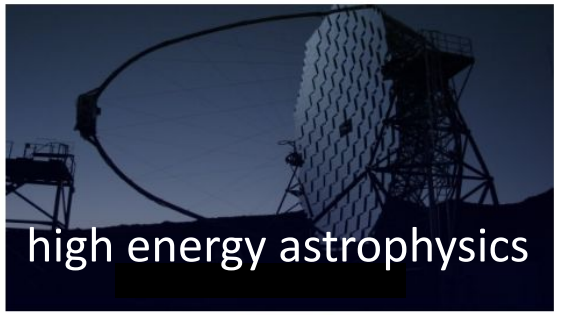
ICCUB: research areas

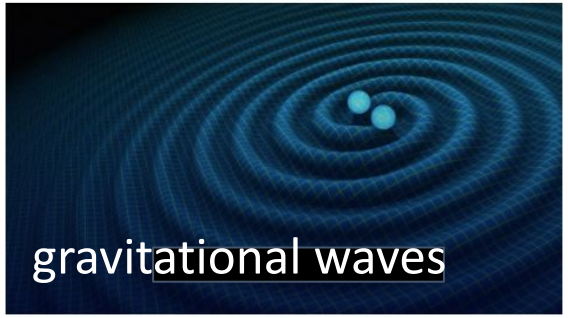
interdisciplinary center, basic research

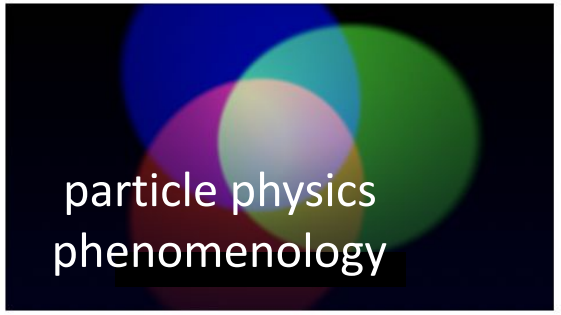


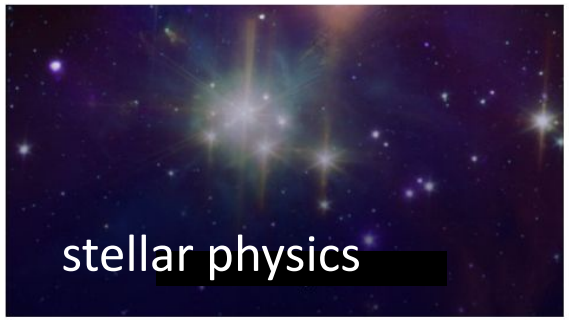


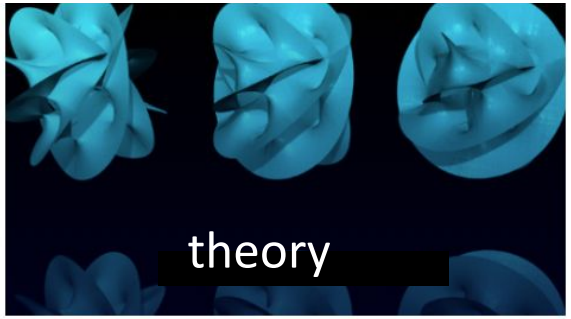












Three grand challenges for the next four years:

What's beyond the two standard models of all physics?

What's the physics generating gravitational waves?

Exploitation of quantum resources for science and technology

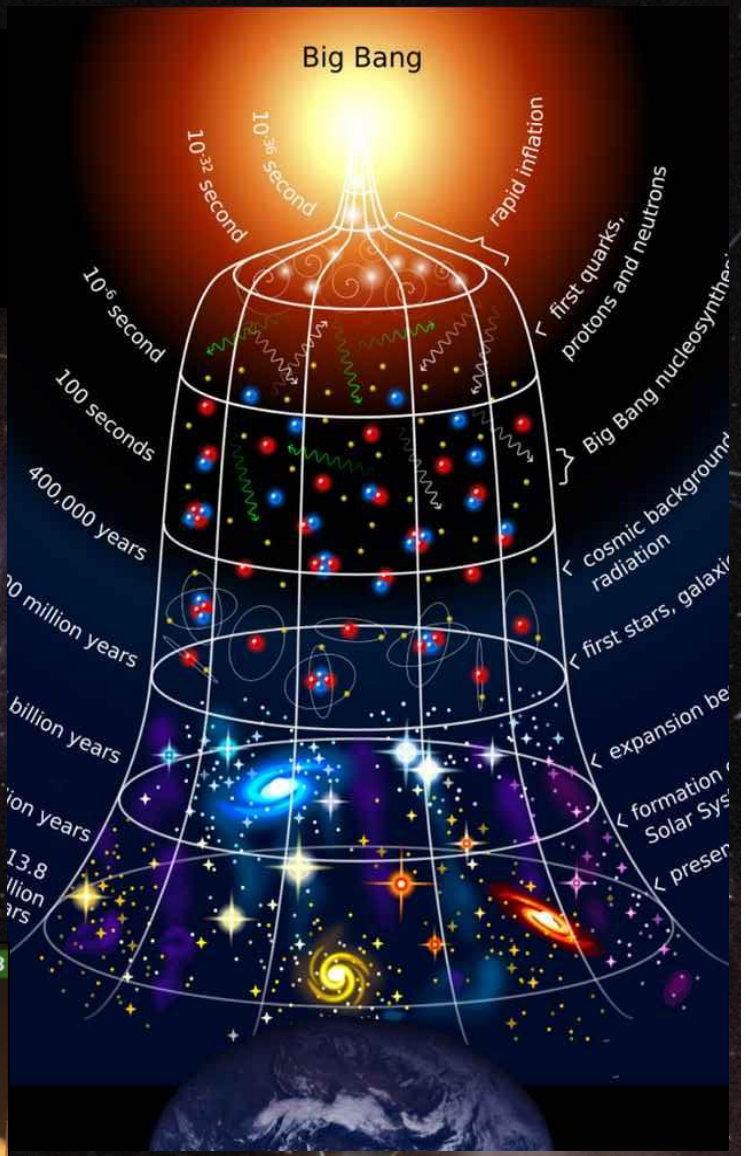
Scientific strategy

"from the quarks to the cosmos"

context: ambitious and complex scientific projects with large collaborations becoming the norm

ICCUB:

- consolidate, build on recent gains
- nurture talent and human capital
- training (growth is lifelong!)
- enhance KTT
- resist hyperspecialization
- foster high-potential research directions
- exploit connexions and synergies
- excellence with accountability



Cornell University

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Subject search and browse:

Physics Search Form Interface Catchup

Physics

- Astrophysics (**astro-ph** new, recent, search) Astrophysics of Galaxies; Cosmology and Nongalactic Astrophysics; Earth and Planetary Astrophysics; High Energy Astrophysical Phenomena; Instrumentation and Methods for Astrophysics; Solar and Stellar Astrophysics
- Condensed Matter (**cond-mat** new, recent, search) Disordered Systems and Neural Networks; Materials Science; Mesoscale and Nanoscale Physics; Other Condensed Matter; Quantum Gases; Soft Condensed Matter; Statistical Mechanics; Strongly Correlated Electrons; Superconductivity
- General Relativity and Quantum Cosmology (**gr-qc** new, recent, search)
- High Energy Physics - Experiment (**hep-ex** new, recent, search)
- High Energy Physics - Lattice (**hep-lat** new, recent, search)
- High Energy Physics - Phenomenology (**hep-ph** new, recent, search)
- High Energy Physics - Theory (**hep-th** new, recent, search)
- Mathematical Physics (**math-ph** new, recent, search)
- Nonlinear Sciences (**nlin** new, recent, search)

ads

astr

Classic For

QUICK FIELD: Author First Autho

Recommendations

author	author:"Encrenaz
first author	first_author:"Quic
abstract + title	abs:"dark energy
year	year:2000
year range	year:2000-2005
full text	full:"super Earth"
publication	bibstem:ApJ

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Journal of Cosmology and Astroparticle Physics

An IOP and SISSA journal

ICCUB

Institut de Ciències del Cosmos

UNIVERSITAT DE BARCELONA

EXCELENCIA MARÍA DE MAEZTU 04/2025-03/2031

Meet Denario, the AI ‘research assistant’ that is already getting its own papers published

The Denario project: Deep knowledge AI agents for scientific discovery

Boris Bolliet*, Pablo Villanueva-Domingo*, Francisco Villaescusa-Navarro*,
Adrian E. Bayer, Aidan Acquah, Chetana Amancharla, Almog Barzilay Siegal , Pablo Bermejo,
Camille Bilodeau, Pablo Cárdenas Ramírez, Miles Cranmer, Urbano L. França, ChangHoon Hahn,
Yan-Fei Jiang, Raul Jimenez, Jun-Young Lee, Antonio Lerario, Osman Mamun, Thomas Meier,
Anupam Anand Ojha, Pavlos Protopapas, Shimanto Roy, David N. Spergel, Pedro Tarancón-Álvarez,
Ujjwal Tiwari, Matteo Viel, Digvijay Wadekar, Chi Wang, Bonny Y. Wang, Licong Xu, Yossi Yovel, Shuwen Yue,
Wenhan Zhou, Qiyao Zhu, Jiajun Zou, Íñigo Zubeldia

*Equal Contribution. Listing order of BB, PVD, FVN is random.

SCAN ME

Paper | Code | Docs | App

ICCUB | Institut de Ciències del Cosmos UNIVERSITAT DE BARCELONA

EXCELENCIA MARÍA DE MAEZTU 04/2025-03/2031

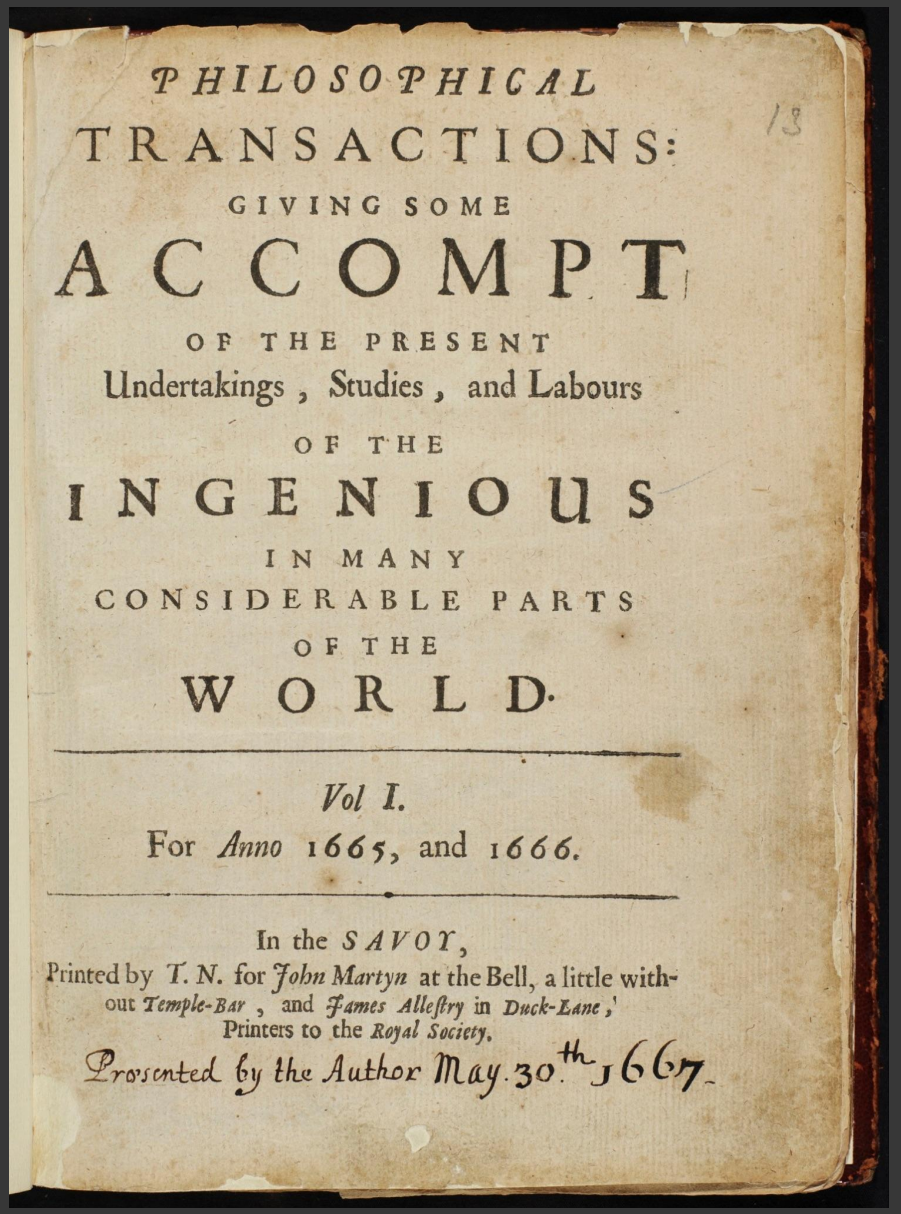
No, AI cannot be an author:

AI cannot take responsibility

WHAT IS A SCIENTIFIC PAPER?

The modern concept of a scientific paper emerged with the founding of the **Royal Society of London** and its journal ***Philosophical Transactions*** in **1665**

Your editor…



PHILOSOPHICAL
TRANSACTIONS:
GIVING SOME
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OF THE
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Vol I.
For *Anno* 1665, and 1666.

In the *SAVOY*,
Printed by *T. N.* for *John Martyn* at the Bell, a little without *Temple-Bar*, and *James Allestry* in *Duck-Lane*,
Printers to the *Royal Society*.
Presented by the Author May. 30.th 1667.

Before that scientific discoveries were published in "pamphlets" and books (Galileo…)

Scientific publishing

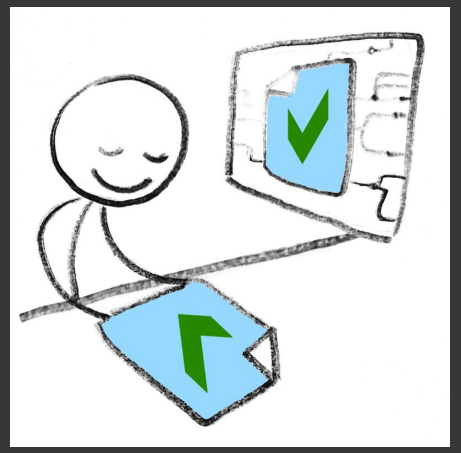
Authors do research and produce paper

t~months/years

arXiv

t~hrs/days

Journals
Editors/referees
QA,Curation, refs, metadata etc.



t~months

Scholarly record
knowledge

JCAP

Non-for-profit

Researchers discover new ideas

Results are "public"

Scientific publishing is a business

Based on 'publish or perish' culture and 'bibliometrics' credo

Commercial publishers reach profit margins of 30 to 40% per year

which is higher than that of companies such as Microsoft, Google and Coca Cola

The academic publishing industry has a **financial volume between the music industry and the film industry** (Buranyi S. for the Guardian 2017)

In 2020 annual revenues from article processing charges among major publishers have exceeded 2 billion USD (Zhang et al, 2022, scientometric).
This is three times the UNESCO budget.

All funded by… your grants, overheads, libraries

It stays afloat because

Must be << of the effort on this

Effort of scientists on this
(non promotable task)

Authors do research
and produce paper

t~months/years

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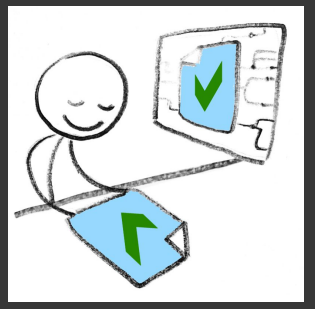


t~months

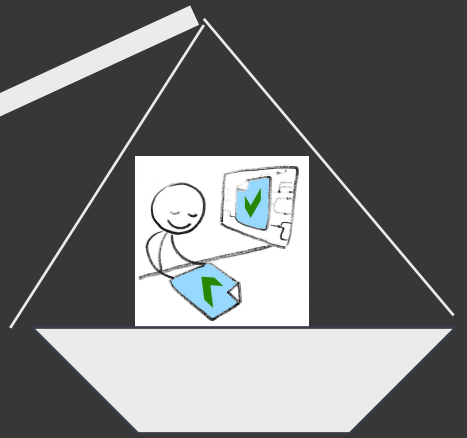
Scholarly record
knowledge

Researchers discover new ideas

Results are
"public"

And content of this must be of high value: interest and novelty. Pristine. Not redundant. Added value.

Effort balance:



QA, curation etc.

Authors produce paper

Enables high value of

Bibliometrics credo

What makes a good scientist?
"The metric tide"
Want indicators that are

- Objective
- Quantitative
- Reproducible
- Transparent
- …

Number of papers
Journal impact factors
Number of citations

Goodhart's law

When a measure becomes a target it ceases to be a good measure

Bibliometrics credo

What makes a good scientist?
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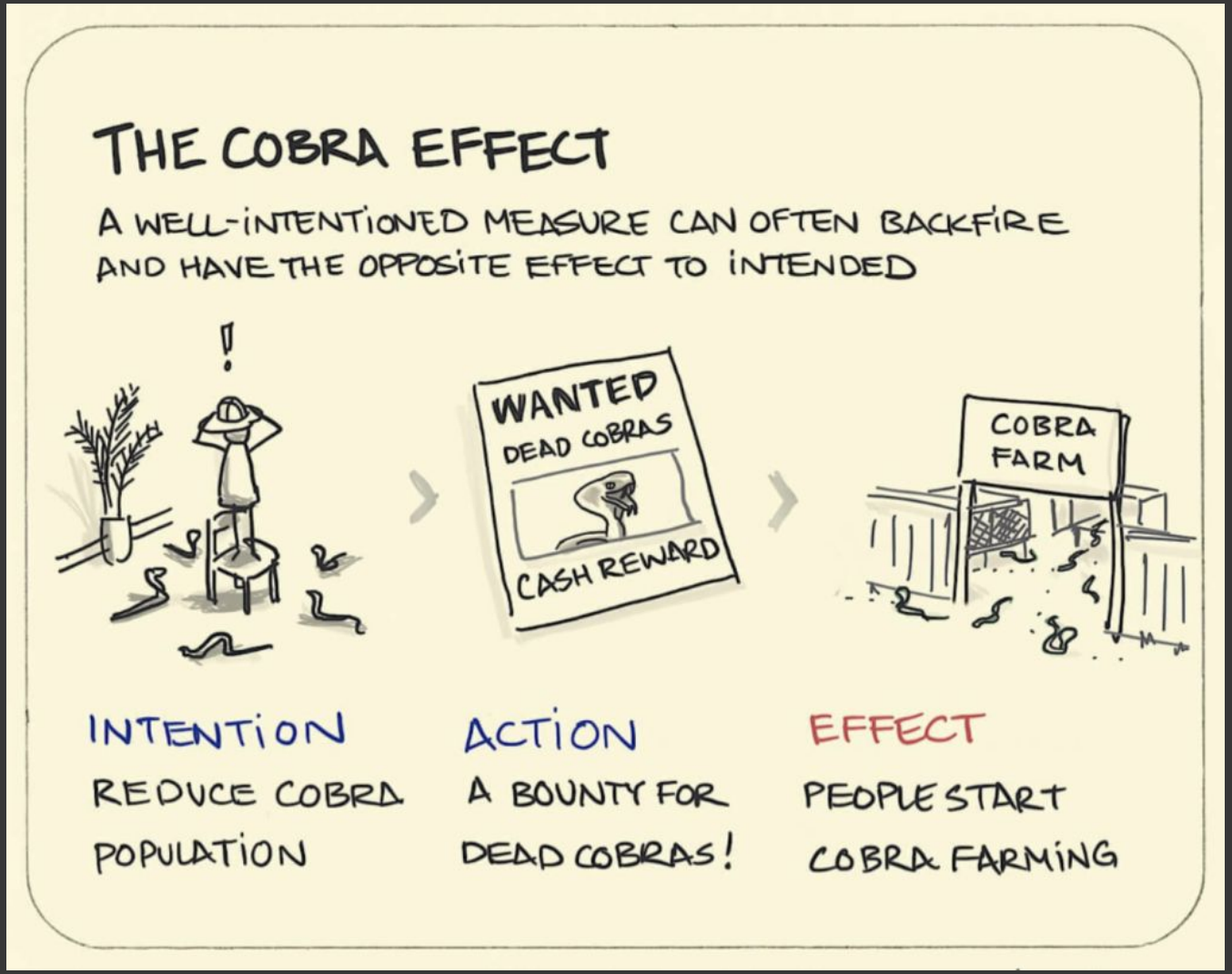
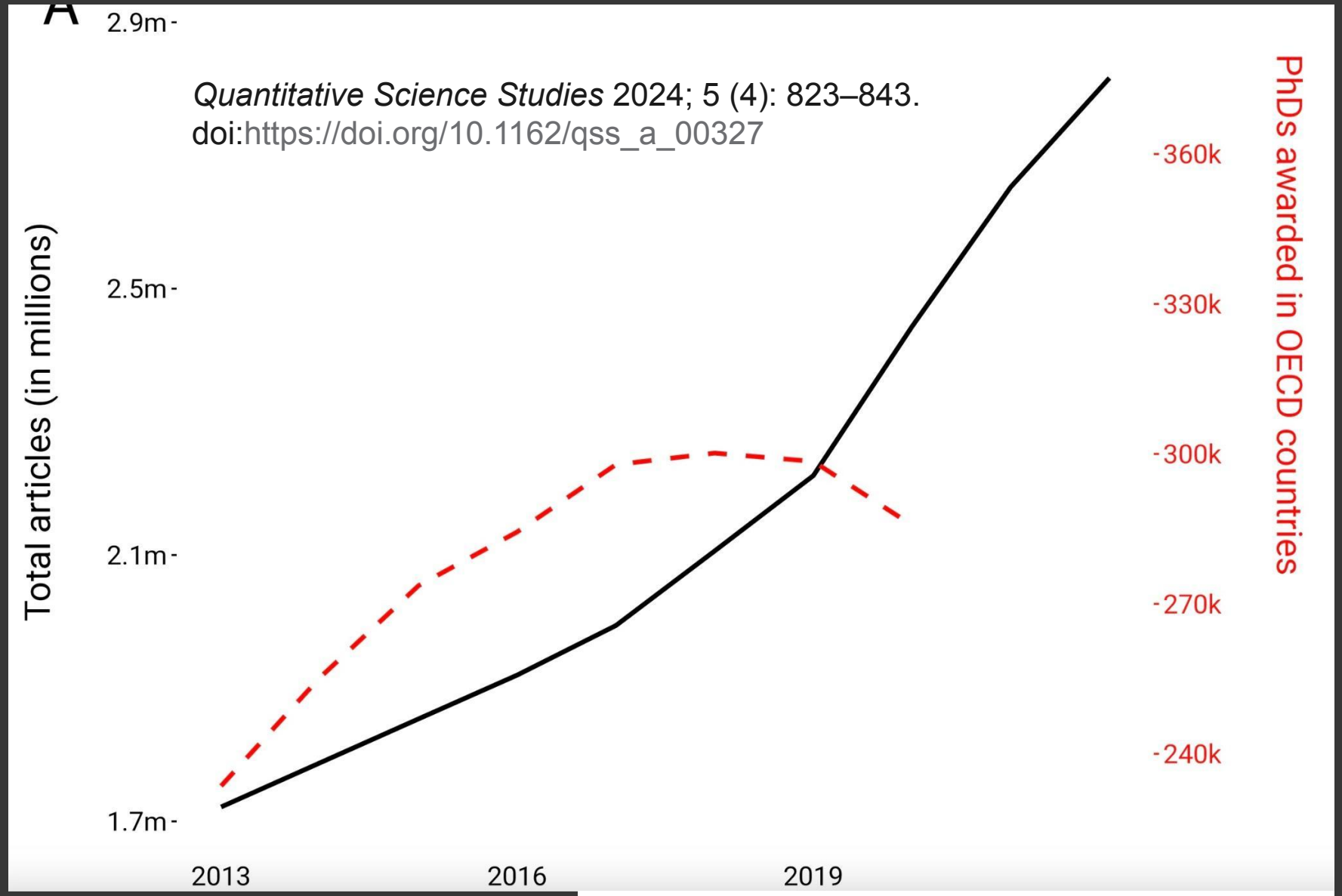


Image Taken from jimstoneconsulting

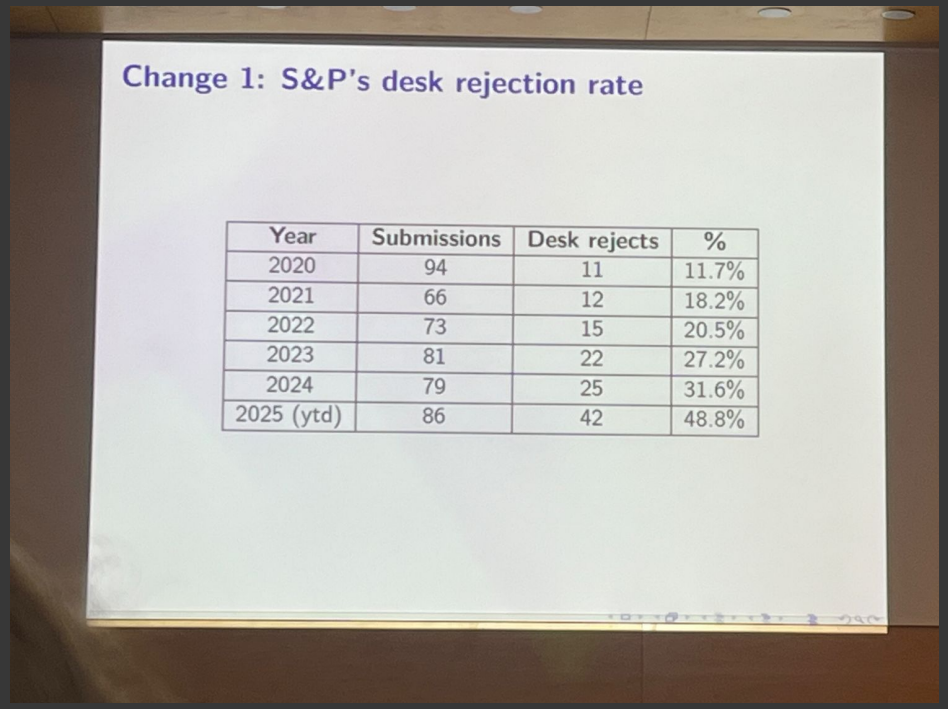
The growth of scientific publications



Quantitative Science Studies 2024; 5 (4): 823–843.
doi:https://doi.org/10.1162/qss_a_00327

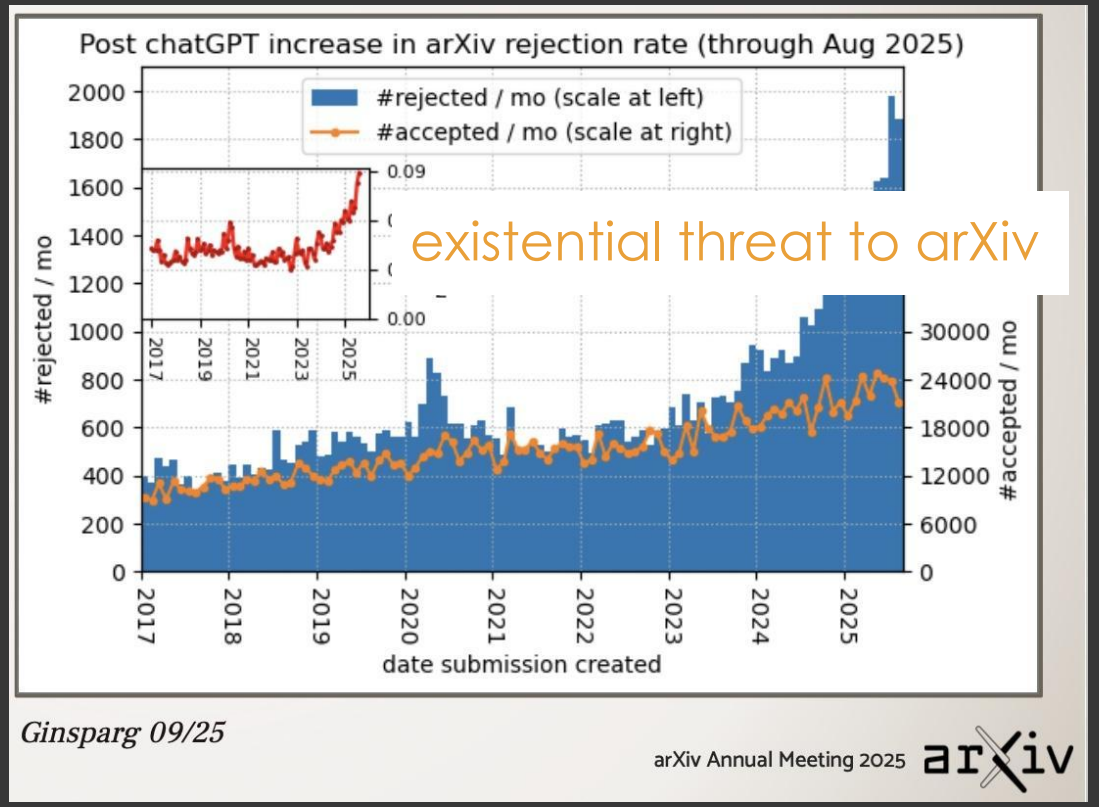
The growth of dubious quality submissions

Philosophy
(Louise McNally at Academia Europaea)



Year	Submissions	Desk rejects	%
2020	94	11	11.7%
2021	66	12	18.2%
2022	73	15	20.5%
2023	81	22	27.2%
2024	79	25	31.6%
2025 (ytd)	86	42	48.8%

arXiv aggregated sections



What we detect here is just the tip of the iceberg

AI generated papers have been around and are around across disciplines

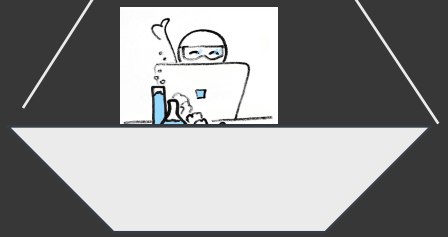
if you are a referee or an editor be aware

AI slop

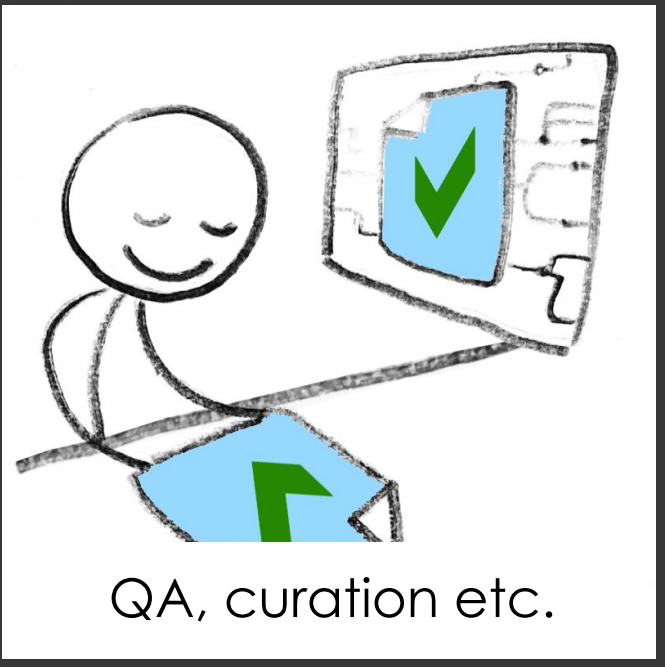
non sensical

content looks polished, reads well, but… lacks substance or novelty or …

Effort (un)balance:



Authors produce paper



QA, curation etc.

It can't stay afloat because

Is >> than the effort on this

Effort of scientists on this
(non promotable task)

Authors do research
and produce paper

t~months/years

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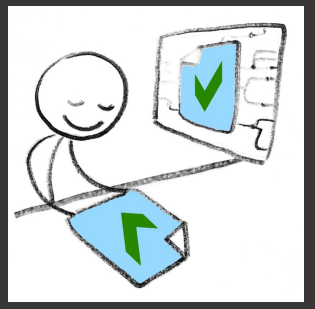

t~months

Scholarly record
knowledge

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"public"

A nt of this
must b high value:
interes velty.
Pristine. No undant.
Added valu

Denario brings it into the open

The technology is there (whether we like it or not). This is a tool. It will be used.

Current approach→ "Red Queen's race"

> "Technology challenges us to assert our human values, which means that first of all, we have to figure out what they are." – Sherry Turkle

What is the "atom", the building block, of (new) scientific knowledge?

What is good research? What is "good researcher"?

IMPORTANT:

You must

Declare

how AI has been used in the preparation of the paper

(from doing the research to writing the text)

in the methods or acknowledgments section

You may

use AI to **polish the language**

(grammar, syntax, clarity..)

but you may **not**

significantly increase

(or decrease)

the length of the text

The world has changed: e.g.,

(HARVARD) COMPUTERS

1891

today

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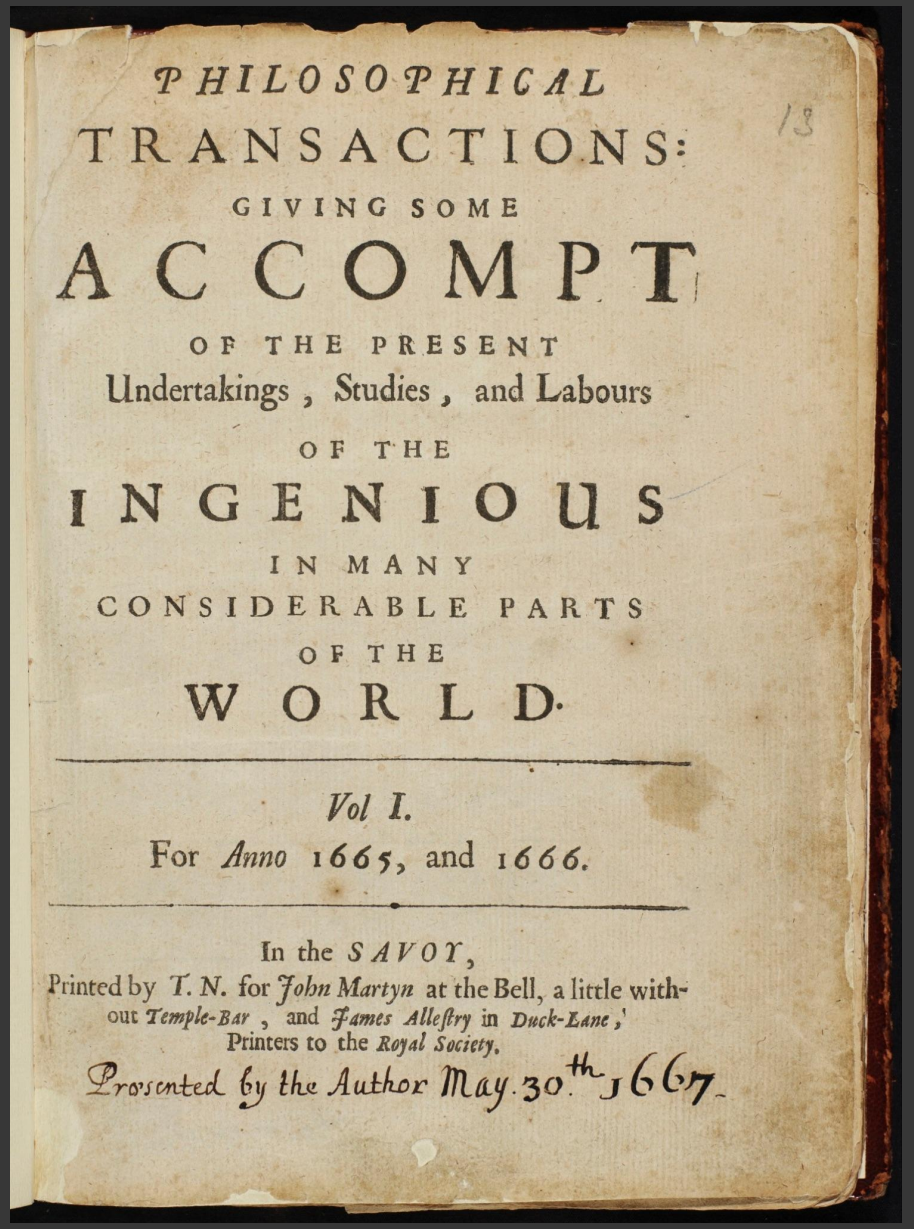
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Printers to the *Royal Society*.
Presented by the Author May. 30th 1667.

The world has changed a lot since then….

Enjoy the meeting!