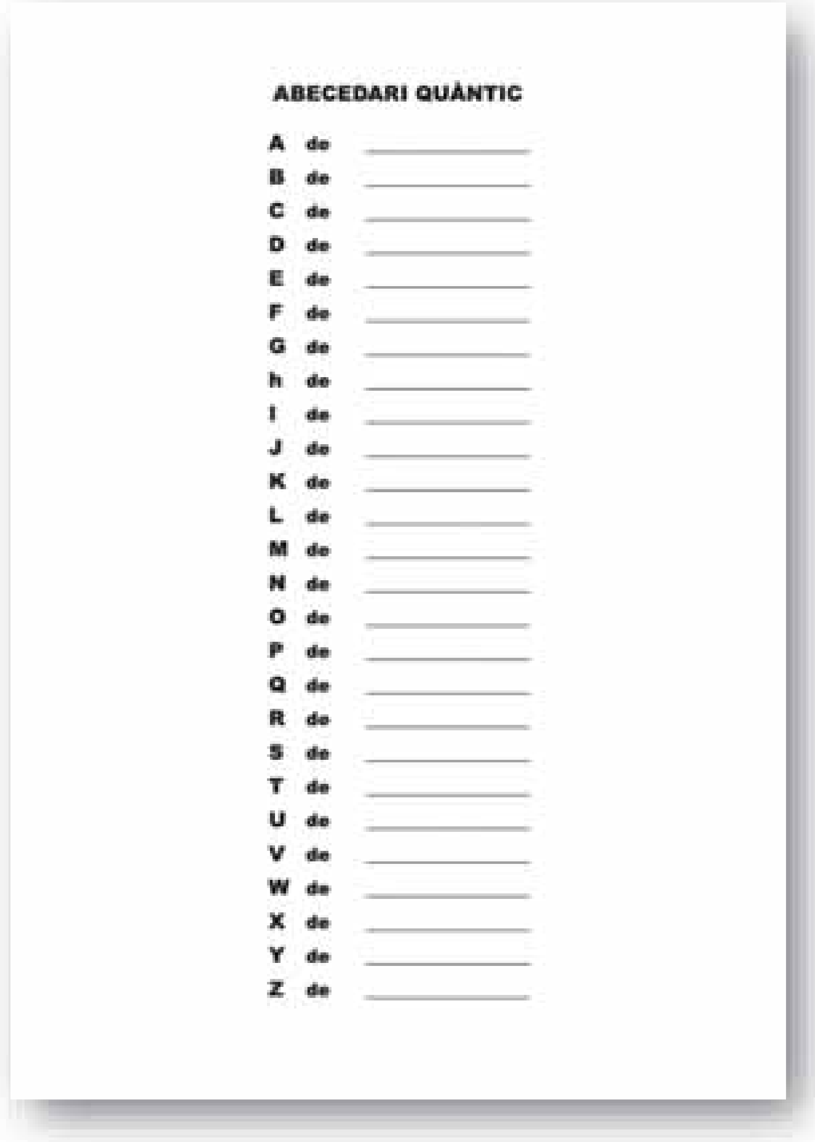
iHC Institut d'Història de la Ciència UAB

abecedari quàntic

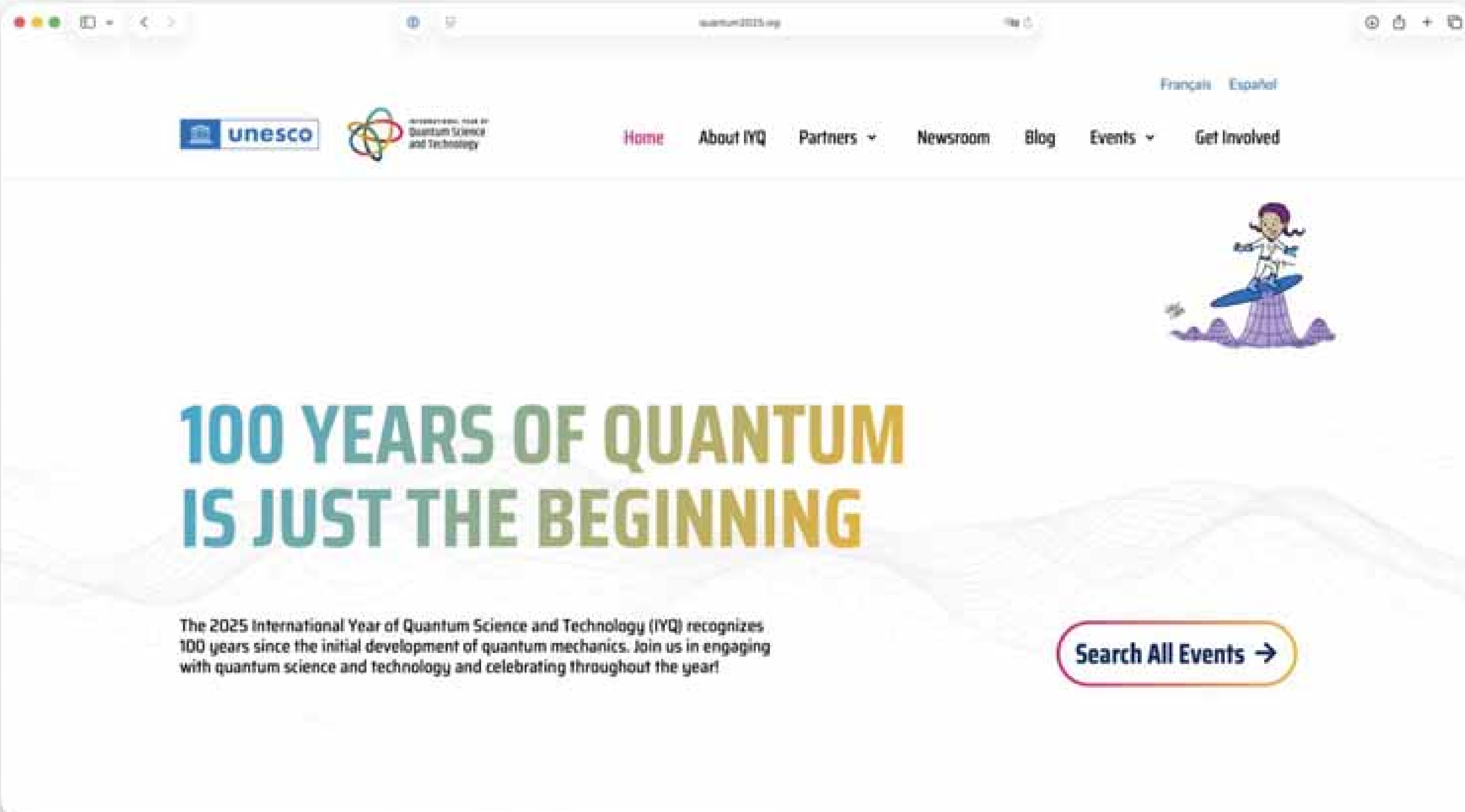
Xavier Roqué
iHC i Departament de Filosofia UAB

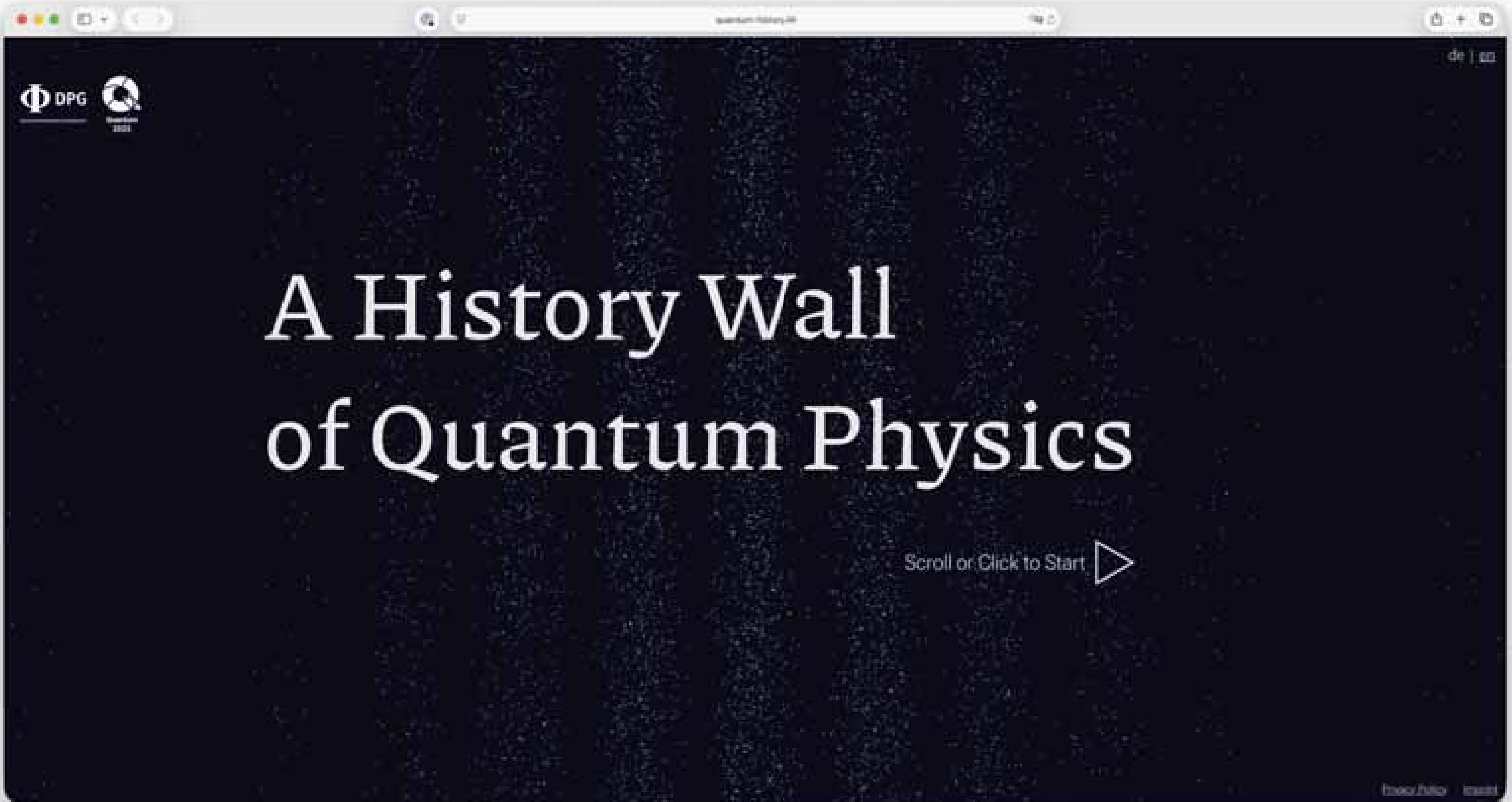
Xerrada inaugural de la mostra **100 anys de la mecànica quàntica**
CRAI Biblioteca de Física i Química
Any Internacional de la Ciència i la Tecnologia Quàntiques
UB, 12 de novembre 2025


ABECEDARI QUÀNTIC

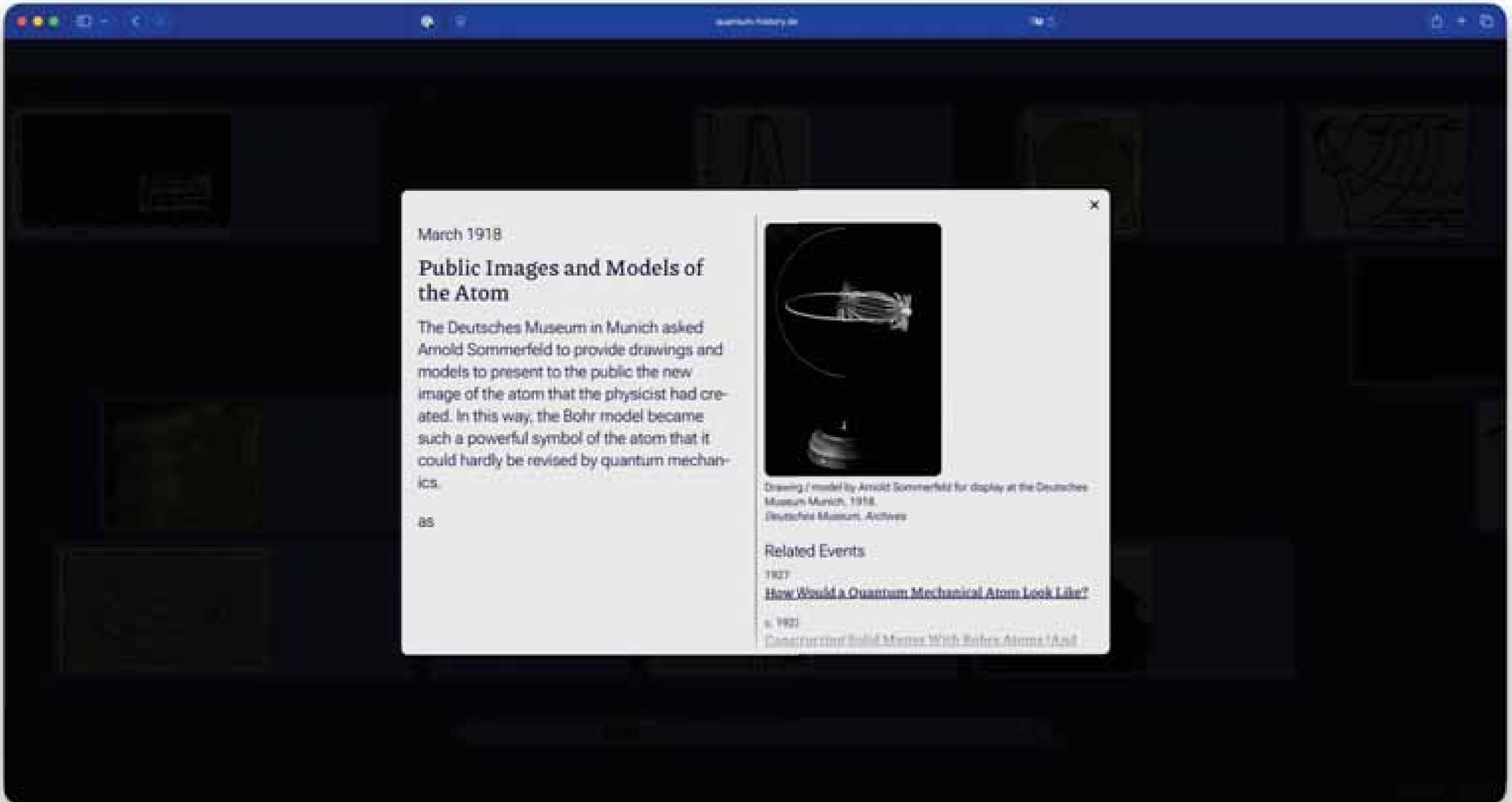
A de ________
B de ________
C de ________
D de ________
E de ________
F de ________
G de ________
h de ________
I de ________
J de ________
K de ________
L de ________
M de ________
N de ________
O de ________
P de ________
Q de ________
R de ________
S de ________
T de ________
U de ________
V de ________
W de ________
X de ________
Y de ________
Z de ________

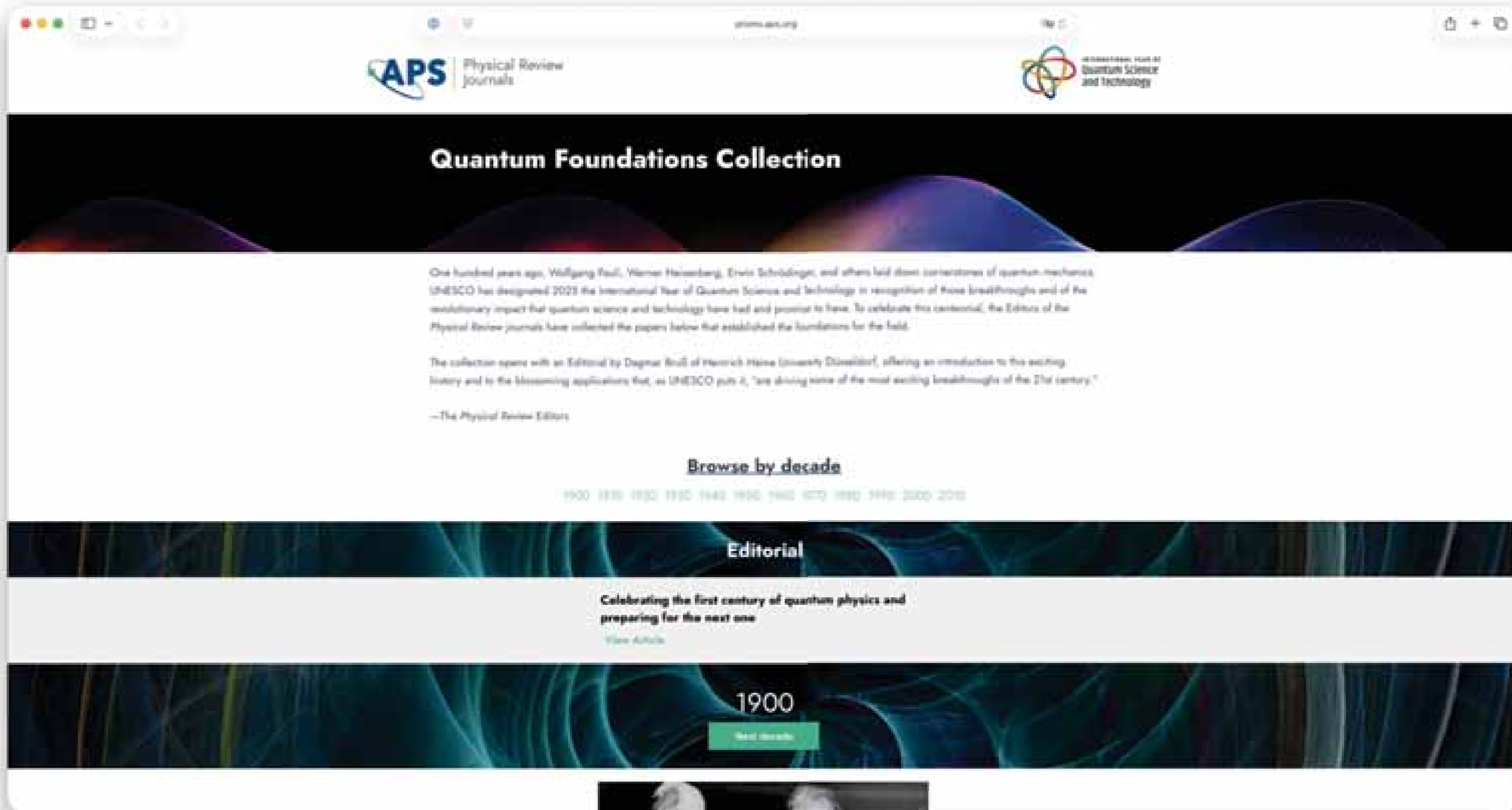

CHEMICAL
ABSTRACTS


Français Español
unesco
Quantum Science and Technology
Home
About IYQ
Partners
Newsroom
Blog
Events
Get Involved
100 YEARS OF QUANTUM IS JUST THE BEGINNING
The 2025 International Year of Quantum Science and Technology (IYQ) recognizes 100 years since the initial development of quantum mechanics. Join us in engaging with quantum science and technology and celebrating throughout the year!
Search All Events

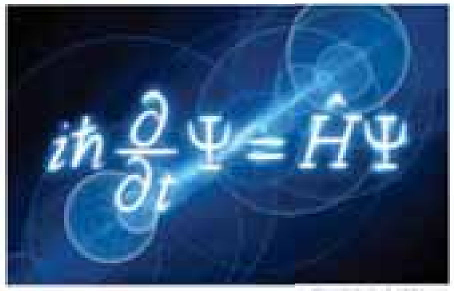

de | en
DPG
A History Wall
of Quantum Physics
Scroll or Click to Start

Quantum History Wall
Start
About
de | en
"Specific Heat Decreases Strongly at Low Temperatures..."
Discovery of Superconductivity
Undoing the Anomalous Zeeman Effect
Are Bohr's Electron Orbits Real?
h Enters the Atom
The Nuclear Atom (Was No Quantum Physics)
Atomic Theory With the Quantum: A First Overambitious Attempt
An Experimental Proof of Bohr's Quantum Jumps?
Light Quanta Are Indistinguishable!
$W_{\tau_2} - W_{\tau_1} = h\nu,$
The Bohr Atom: Progress and Paradoxes
From Spontaneous To Stimulated Emission
"Un Conseil", or: The Invention of the Workshop
Hilbert und die Physik.
Von M. Born, Göttingen.
A Mathematician Learning and Teaching Modern Physics
1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000
Privacy Policy
Imprint


March 1918
Public Images and Models of the Atom
The Deutsches Museum in Munich asked Arnold Sommerfeld to provide drawings and models to present to the public the new image of the atom that the physicist had created. In this way, the Bohr model became such a powerful symbol of the atom that it could hardly be revised by quantum mechanics.
as
Drawing / model by Arnold Sommerfeld for display at the Deutsches Museum Munich, 1918.
Deutsches Museum, Archives
Related Events
How Would a Quantum Mechanical Atom Look Like?


APS
Physical Review
Journals
Quantum Foundations Collection
Browse by decade
Editorial
Celebrating the first century of quantum physics and preparing for the next one
1900

1920



1922 Atoms have quantized spin

By observing the deflection of atoms in a spatially varying magnetic field, Walther Gerlach and Otto Stern showed experimentally that the spin of an atom is quantized and exists in two discrete states.

W. Gerlach and O. Stern, Der experimentelle Nachweis der Richtungsquantelung im Magnetfeld, Z. Phys. 9, 349 (1922)

View Article

1923 Light is not purely wavelike

Arthur Compton discovered the phenomenon now known as the Compton effect, by which a high-energy photon transfers some of its momentum to a charged particle. The result confirmed that light can act both as a wave and as a stream of particles.

A. Compton, A quantum theory of the scattering of x-rays by light elements, Phys. Rev. 21, 483 (1923)

View Article

1925 Pauli exclusion principle

Wolfgang Pauli posited that two electrons in an atom cannot simultaneously inhabit the same quantum state. For the case of electrons in atoms, the principle implies that they can never have the same values of their four quantum numbers, including the spin quantum number. Pauli's principle explained how Bohr's model of the atom can be connected to the structure of the periodic table and was later extended to all fermions.

1925 Matrix formulation of quantum theory

After his famous trip to Helgoland, Werner Heisenberg derived the quantized energy levels of a one-dimensional oscillator in terms of physical quantities, such as transition probabilities, that could in principle be measured. Three fundamental papers by Heisenberg, Max Born and Pascual Jordan developed the first consistent formulation of quantum mechanics, based on matrices.

W. Heisenberg, Über quantentheoretische Umdeutung kinematischer


sites.duke.edu
Women in the History of Quantum Physics
INTRODUCTION
WIHQP PUBLICATIONS
WIHQP TALKS
WIHQP LOGO
Introduction
From its uncertain beginnings at the dawn of the twentieth century, quantum physics has had an enthralling history of scientific success and has grown into an extraordinarily rich and diverse techno-scientific field. Conventional narratives of its historical development, however, feature an almost exclusively male cast of characters, with only the exceptional presence of well-known heroines of physics such as Maria Skłodowska-Curie, Lise Meitner, and Maria Göppert Mayer. Yet, many more women have actively contributed to the progress of quantum physics than are typically acknowledged. Women in the History of Quantum Physics (WiHQP) aims to recover and highlight the contributions of the numerous female physicists who, from diverse backgrounds and in different ways, have helped propel the field forward. By focusing on lesser-known figures and introducing a gender perspective to the historical study of physics, we aim to challenge the conventional male-dominated narratives that often reinforce the masculine image of the field.
The WiHQP collaboration was founded in early 2021, in preparation for the International Year of Quantum Science and Technology. The group, which encompasses an international and interdisciplinary team of historians, philosophers, physicists, and writers — ranging from early career scholars to renowned academics, has been remarkably productive with several conference panels completed and more scheduled, a book in press, and yet more projects in the works.
For more info, please contact Margriet van der Heijden (chair), Patrick Charbonneau (associate chair), or Daniela Monaldi (past chair). You can also follow our activities by signing up for our Facebook group.
WiHQP gratefully acknowledges funding and support from APS-FHPP. For other quantum century activities, consult the Consortium for History of Science, Technology and Medicine.

sites.duke.edu

INTRODUCTION | WIHQP PUBLICATIONS | WIHQP TALKS | WIHQP LOGO

WiHQP Publications

- Mirjam Blaauboer, "Hendrika J. van Leeuwen: Portret van de eerste vrouwelijke lector bij Technische Natuurkunde in Delft," *Nederlands Tijdschrift voor Natuurkunde* **81**(1), 4-6 (January 2015). https://www.lorentz.leidenuniv.nl/IL-publications/dissertations/biographies/NTvN_vanLeeuwen.pdf
- Elise Crull and Guido Bacciagaluppi, eds. *Grete Hermann – Between Physics and Philosophy* (Dordrecht: Springer, 2017). https://doi.org/10.1007/978-94-024-0970-3
- Mirjam Blaauboer, "Leeuwen, Hendrika Johanna van, in: *Digitaal Vrouwenlexicon van Nederland* (2017) https://resources.huygens.knaw.nl/vrouwenlexicon/lemmata/data/Leeuwen
- Gernot Münster, "(K)eine klassische Karriere?" *Physik Journal* **19**(6), 30-34 (June 2020). https://pro-physik.de/zeitschriften/physik-journal/2020-6/
- Margriet van der Heijden, "Tatiana Ehrenfest-Afanassjewa: No Talent for Subservience," In: Uffink, J., Valente, G., Werndl, C., Zuchowski, L. (eds) *The Legacy of Tatjana Afanasjewa* (Cham: Springer, 2021). https://doi.org/10.1007/978-3-030-47971-8_1
- Michelle Frank, "A Hidden Variable behind Entanglement," *Scientific American Magazine* **328**(4), 42 (April 2023). https://www.scientificamerican.com/article/the-little-known-origin-story-behind-the-2022-nobel-prize-in-physics/
- Mike Cuffaro and Michel Janssen, "Women in the History of Quantum Physics project under way," *AIP History Newsletter* **56**(1), 23-23 (2024). https://aip.brightspotcdn.com/52/12/6f9164414996eb9caaf606c2c2575/history-newsletter-v56n1-2024.pdfhttps://www.aip.org/sites/default/files/2024-06/v56n1_2024-f-digital-pages.pdf
- Andrea Reichenberger, "Philosophie und Physik: Zu Grete Hermanns neukantianischen Interpretation der Quantenmechanik." In: Kay Herrmann und Boris Schwitzer (eds.). *Der Geist der kritischen Schule*. Berlin, Heidelberg: J. B. Metzler. 2024, pp. 271–295. https://doi.org/10.1007/978-3-662-68345-3_18
- Margriet van der Heijden, "More is known about him than about her: Tatiana Ehrenfest-Afanassjewa," *Physics Today* **77**(1), 40–47 (2024). https://doi.org/10.1063/PT.3.5381
- Andrea Reichenberger, "Grete Hermann's ethical philosophy of physics," *Physics Today* **77**(9), 44–50 (2024). https://doi.org/10.1063/pt.elra.qcce
- Justina M. Singleton, "FHPP Winning Essay: From Wright Field to MIT: The lessons and legacy of Carolyn Beatrice Parker," *APS News*, May 5 (2025). https://www.aps.org/apsnews/2025/05/winning-essay-carolyn-beatrice-parker
- Arne Schirrmacher, "Die Quantenphysikerinnen," *Physik Journal* **24**(4), 28-30 (2025). https://pro-physik.de/zeitschriften/physik-journal/2025-4/
- Daniela Monaldi, "Laura Chalk," *Physik Journal* **24**(4), 32-34 (2025). https://pro-physik.de/zeitschriften/physik-journal/2025-4/
- Johannes-Geert Hagmann, "Maria Goeppert Mayer," *Physik Journal* **24**(5), 38-40 (2025). https://pro-physik.de/zeitschriften/physik-journal/2025-5/
- Andrea Reichenberger, "Grete Hermann: Eine Brückenbauerin zwischen Physik, Philosophie und Politik," *Physik Journal* **24**(6), 36-38 (2025). https://pro-physik.de/zeitschriften/physik-journal/2025-6/
- Margriet van der Heijden and Miriam Blaauboer, "Hendrika Johanna van Leeuwen: Die Wissenschaftlerin hinter dem Bohr-van-Leeuwen-Theorem," *Physik Journal* **24**(7), 42-44 (2025). https://pro-physik.de/zeitschriften/physik-journal/2025-7/
- Andrea Reichenberger, "Shaping the history of quantum physics to make women visible," *Nature Reviews Physics* (2025). https://doi.org/10.1038/s42254-025-00850-4

Chris Burden
The Atomic Alphabet, 1980

1900

1925

Condicions autoimposades

Enllaçar les lletres amb sentit històric...

~~...sèrie lineal d'idees brillants d'uns homes joves~~

~~successió de revolucions tecnològiques~~

~~explotació pràctica de descobriments desinteressats~~

Revelar dimensions ignorades, especialment el gènere i la política

Parar esment en la literatura històrica

2025

1900

1925

1961–1965

A de ARXIU

1990

2025

Archive for the History of Quantum Physics

American Philosophical Society, Philadelphia
American Institute of Physics, College Park
Harvard University, Cambridge

Cornell University, Ithaca
University of Pittsburgh
University of Minnesota, Minneapolis
University of California, Berkeley

Niels Bohr Archive, Copenhagen
Science Museum Library, London
Deutsches Museum Library, Munich
Accademia dei XL, Rome
Médiathèqué, Cité des Sciences et de l'Industrie, Paris
Universidad Autónoma de Madrid
Universitat Autònoma de Barcelona
Universität Konstanz
Max Planck Institut für Wissenschaftsgeschichte, Berlin

Hebrew University of Jerusalem
University of Melbourne
National Diet Library, Tokyo

Archive for the History of Quantum Physics
ARCHIVES FOR THE HISTORY OF QUANTUM PHYSICS
Heisenberg Correspondence
Manuscripts
ARCHIVES FOR THE HISTORY OF QUANTUM PHYSICS
AHQP-38
Cambridge Minute Books
ARCHIVES FOR THE HISTORY OF QUANTUM PHYSICS
Schrödinger Papers at Du
Institute
ARCHIVES FOR THE HISTORY OF QUANTUM PHYSICS
AHQP-39
Schrödinger Papers, to ca. 1920
ARCHIVES FOR THE HISTORY OF QUANTUM PHYSICS
Klein Papers

1900

1912–1913

1925

1927

1962

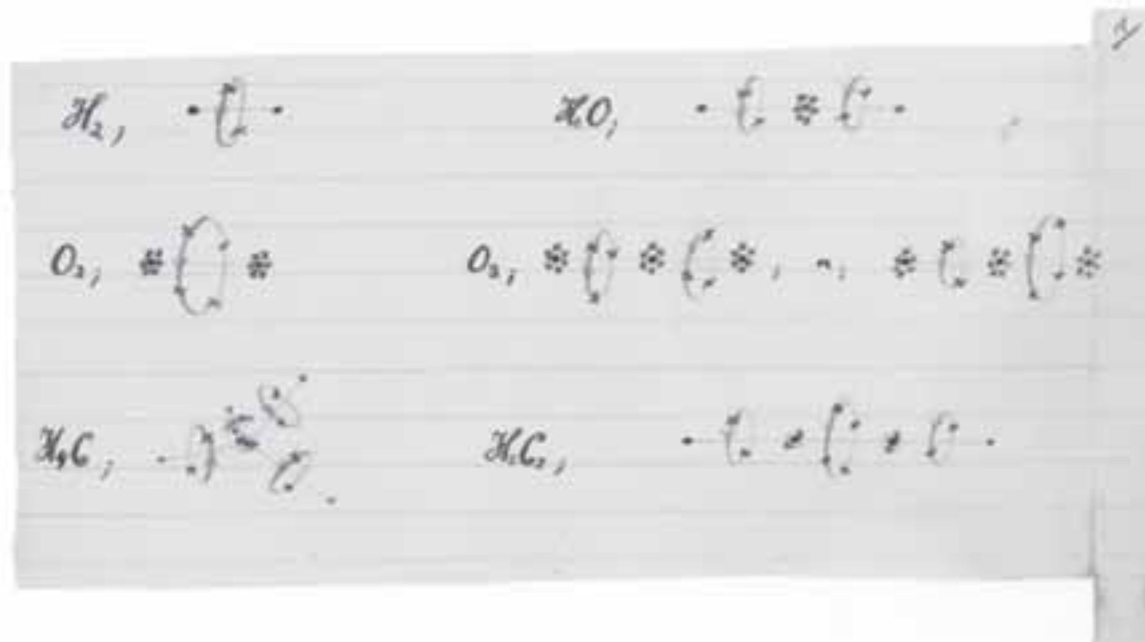
2025

B de BOHR

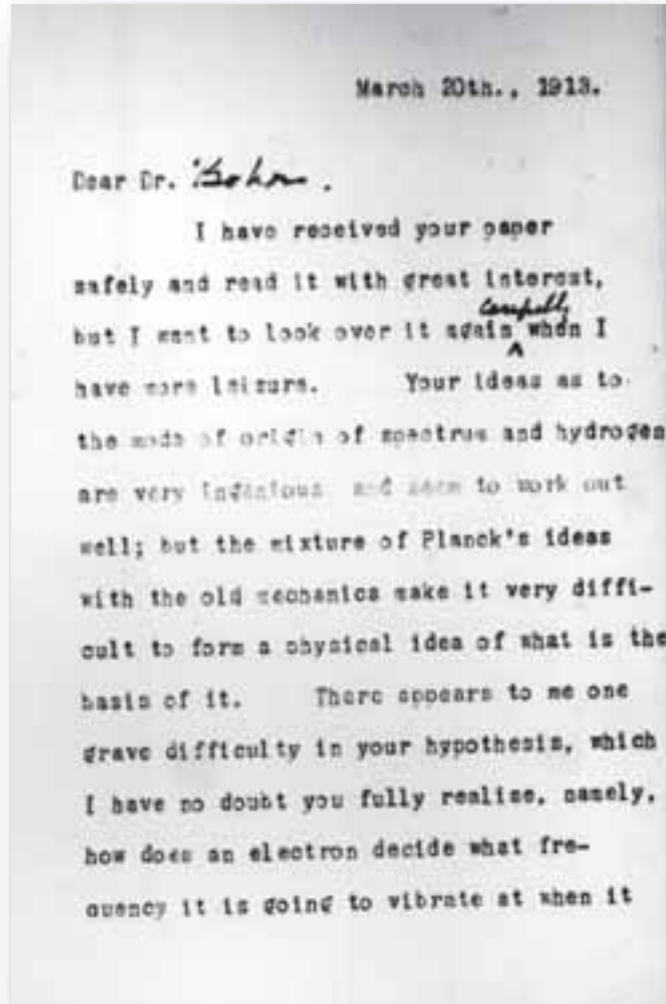
“Crec que he descobert alguna cosa sobre l’estructura dels àtoms. Podria estar equivocat… però no ho crec”.

Niels a Harald Bohr, 19/06/1912, citat a N. Bohr, *L’estructura i la filosofia dels àtoms.* Ed. a cura de J. Heilbron, trad. de X. Roqué (Barcelona: Institut d’Estudis Catalans; Vic: Eumo, 2010), p. 15.

Imatge: “Rutherford Memorandum” (juliol 1912), dins: F. Aaserud i J. L. Heilbron, *Love, Literature and the Quantum Atom* (Oxford: Oxford University Press, 2013), p. 168.



“La seves idees sobre l’espectre de l’hidrogen són molt enginyoses i sembla que funcionen; però la combinació de les idees de Planck amb la mecànica antiga fa que sigui molt difícil formar-se una idea física de tot plegat”.



March 20th., 1913.

Dear Dr. Bohr.

I have received your paper safely and read it with great interest, but I want to look over it again carefully when I have more leisure. Your ideas as to the mode of origin of spectrum and hydrogen are very ingenious and seem to work out well; but the mixture of Planck's ideas with the old mechanics make it very difficult to form a physical idea of what is the basis of it. There appears to me one grave difficulty in your hypothesis, which I have no doubt you fully realise, namely, how does an electron decide what frequency it is going to vibrate at when it

E. Rutherford a N. Bohr, 13 de març de 1913
AHQP, bobina 6, secció 3

1900

1925

1927

C de COMPLEMENTARIETAT

2025

Contraria sunt complementa

L'ús d'un concepte clàssic per a elucidar un fenomen exclou l'ús simultani d'un altre concepte clàssic igualment necessari en d'altres circumstàncies.

Escut d'armes de Niels Bohr, capella del castell de Frederiksborg, Hillerød. Europeana CC BY-NC-ND

1900
1905

1922
1924–1927

D de DUALITAT

2025

“La difracció d’electrons en un cristall […]
és anàloga a la difracció de raigs X […],
i és evident que s’ha d’interpretar
en termes de la mecànica ondulatòria”.

C. J. Davisson and L. H. Germer, “Reflection of electrons by a crystal of nickel”. *Proceedings of the National Academy of Sciences*, 14 (1928): 317–322

Lester Germer i Clinton Davisson (1927)
Bell Laboratories, Alcatel-Lucent USA, courtesy
AIP Emilio Segrè Visual Archives

1900

1925

1935

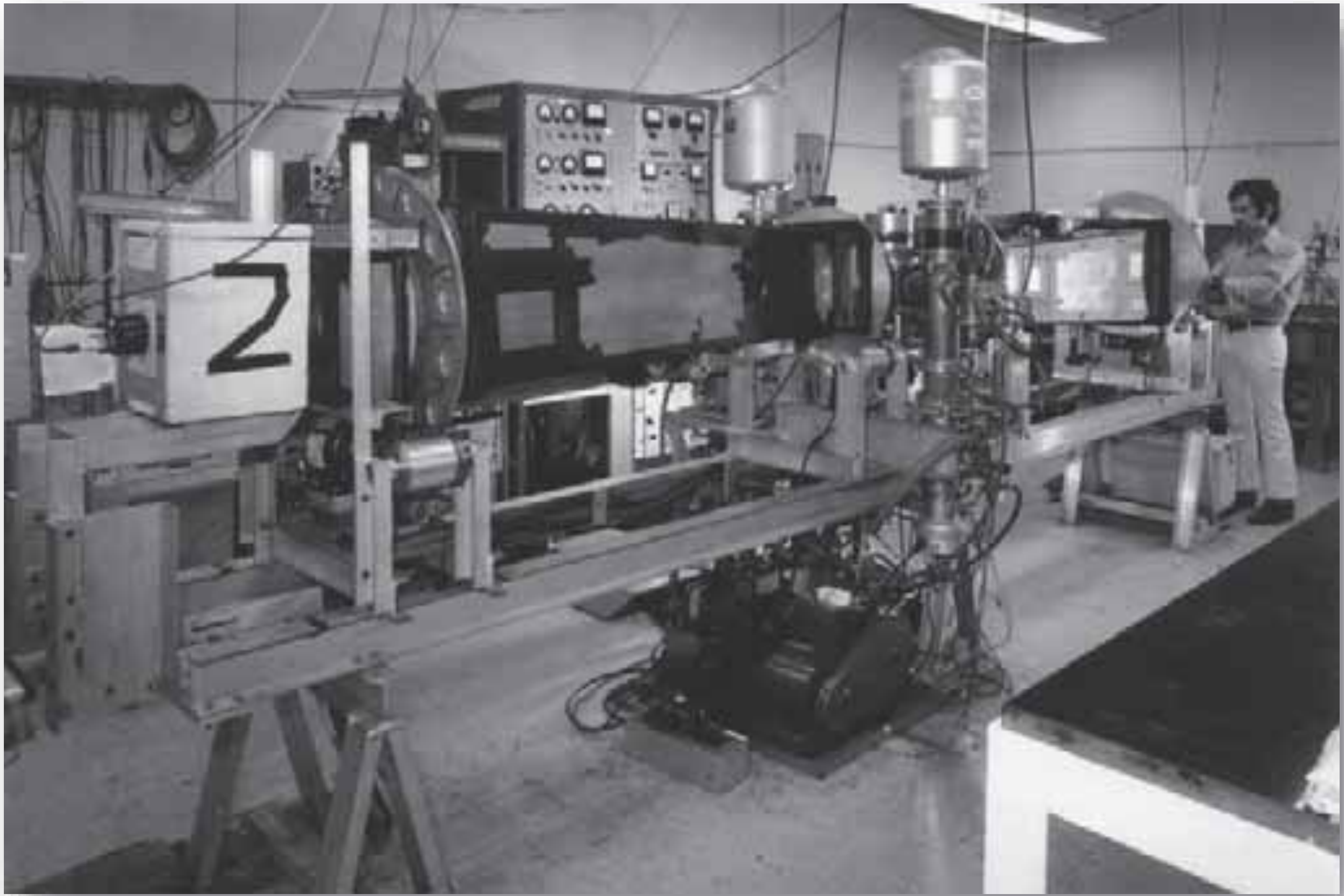
1964

E de ENTRELLAÇAMENT

1972

2022

2025



Stuart Freedman (1944–2012)
Experiments sobre entrellaçament, 1972

Imatge: UC Berkeley

1900

1905

1923

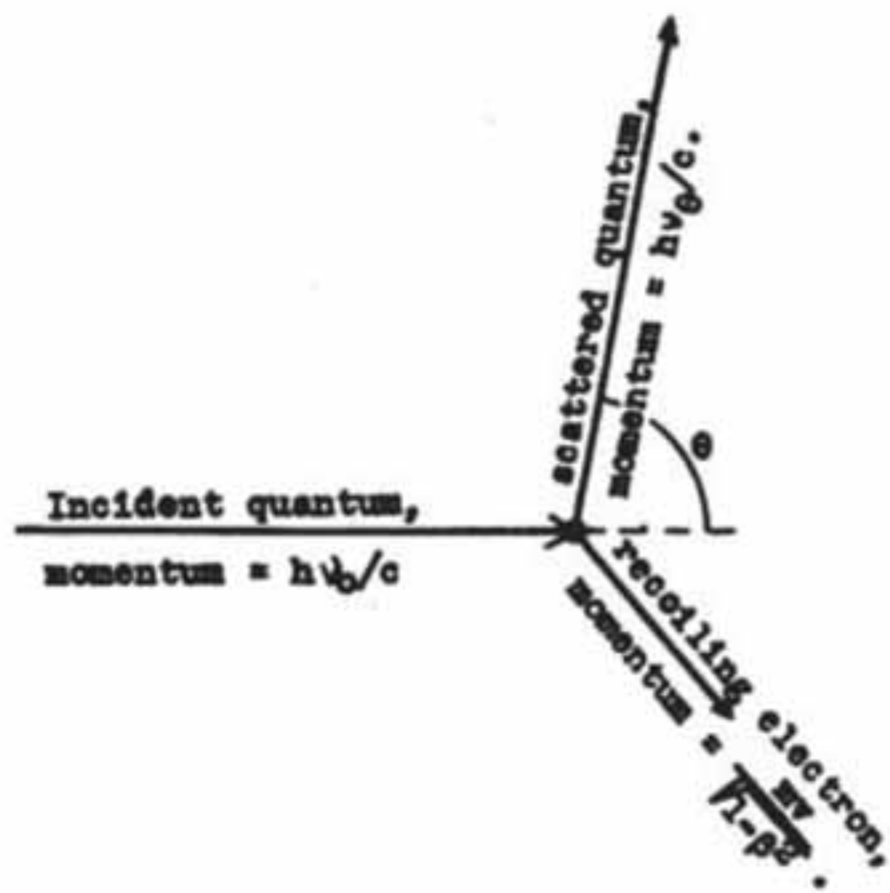
1925

1926

F de FOTÓ

2025

“Aquests experiments indiquen que la dispersió de raigs X és un fenomen quàntic i que el quantum de radiació té moment, a més d’energia”.



Arthur H. Compton, “A quantum theory of the scattering of X-rays by light elements”. *The Physical Review*, 21 (1923): 483–502

1900

1925

G de GÈNERE

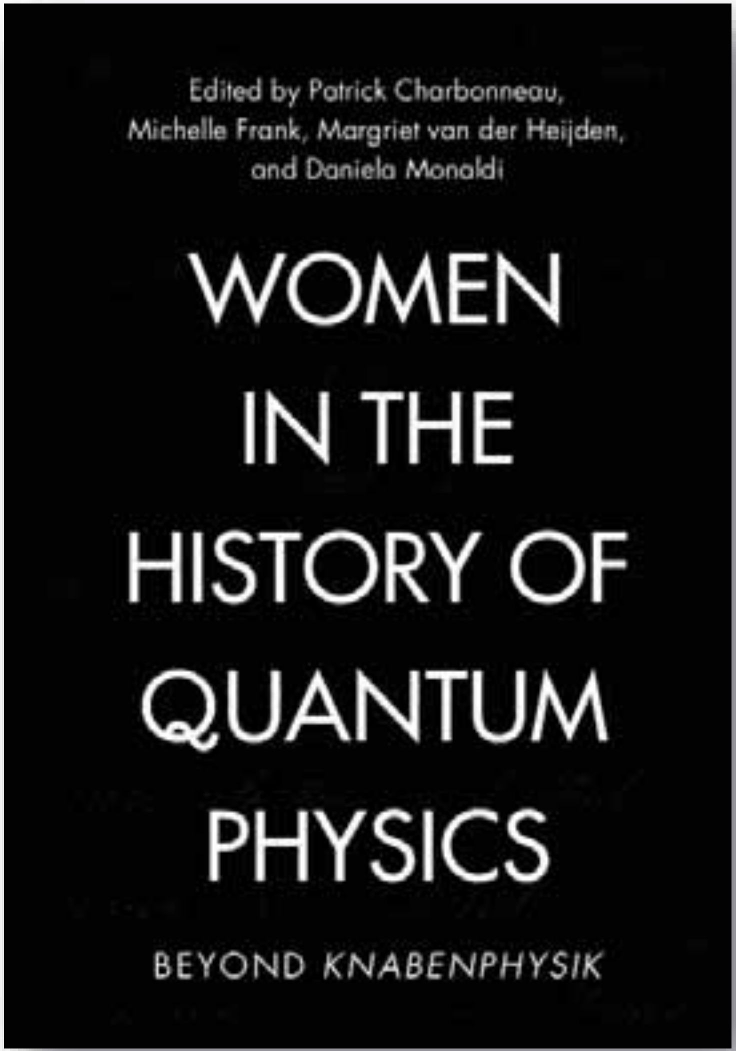
2021

2025

“Hem deixat de banda les heroines més conegudes de la física (Marie Skłodowska Curie, Lise Meitner, Maria Goeppert Mayer) perquè són figures llegendàries que, tanmateix, han perpetuat una mitologia d'excepcionalitat.”

De debò?

Cambridge University Press, 2025



1900

1925

h de *h*

2025

constant de Planck $6{,}62607015 \times 10^{-34}\ \mathrm{J \cdot s}$

1900

1925

1927

I de INDETERMINACIÓ

2025

“En la formulació estricta de la llei causal: ‘Si coneixem el present amb tot detall, podem predir el futur’, no és la conclusió, sinó la premisa que és falsa. No podem, per principi, conèixer el present amb tot detall.”

$$\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$$

W. Heisenberg, “Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik”. *Zeitschrift für Physik* 34 (1927): 172–198.

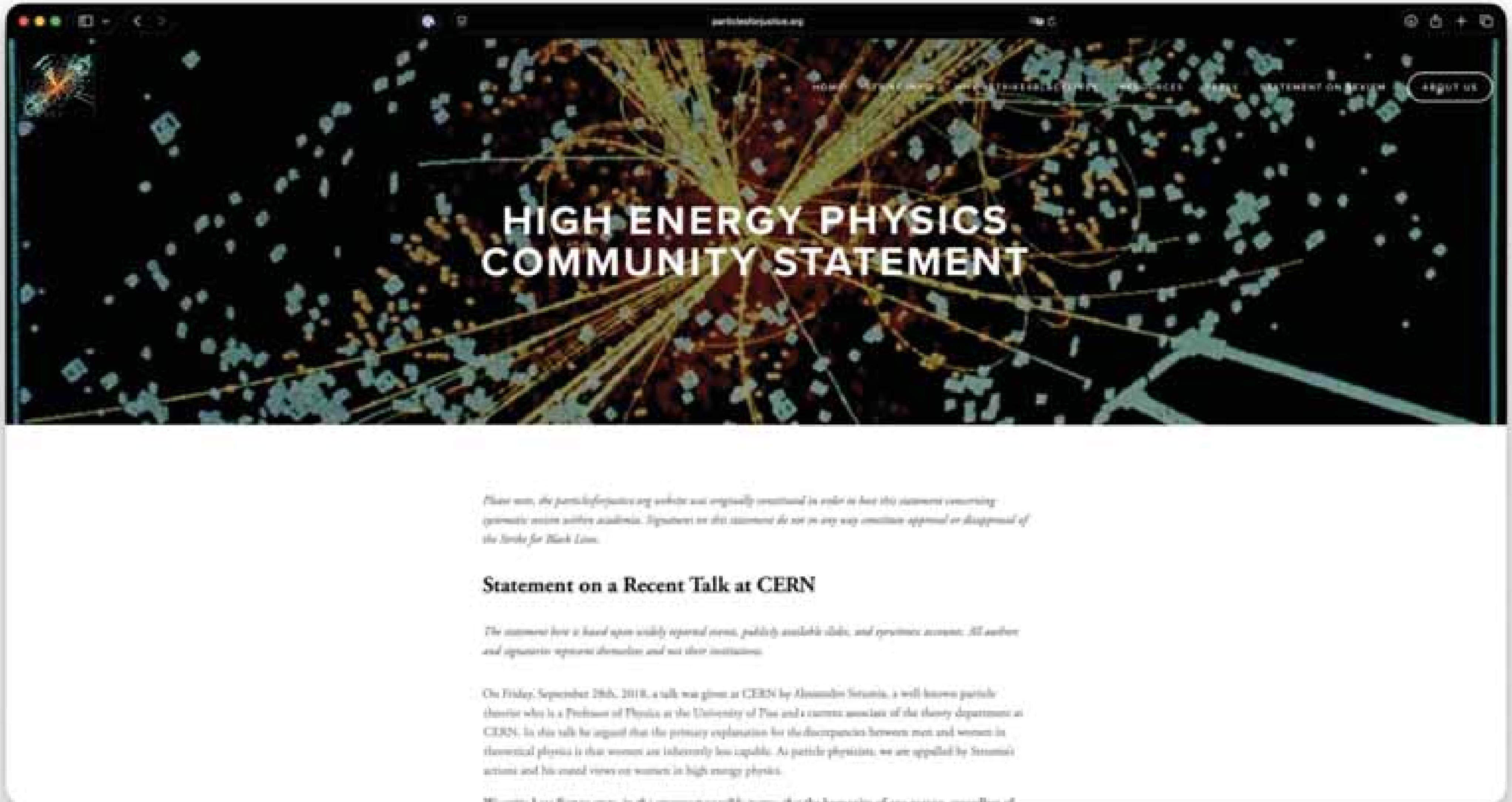
1900

1925

J de JUSTÍCIA

2018

2025


HIGH ENERGY PHYSICS
COMMUNITY STATEMENT
Statement on a Recent Talk at CERN

1900

1925

1941

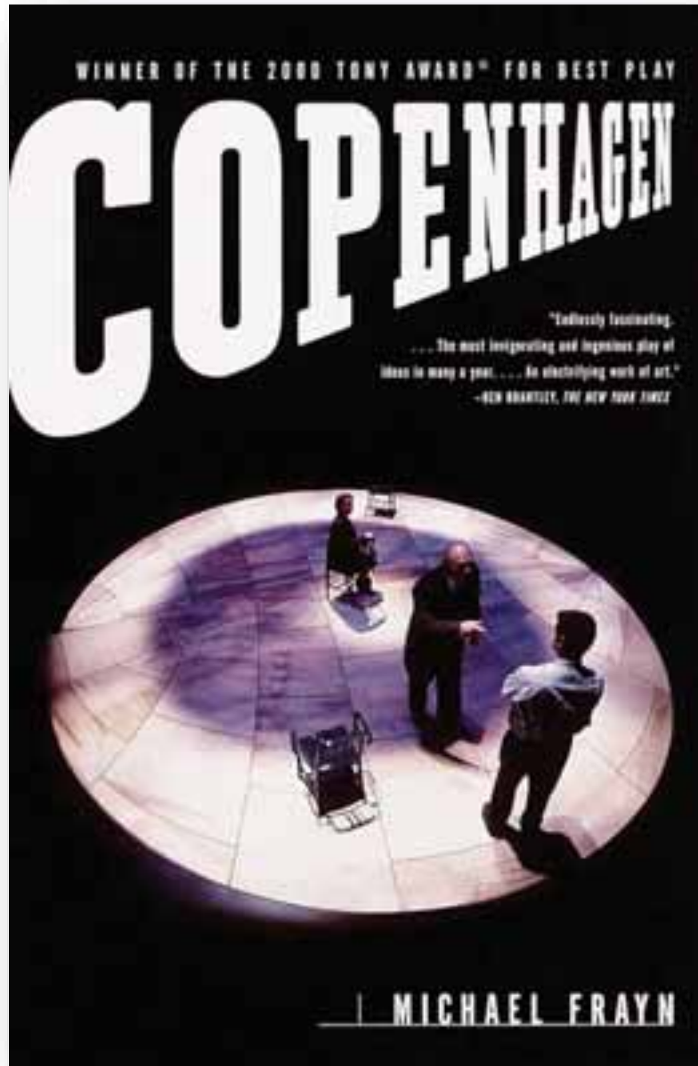
K de KØBENHAVN

1998

2025

“**Margrethe:** Tot és personal! […] Ho sento, però vols que tot sembli heroicament abstracte i lògic. I quan ho expliques sembla que tot encaixi, sí, tot té un principi i un final. Però jo hi era, i quan ho recordo encara hi soc, i quan miro al meu voltant no veig una història! Hi veig confusió i ràbia i gelosia i llàgrimes, i ningú no sap què signifiquen les coses ni cap a on aniran.”

Michael Frayn, *Copenhagen*
London: Methuen, 1998



1900

1924

L de λ

2025

$$\lambda = \frac{h}{p}$$

1900

1917

1938

M de MEITNER

2025

Lise Meitner (1878–1968)

Amanda Hopkinson. "Introduction to Lotte Meitner-Graf: a life". *Jewish Historical Studies* 54 (2023): 73-97.
DOI: 10.14324/111.444.jhs.2023v54.05

1900

1911

1925

1938

1945

N de NUCLI

2025

“El nucli de l’urani, en capturar un neutró, **es divideix en dos nuclis** de la mateixa mida que tenen una **energia total de 200 MeV**…

“Aquesta quantitat d’energia coincideix amb la diferència entre l’energia d’enllaç de l’urani i la d’elements al mig de la taula periòdica.

“Aquest procés l’anomenem **‘fissió’.**”


Feb. 11, 1939 NATURE

Letters to the Editor

Meitner, Lise and Frisch, O. R. “Disintegration of Uranium by Neutrons: a New Type of Nuclear Reaction”. *Nature* (11 Feb 1939): 239–240.

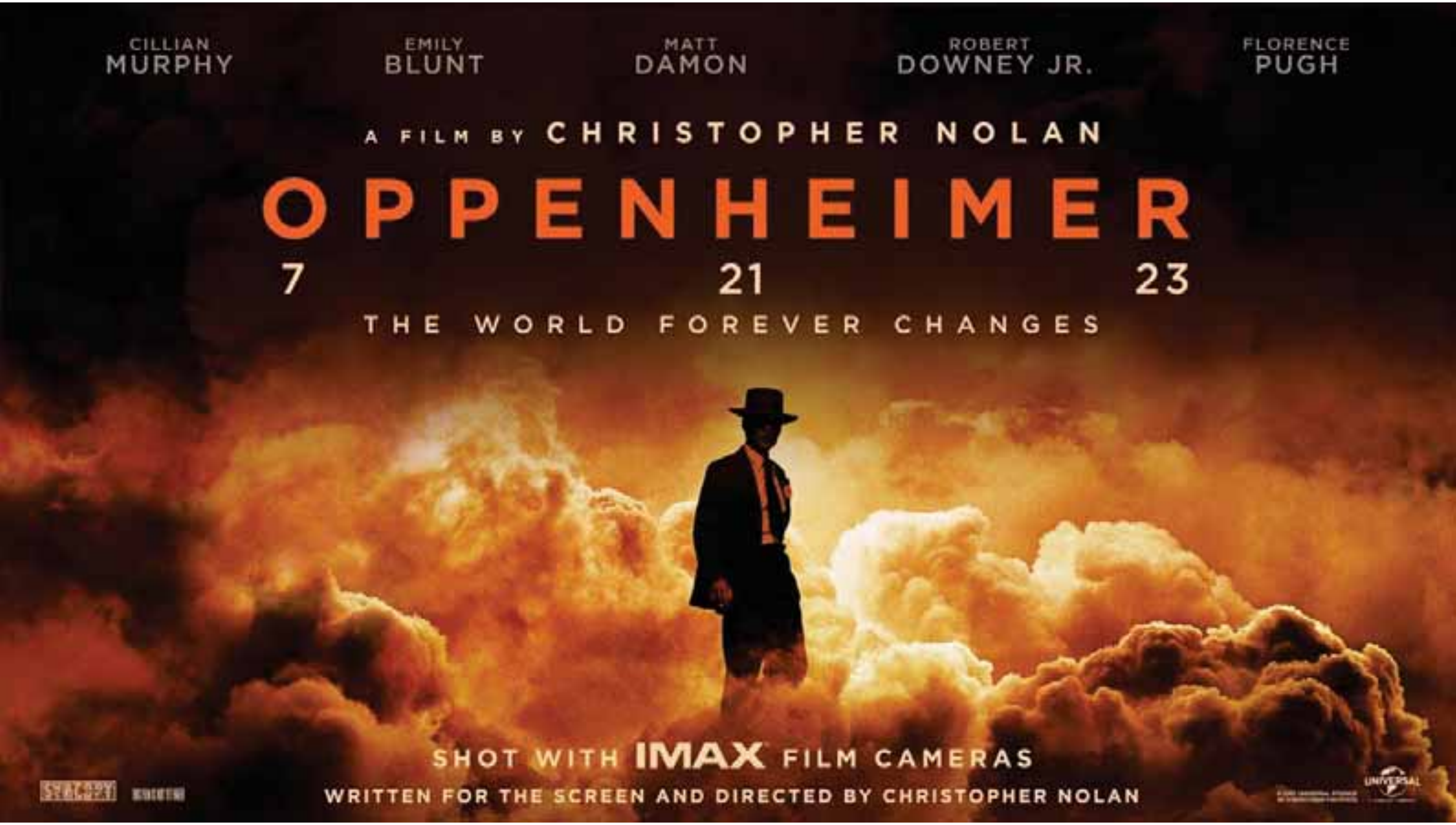
1900

1925

1945

O de OPPENHEIMER

2025


CILLIAN
MURPHY
EMILY
BLUNT
MATT
DAMON
ROBERT
DOWNEY JR.
FLORENCE
PUGH
A FILM BY CHRISTOPHER NOLAN
OPPENHEIMER
7 21 23
THE WORLD FOREVER CHANGES
SHOT WITH IMAX FILM CAMERAS
WRITTEN FOR THE SCREEN AND DIRECTED BY CHRISTOPHER NOLAN
UNIVERSAL

1900

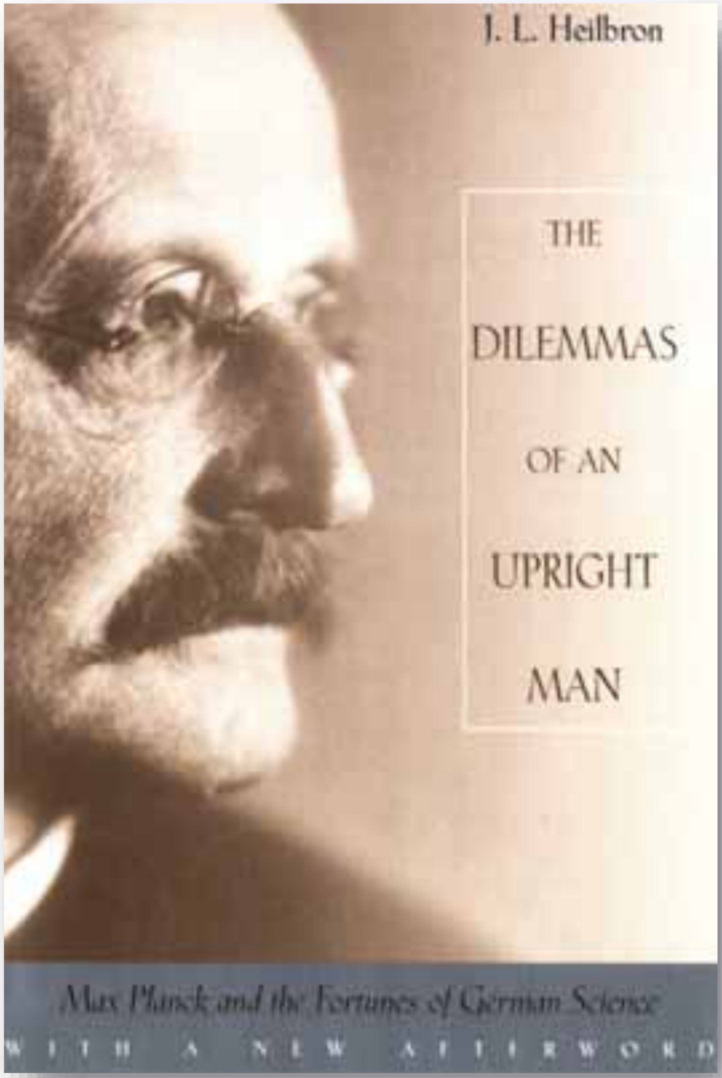
1925

P de PLANCK

2025

“L’orgull per l’Alemanya imperial
i el compromís amb l’ideal acadèmic
de la unitat del coneixement
foren els pilars de la política científica de Planck.”

John L. Heilbron, *The dilemmas of an upright man. Max Planck as spokesman for German science*. Berkeley: University of California Press, 1986. Reeditat amb nou subtítol: *Max Planck and the fortunes of German science (with a new afterword)*. Cambridge, MA: Harvard University Press, 2000.



Physikalisch-Technische Reichanstalt/ Bundesanstalt

Berlin, 1913
J. Goldiner, Berlin
Wikimedia Commons

1900

1925

Q de QUANTUM

2025

$$E = h\nu$$

1900

1925

1930

R de RADIOACTIVITAT

2025

"Senyores i senyors radioactius…"

W. Pauli a L. Mietner, 04/121930
CERN Document Server Meitner_0393

Original - Photocopie of PLC 0393

Abschrift/15.12.56 PM

Offener Brief an die Gruppe der Radioaktiven bei der Gauvereins-Tagung zu Tübingen.

Abschrift

Physikalisches Institut
der Eidg. Technischen Hochschule
Zürich

Zürich, 4. Dez. 1930
Gloriastrasse

Liebe Radioaktive Damen und Herren,

Wie der Ueberbringer dieser Zeilen, den ich huldvollst anzuhören bitte, Ihnen des näheren auseinandersetzen wird, bin ich angesichts der "falschen" Statistik der N- und Li-6 Kerne, sowie des kontinuierlichen beta-Spektrums auf einen verzweifelten Ausweg verfallen um den "Wechselsatz" (1) der Statistik und den Energiesatz zu retten. Nämlich die Möglichkeit, es könnten elektrisch neutrale Teilchen, die ich Neutronen nennen will, in den Kernen existieren, welche den Spin 1/2 haben und das Ausschliessungsprinzip befolgen und sich von Lichtquanten ausserdem noch dadurch unterscheiden, dass sie nicht mit Lichtgeschwindigkeit laufen. Die Masse der Neutronen müsste von derselben Grossenordnung wie die Elektronenmasse sein und jedenfalls nicht grösser als 0,01 Protonenmasse.- Das kontinuierliche beta- Spektrum wäre dann verständlich unter der Annahme, dass beim beta-Zerfall mit dem Elektron jeweils noch ein Neutron emittiert wird, derart, dass die Summe der Energien von Neutron und Elektron konstant ist.

1900

1911
1913

1921

1924

1927

1930

1933

S de SOLVAY

2025

1927

1900

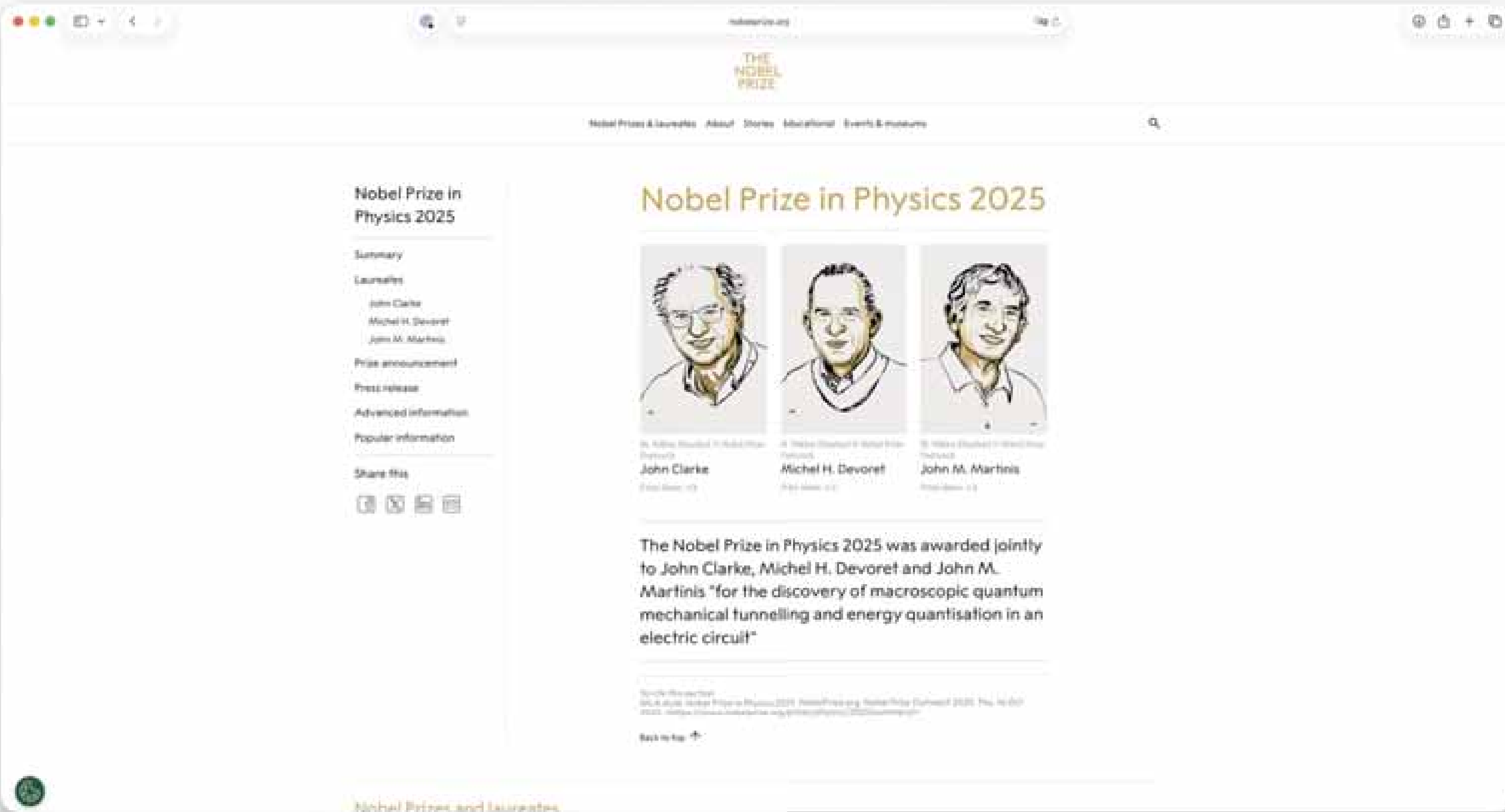
1925

1928

T de TÚNEL

1986

2025



nobelprize.org
THE NOBEL PRIZE
Nobel Prizes & laureates
About
Stories
Educational
Events & museums
Nobel Prize in Physics 2025
Summary
Laureates
John Clarke
Michel H. Devoret
John M. Martinis
Prize announcement
Press release
Advanced information
Popular information
Share this
Nobel Prize in Physics 2025
John Clarke
Michel H. Devoret
John M. Martinis
The Nobel Prize in Physics 2025 was awarded jointly to John Clarke, Michel H. Devoret and John M. Martinis "for the discovery of macroscopic quantum mechanical tunnelling and energy quantisation in an electric circuit"
Back to top
Nobel Prizes and laureates

1900

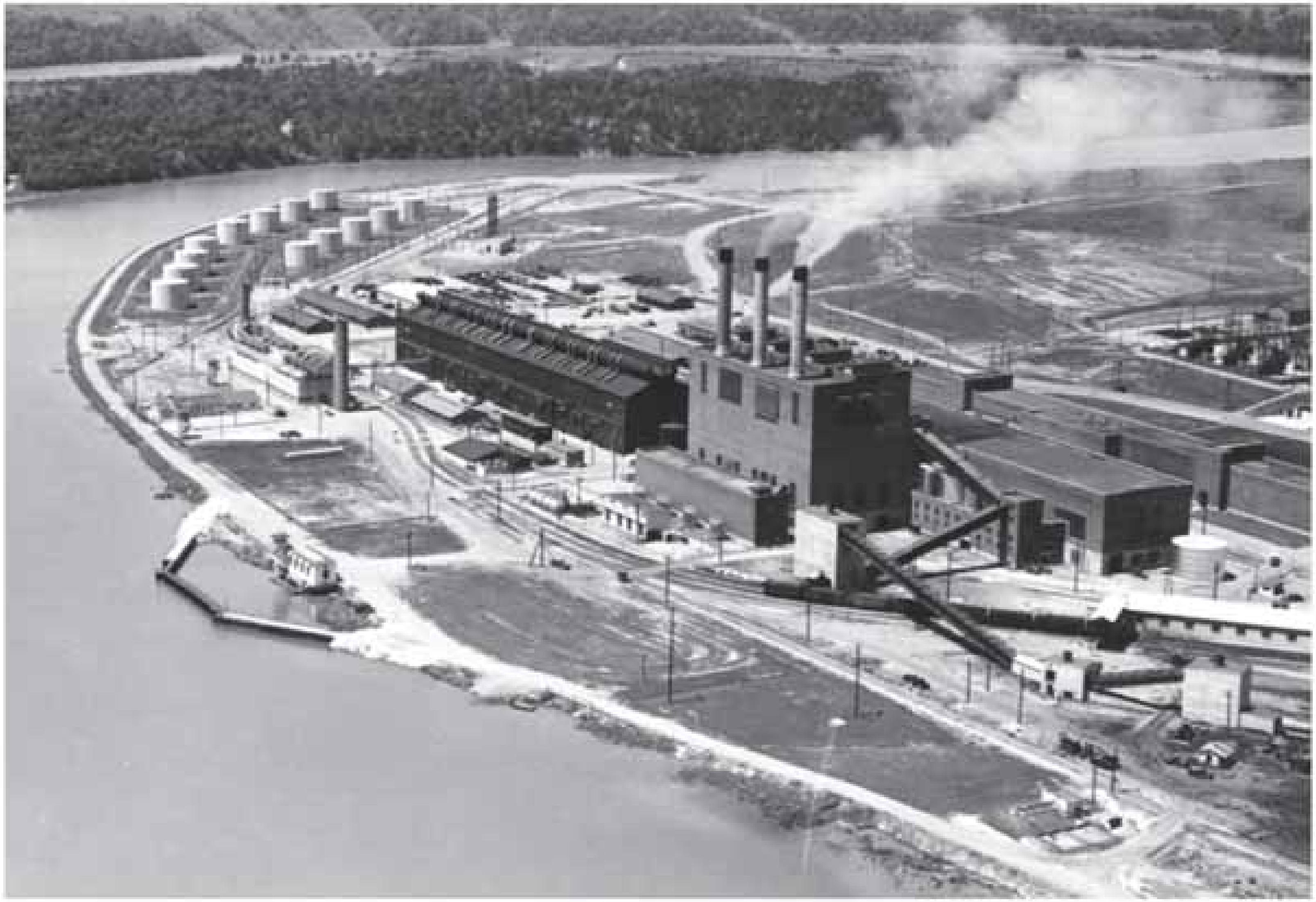
1925

1938

1945

U de URANI

2025



Planta de separació d'isòtops
Oak Ridge, Tennessee
US Department of Energy
Ed Wescott

“Hecht s’endinsa en els mons nuclears africans, fixant-se en els miners i en el risc ocupacional de l’exposició a la radiació. És una mina un lloc de treball nuclear si no es detecta ni es mesura el nivell de radiació?”

G. Hecht, *Being Nuclear. Africans and the Global Uranium Trade*. Cambridge, MA: MIT Press, 2012

1900

1925
1927

V de VERITAT

2025

“Al cor del progrés científic hi ha
la recerca de la veritat.

“Però […] la ciència, la medicina i la tecnologia actuals
pateixen l’atac de dogmes ideològics
que primen la identitat de grup davant l’esforç individual
[i] que injecten política al cor del mètode científic.

“Aquestes agendes no només distorsionen la veritat,
sinó que han erosionat la confiança pública,
han minat la integritat de la recerca,
han ofegat la innovació,
i han afeblit la nostre competitivitat.”

Executive Order 14177 of 23/01/2025, President’s Council of
Advisors on Science and Technology


Presidential Documents

Executive Order 14177 of January 23, 2025

President's Council of Advisors on Science and Technology

1900

1925

1949

1957

W de WU

2022
2025

Chien-Shiung Wu (1912–1997)

Science Service (Smithsonian Institution)
Restored by Adam Cuerden, Flickr
Wikimedia Commons

10

Untangling Entanglement History: Early Quantum Contributions of Chien-Shiung Wu

MICHELLE FRANK

> Science is not static but ever growing and dynamic. It involves not just the addition of new information, but the continuous revision of old knowledge. From a flat earth to a round globe, from classical Newtonian Mechanics to Quantum Mechanics, there are many illustrations. It is the courage to doubt what has long been established and the incessant search for its verification and proof that pushes the wheel of science forward.[1]
>
> *Chien Shiung Wu*
> *AAUW Achievement Award Acceptance Speech, 1959*
> *& Nishina Memorial Lecture 1983*

10.1 Introduction

In October 2022, the Nobel Prize Committee in Stockholm, Sweden, released a public statement championing experimental innovation. The three physicists recognized that year – John Clauser, Alain Aspect, and Anton Zeilinger – contributed to the world's understanding of quantum entanglement over a span of decades. Each devised increasingly sophisticated and innovative "Bell tests" to probe whether hidden

Portions of this work were originally published by *Scientific American* in Spring, 2023. Sincere thanks are due to my WiHQP co-editors, Daniela Monaldi, Patrick Charbonneau, and Margriet van der Heijden. [illegible] Thank you also to anonymous reviewers for thoughtful suggestions as this chapter developed. [illegible] the Consortium for History of Science, Technology and Medicine, the Center for History of Physics at the American Institute of Physics, [illegible] for fellowship and funding support. [illegible] the CUNY Graduate Center [illegible] Columbia University's Rare Book and Manuscript Library, [illegible] AIP's Niels Bohr Library & Archives, the Nobel Archives, the Institute for Advanced Study, and the CalTech Archives and Special Collections, all of whom offered valuable research support. [illegible] the Columbia University Physics faculty for providing insight about Wu's years at Columbia. [illegible] Any errors that remain are my own.

[1] C. S. Wu Papers, Rare Book and Manuscript Library, Columbia University, Box 6, Folder 21. Published in Wu (2008).

Michelle Frank, a P. Charbonneau, M. Frank, M. van der Heijden i D. Monaldi, eds. *Women in the History of Quantum Physics* (Cambridge: Cambridge University Press, 2025)

Marta Jordi, a P. Charbonneau, M. Frank, M. van der Heijden i D. Monaldi, eds. *Women in the History of Quantum Physics* (Cambridge: Cambridge University Press, 2025)

15

Out of the Ivory Tower: Maria Lluïsa Canut and X-Ray Crystallography

MARTA JORDI TALTAVULL

15.1 Introduction

Maria Lluïsa Canut Ruiz (1924–2005) was a physicist and one of the most prominent crystallographers in Spain during the Francoist regime. Together with the natural scientist José Luis Amorós Portolés (1920–2001), her partner in science and in life, she was awarded the Francisco Franco Prize in Sciences in 1963 for their joint contribution to crystallography, and she received the Research Recognition Award of the Southern Illinois University in 1968, among other accolades. Both also achieved international recognition.[1]

Canut spent her scientific career in Barcelona, Madrid, and Illinois. Over the course of approximately 20 years she published more than 60 scientific papers and co-authored three books, all exploring and steadily mastering a novel and original field of research: the relationship between X-ray diffuse scattering through crystals and their thermal dynamics. X-Ray crystallography traces its origins back to a ground-breaking discovery in quantum physics made in 1912: X-rays passing through crystals produce diffraction patterns that are directly related to the microscopic structure of the crystals (Eckert, 2012). Three decades later, diffuse zones observed in X-ray diffraction patterns began to be interpreted in terms of the dynamics and non-ideal features of crystal structures. This was Canut's and Amorós' field of interest.

Amorós has been recognized as a prominent crystallographer since the early 1960s.[2] Two of his former PhD students have also written about his scientific trajectory and

I thank Joan March, Agustí [illegible], and Guillem Pons for their generosity in sharing with me their archival findings and discussions about the topic, and María Victoria López-Acevedo and Sol López for their hospitality at UCM. I also thank Oscar [illegible] for his support as in charge of the IME archives. Finally, I thank the editors for their admirable effort and patience in the revision of this chapter and the whole book.

[1] Many uncatalogued primary sources have been accessed to write the chapter, in particular, Canut's records at: Archivo General de la Administración (AGA, General Archive for the Administration), Consejo Superior de Investigaciones Científicas (CSIC, Superior Council for Scientific Research), Universitat de Barcelona (UB, University of Barcelona), Southern Illinois University (SIU), Fundación Juan March (Juan March Foundation), and Institut Menorquí d'Estudis (IME, Menorcan Institute for Studies).

[2] See, for example, Ewald (1962).

1900

1912

1925

X de RAIGS X

2025

M. von Laue, W. Friedrich i P. Knipping, comunicació a l'Acadèmia de Ciències bavaresa del descobriment de la difracció de raigs X en cristalls (04/05/1912)
P. Forman, "The discovery of the difraction of X-rays by crystalls: A critique of the myths", *Archive for History of Exact Sciences*, 6 (1969): 38-71.

1900

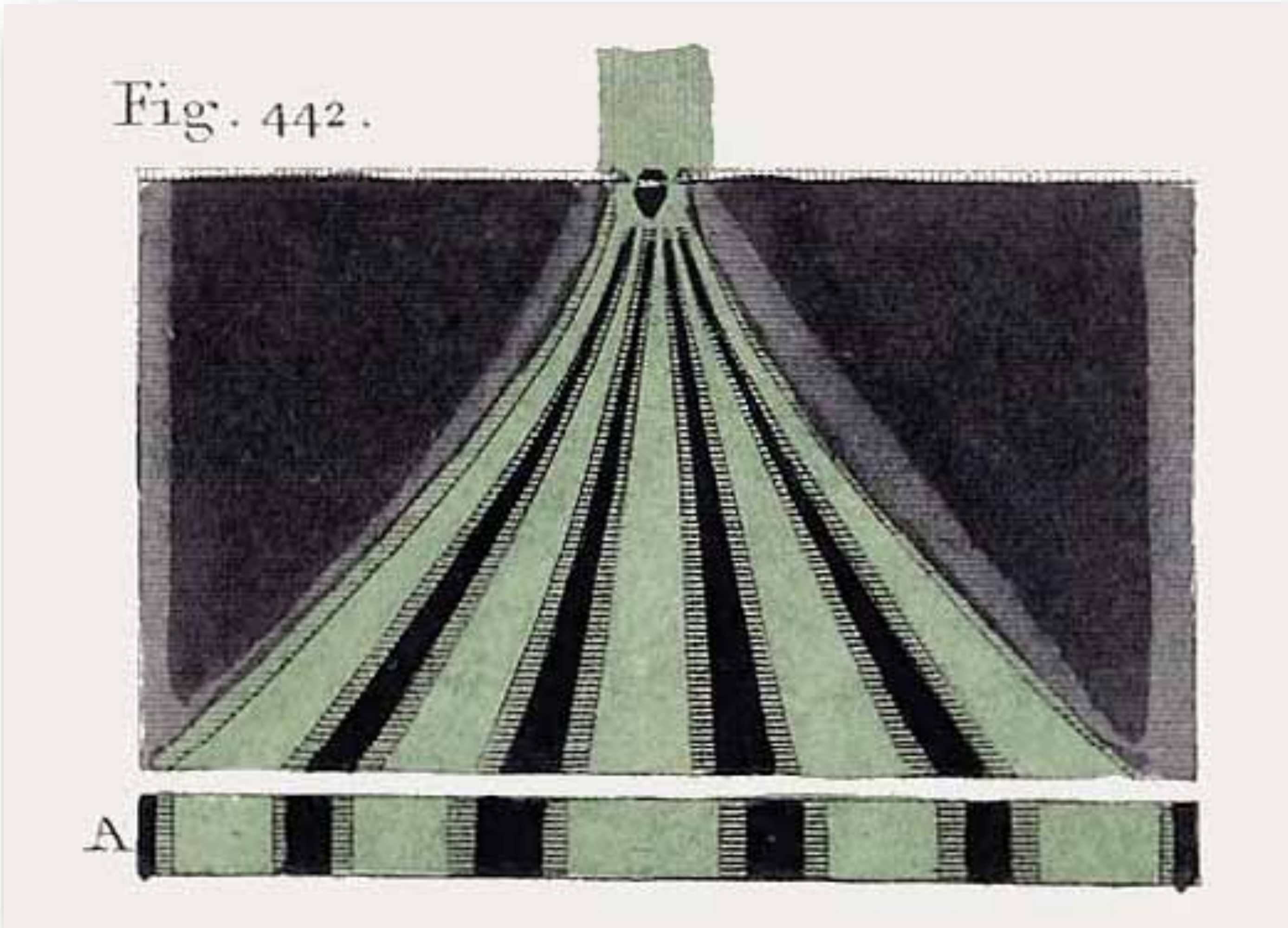
1925

Y de YOUNG

2025

Thomas Young

Demostració experimental de la llei d'interferència de la llum



Thomas Young, *A Course of Lectures on Natural Philosophy and the Mechanical Arts* (1807), pl. XXX

1900

1925

1927

1957

Z de ZÚRIC

1986

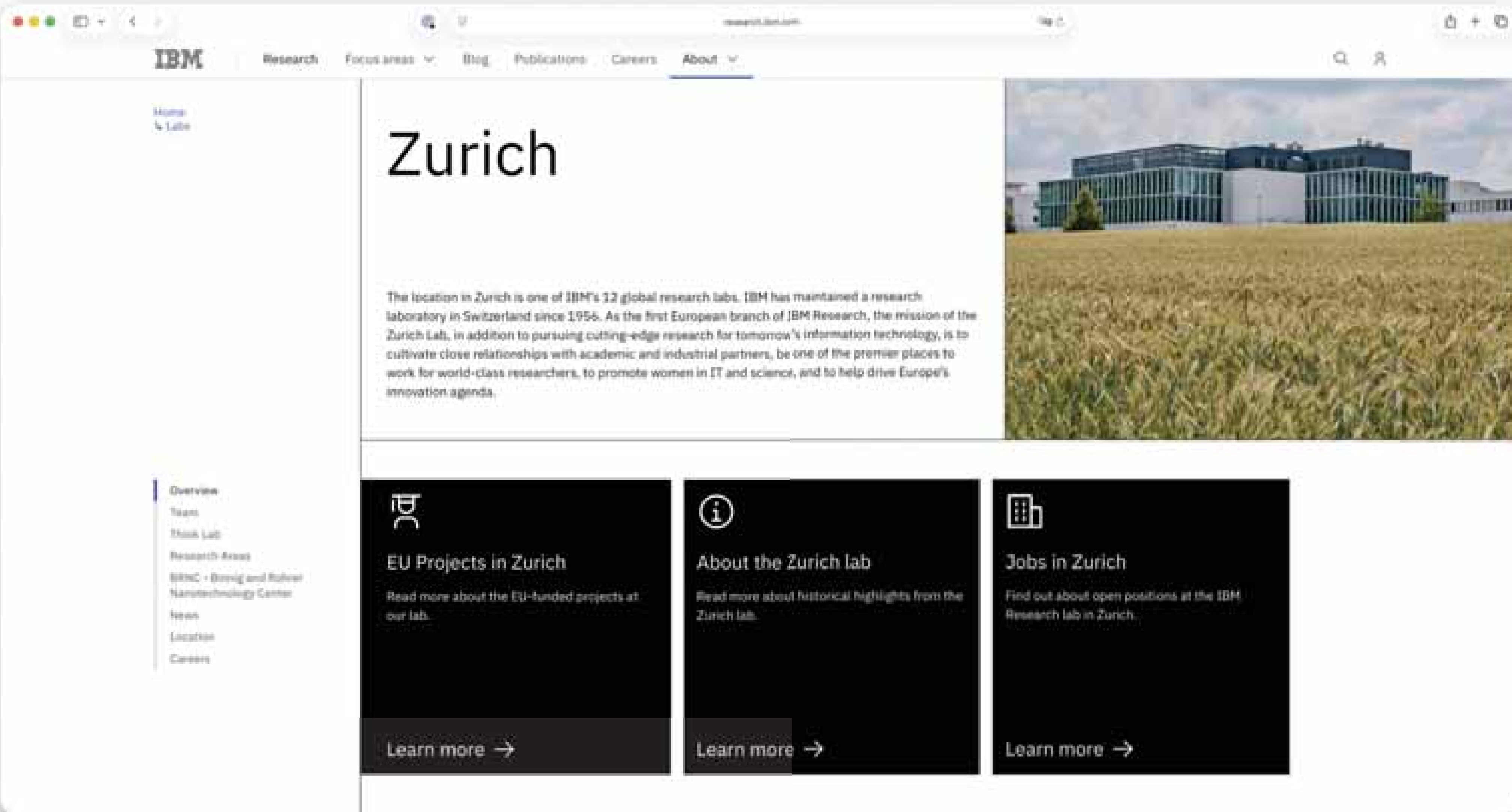
1987

2025

UNIVERSITAS TURICENSIS

MDCCC XXXIII

Institut de Física,
Escola Politècnica de Zurich
Imatge: ETH-Bibliotek, Bildarchive


IBM
Research
Focus areas
Blog
Publications
Careers
About
Home
Labs
Zurich
The location in Zurich is one of IBM's 12 global research labs. IBM has maintained a research laboratory in Switzerland since 1956. As the first European branch of IBM Research, the mission of the Zurich Lab, in addition to pursuing cutting-edge research for tomorrow's information technology, is to cultivate close relationships with academic and industrial partners, be one of the premier places to work for world-class researchers, to promote women in IT and science, and to help drive Europe's innovation agenda.
Overview
Team
Think Lab
Research Areas
BRNC - Binnig and Rohrer Nanotechnology Center
News
Location
Careers
EU Projects in Zurich
Read more about the EU-funded projects at our lab.
Learn more
About the Zurich lab
Read more about historical highlights from the Zurich lab.
Learn more
Jobs in Zurich
Find out about open positions at the IBM Research lab in Zurich.
Learn more

ABECEDARI QUÀNTIC

A de **ARXIU**
B de **BOHR**
C de **COMPLEMENTARIETAT**
D de **DUALITAT**
E de **ENTRELLAÇAMENT**
F de **FOTÓ**
G de **GÈNERE**
h de $\hbar$
I de **INDETERMINACIÓ**
J de **JUSTÍCIA**
K de **KØBENHAVN**
L de [illegible]
M de **MEITNER**
N de **NUCLI**
O de **OPPENHEIMER**
P de **PLANCK**
Q de **QUANTUM**
R de **RADIOACTIVITAT**
S de **SOLVAY**
T de **TÚNEL**
U de **URANI**
V de **VERITAT**
W de **WU**
X de **RAIGS X**
Y de **YOUNG**
Z de **ZÜRIC**

"Canviar la percepció pública sobre el funcionament de la ciència no serà fàcil, però podem començar pels **estudiants de graus en Ciències.**

"Malauradament, la majoria dels plans d'estudi són plens d'**assignatures molt tècniques** i no inclouen la història i la filosofia de la ciència.

"Canviar aquests plans seria el primer pas per crear **un públic que entengui com es fa la ciència**.

"Això vol dir prendre **decisions dràstiques** per incorporar **una visió més àmplia i més profunda** a uns plans d'estudi atapeïts de coneixements bàsics. És urgent que els científics facin concesions en la seva docència pel bé comú."

Thorp, Holden H. "Teach philosophy of science". *Science* 384 (2024): 141.

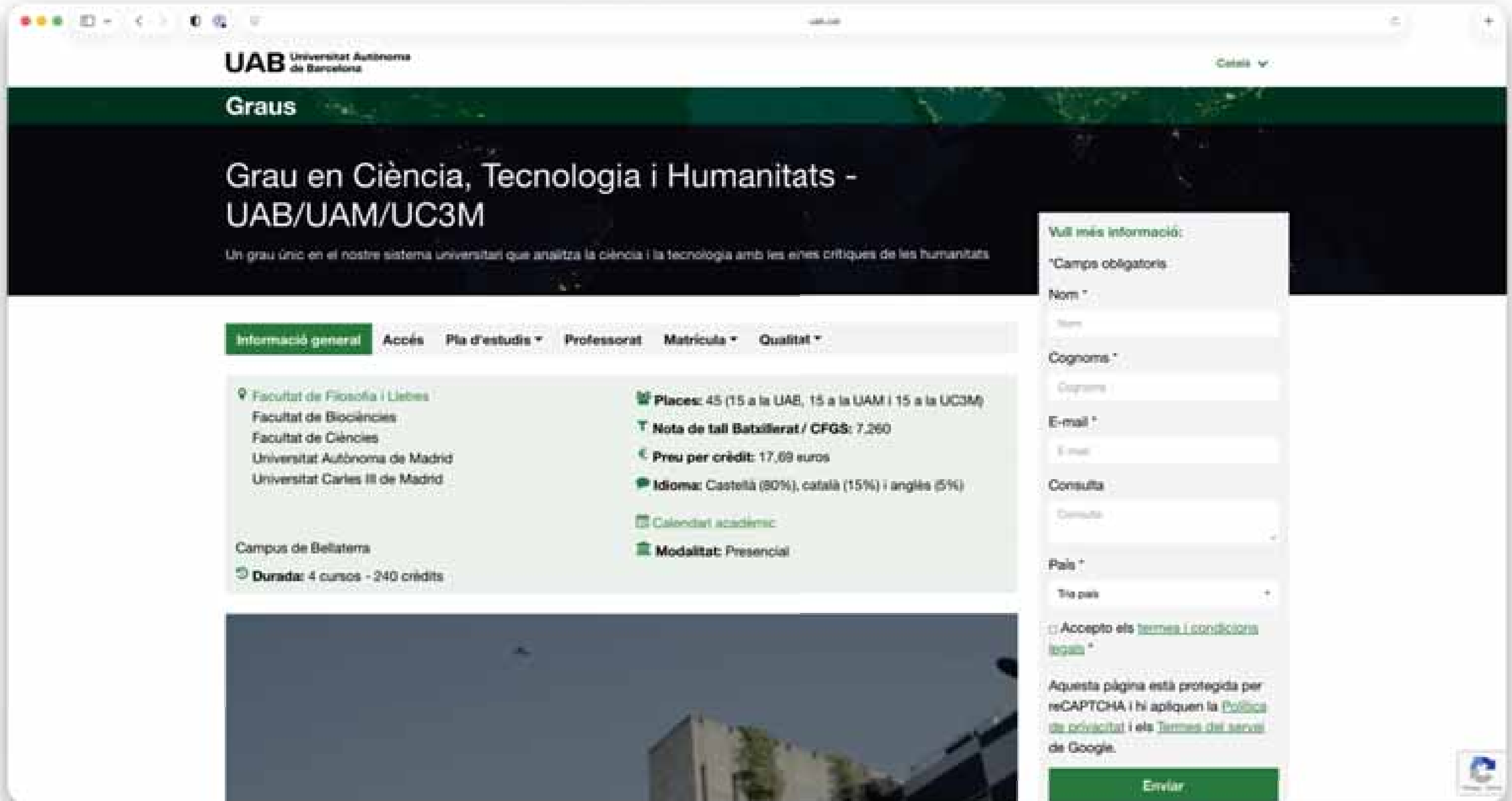

EDITORIAL

Teach philosophy of science

"...it is the essence of science to attempt to make discoveries that change the way scientists think."

H. Holden Thorp

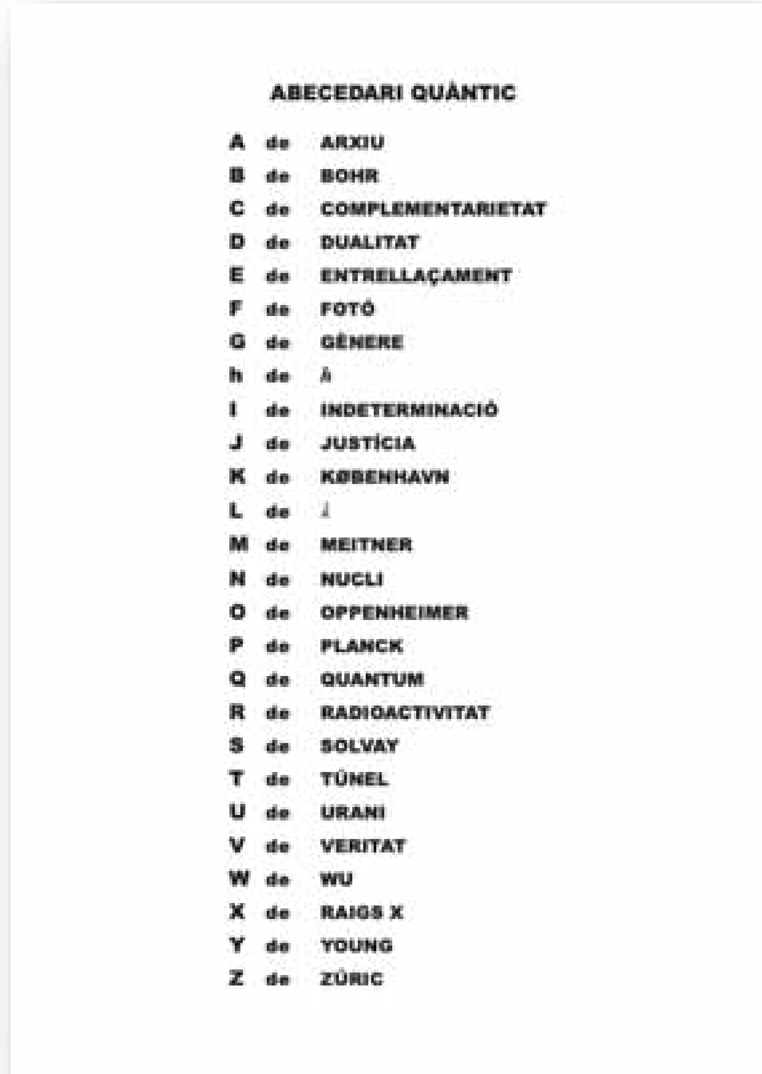
–H. Holden Thorp


UAB Universitat Autònoma de Barcelona
Graus
Grau en Ciència, Tecnologia i Humanitats - UAB/UAM/UC3M
Un grau únic en el nostre sistema universitari que analitza la ciència i la tecnologia amb les eines crítiques de les humanitats
Informació general
Accés
Pla d'estudis
Professorat
Matrícula
Qualitat
Facultat de Filosofia i Lletres
Facultat de Biociències
Facultat de Ciències
Universitat Autònoma de Madrid
Universitat Carlos III de Madrid
Campus de Bellaterra
Durada: 4 cursos - 240 crèdits
Places: 45 (15 a la UAB, 15 a la UAM i 15 a la UC3M)
Nota de tall Batxillerat / CFGS: 7,260
Preu per crèdit: 17,69 euros
Idioma: Castellà (80%), català (15%) i anglès (5%)
Calendari acadèmic
Modalitat: Presencial
Vull més informació:
*Camps obligatoris
Nom *
Cognoms *
E-mail *
Consulta
País *
Tria país
Accepto els termes i condicions legals *
Aquesta pàgina està protegida per reCAPTCHA i hi apliquen la Política de privacitat i els Termes del servei de Google.
Enviar

abecedari quàntic

Xavier Roqué
iHC i Departament de Filosofia UAB

Xerrada inaugural de la mostra **100 anys de la mecànica quàntica**
CRAI Biblioteca de Física i Química
Any Internacional de la Ciència i la Tecnologia Quàntiques
UB, 12 de novembre 2025



ABECEDARI QUÀNTIC

A	de	ARXIU
B	de	BOHR
C	de	COMPLEMENTARIETAT
D	de	DUALITAT
E	de	ENTRELLAÇAMENT
F	de	FOTÓ
G	de	GÈNERE
h	de	$\hbar$
I	de	INDETERMINACIÓ
J	de	JUSTÍCIA
K	de	KØBENHAVN
L	de	[illegible]
M	de	MEITNER
N	de	NUCLI
O	de	OPPENHEIMER
P	de	PLANCK
Q	de	QUANTUM
R	de	RADIOACTIVITAT
S	de	SOLVAY
T	de	TÚNEL
U	de	URANI
V	de	VERITAT
W	de	WU
X	de	RAIGS X
Y	de	YOUNG
Z	de	ZÜRIC