GLOBAL SCIENCE IN A FRACTURED WORLD

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THE STATE OF SCIENCE

ACCELERATING SCIENCE

Current scientific trends

- **Unprecedented opportunities** for science with new insights, sources, tools and technologies promising major breakthroughs.

LIFE

genes

proteins, cells

MATTER

atoms

particles, forces

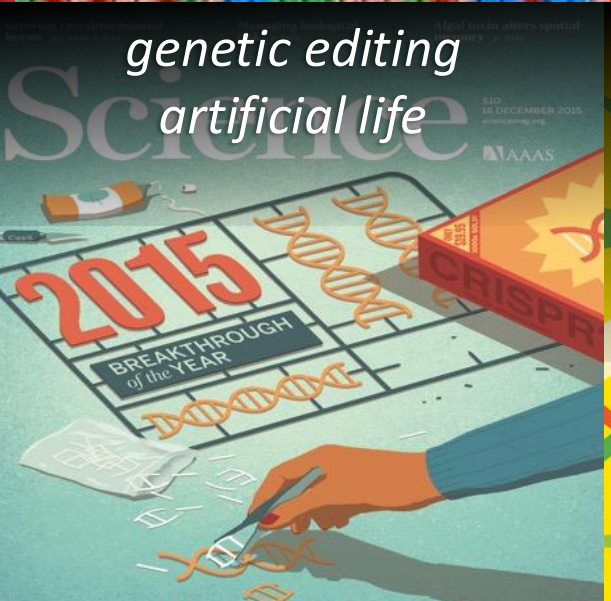
INFORMATION

bits

algorithms, networks

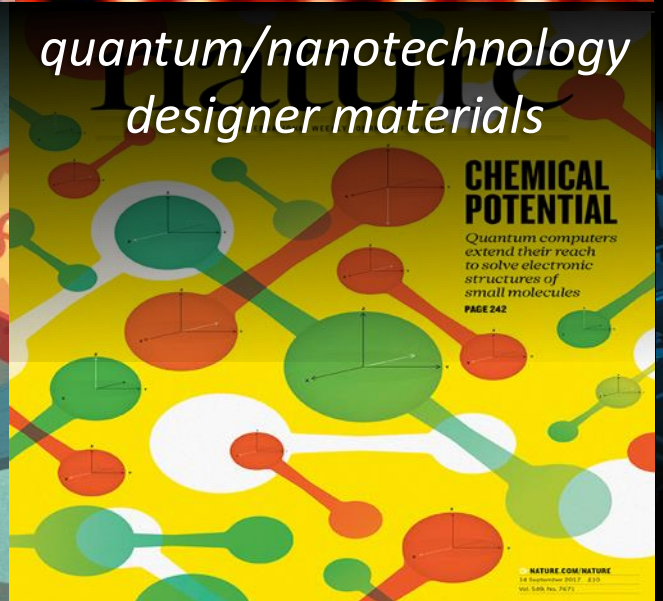
genetic editing

artificial life



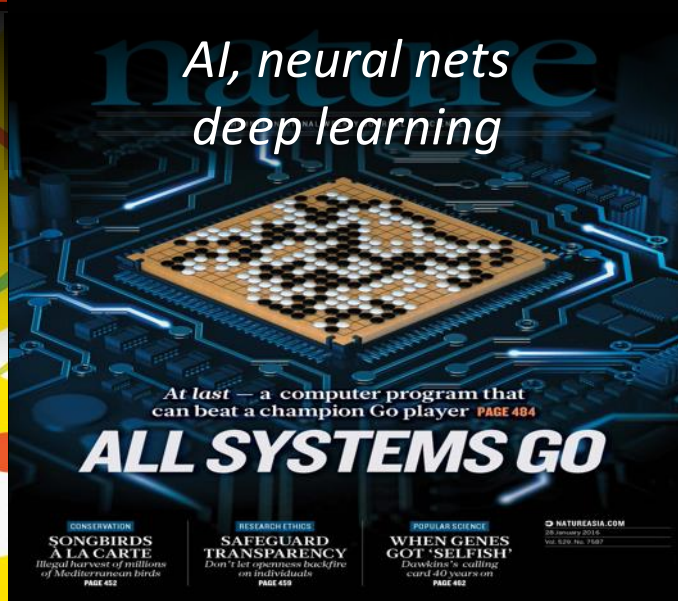
quantum/nanotechnology

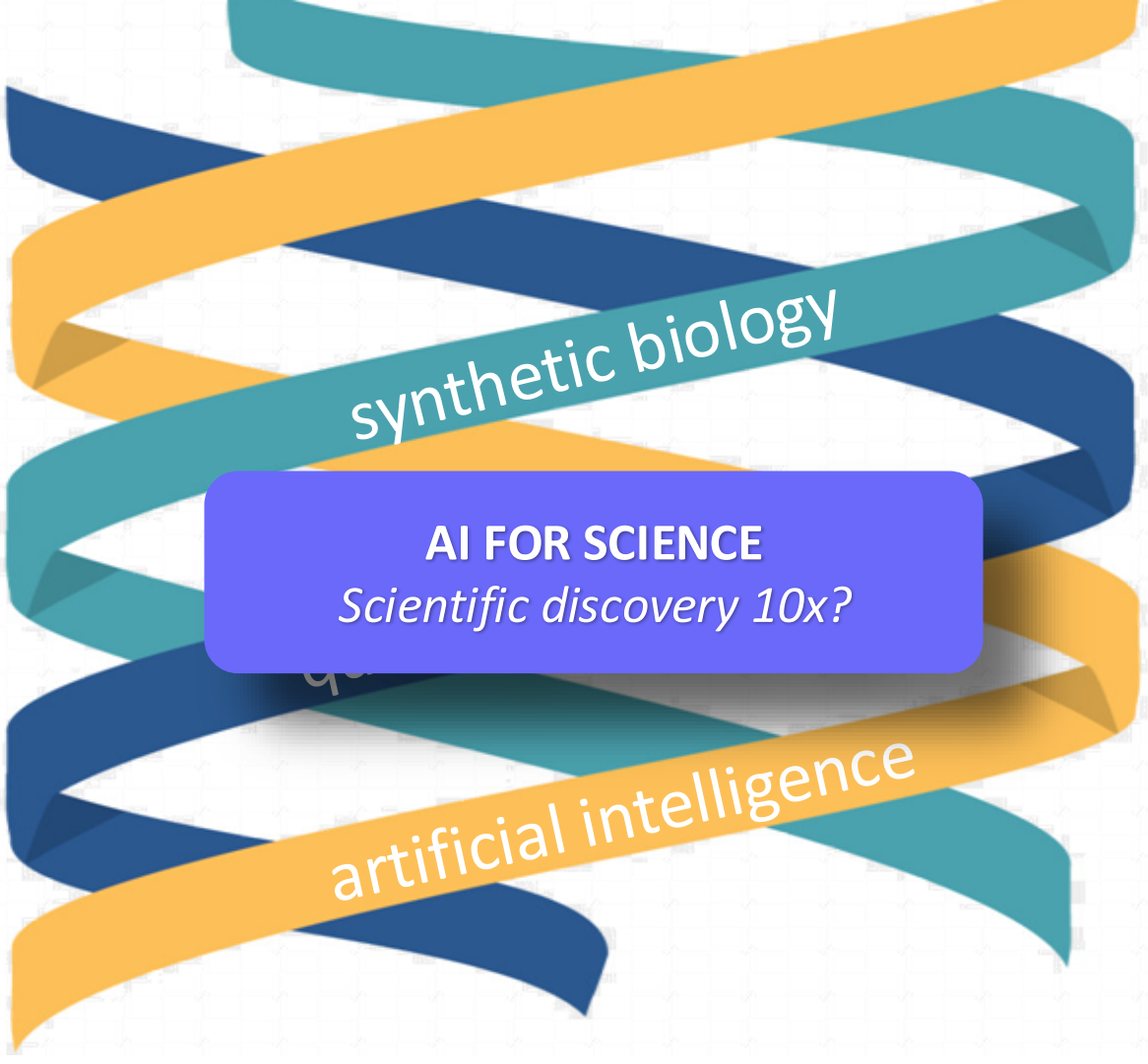
designer materials



AI, neural nets

deep learning




synthetic biology
AI FOR SCIENCE
Scientific discovery 10x?
artificial intelligence

ACCELERATING SCIENCE Cont.

Current scientific trends

- **Unprecedented opportunities** for science with new insights, sources, tools and technologies promising major breakthroughs.
- An unparalleled **worldwide pool of talent**, including from regions and communities historically excluded.
- Modern technology enables **new levels of connectivity**, building a truly global community.

Annual articles published in scientific and technical journals, 2022

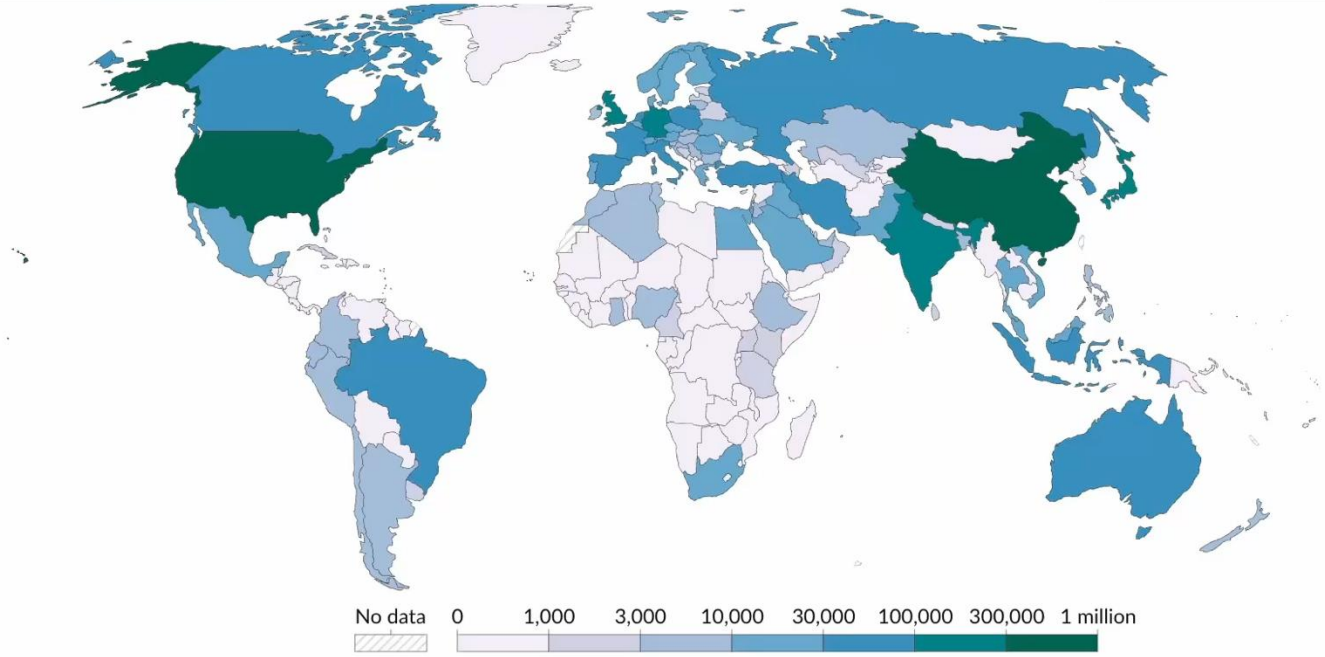
Our World in Data

Includes physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences.

Table | Map | Line | Bar

Zoom to...

2D | 3D



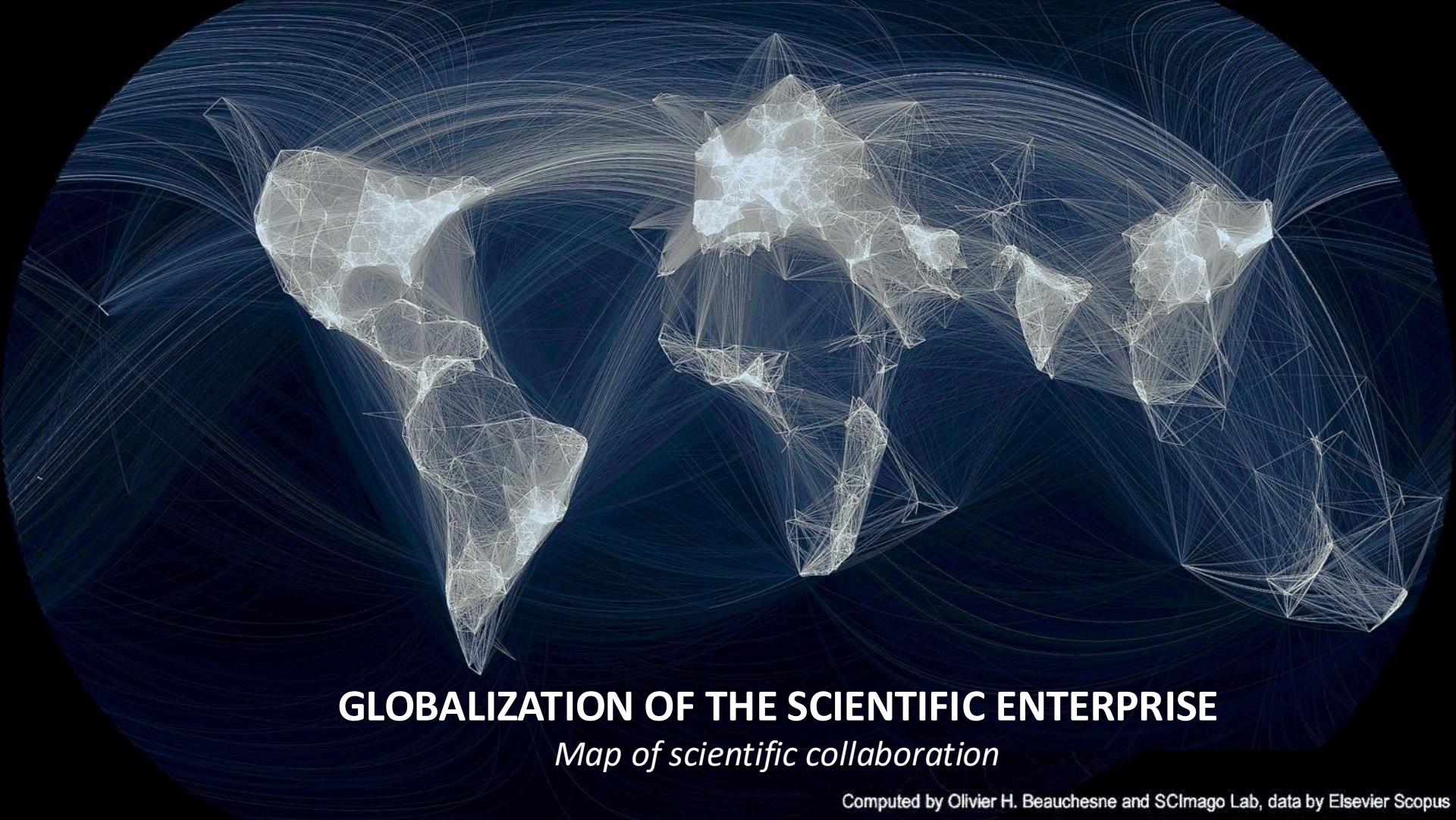
Play time-lapse

1996

2022

Data source: National Science Foundation Science and Engineering Indicators, via World Bank (2025) – Learn more about this data

Note: Articles are counted by the country of the author's institution.


GLOBALIZATION OF THE SCIENTIFIC ENTERPRISE
Map of scientific collaboration
Computed by Olivier H. Beauchesne and SCImago Lab, data by Elsevier Scopus

ACCELERATING SCIENCE

Current scientific trends

- **Unprecedented opportunities** for science with new insights, sources, tools and technologies promising major breakthroughs.
- An unparalleled **worldwide pool of talent**, including from regions and communities historically excluded.
- Modern technology enables **new levels of connectivity**, building a truly global community.
- New knowledge and technology needed for all major national **policy domains**: innovation, energy, security, defense, health, agriculture, …
- Science plays a key role addressing **global societal challenges**: climate, oceans, biodiversity, pandemics, food, water, environment, inequalities, regulation of technology...

SCIENCE UNDER EXTERNAL PRESSURES

Current geopolitical trends

- **Academic freedom under pressure.** Space for intellectual exploration shrinks by pressures from outside and inside the academic world.
    - **Negative** academic freedom: online & physical threats, intimidation, attacks on research infrastructure in wars and conflicts,..
    - **Positive** academic freedom: censorship of politically sensitive research areas,…
- Well-organized global **disinformation campaigns** undermine the scientific consensus on topics like climate and vaccines eroding shared perception of empirical reality.
- **Short-term economic focus.** Governments emphasize economic competitiveness and prioritize immediate results over transformative basic research.
- **Humanities and social sciences marginalized** despite their crucial role in understanding how societies adapt to technological change.

MULTILATERAL SYSTEM ITSELF UNDER STRAIN

International scientific collaboration faces double headwinds

- **UN and its agencies** — and diplomacy itself— are weakened and even actively undermined in a polarized geopolitical climate.
  US is withdrawing from UN agencies like WHO, UNESCO, IPCC,… – precisely the institutions that coordinate global scientific response.
- Global challenges like SDG's and technology regulation seen as **threat to economic and political autonomy** and unconstrained industrial development.
- **Global South** is losing faith that industrialized nations will deliver on the promises of science. Often the countries with least access to science carry the biggest burden of global challenges.
- **Unique opportunity for Europe** to position itself as a home for international science.

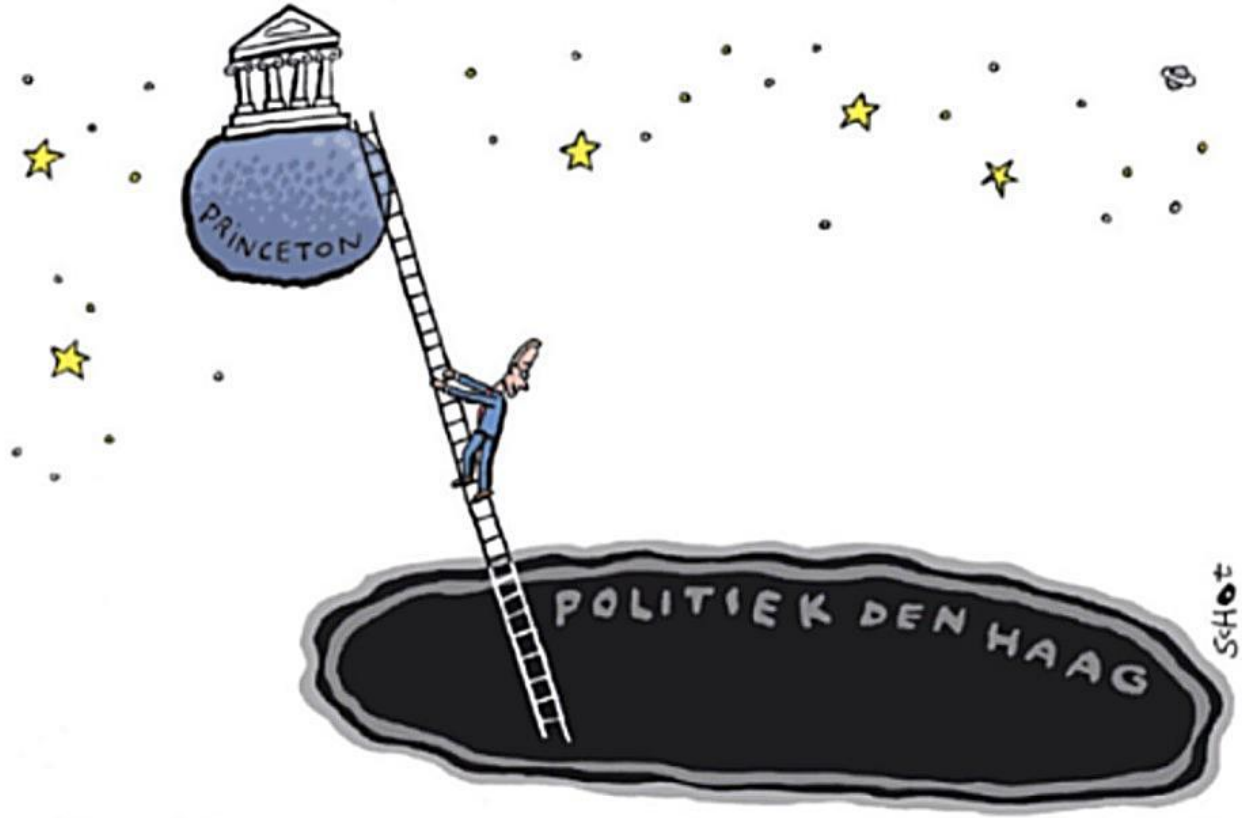
WHY IS THIS HAPPENING?

- Much political backlash results from the **growing impact of research**, delivering uncomfortable truths about issues like environmental degradation and public health risks.

  Social analogue of **Newton's Third Law**: for every action, an equal and opposite reaction. Science pushes society and society pushes back.

- **Science and politics more entangled**. Need to navigate the intricate and growing interface between science and policy. Covid was an accelerant of distrust.
  "If you mix science with politics, you get politics."

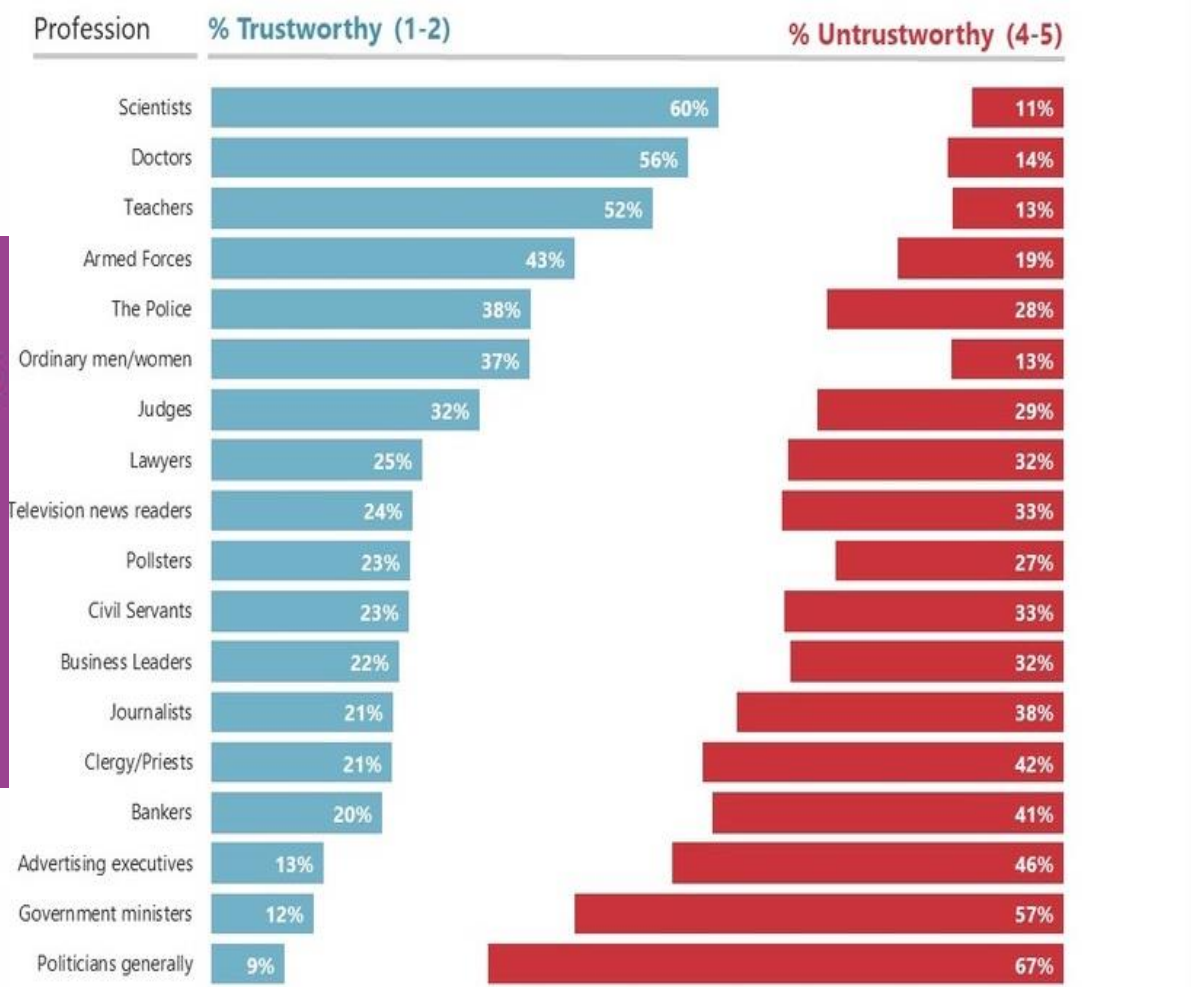
BAS VAN DER SCHOT



NIEUWE MINISTER VAN ONDERWIJS, CULTUUR & WETENSCHAP

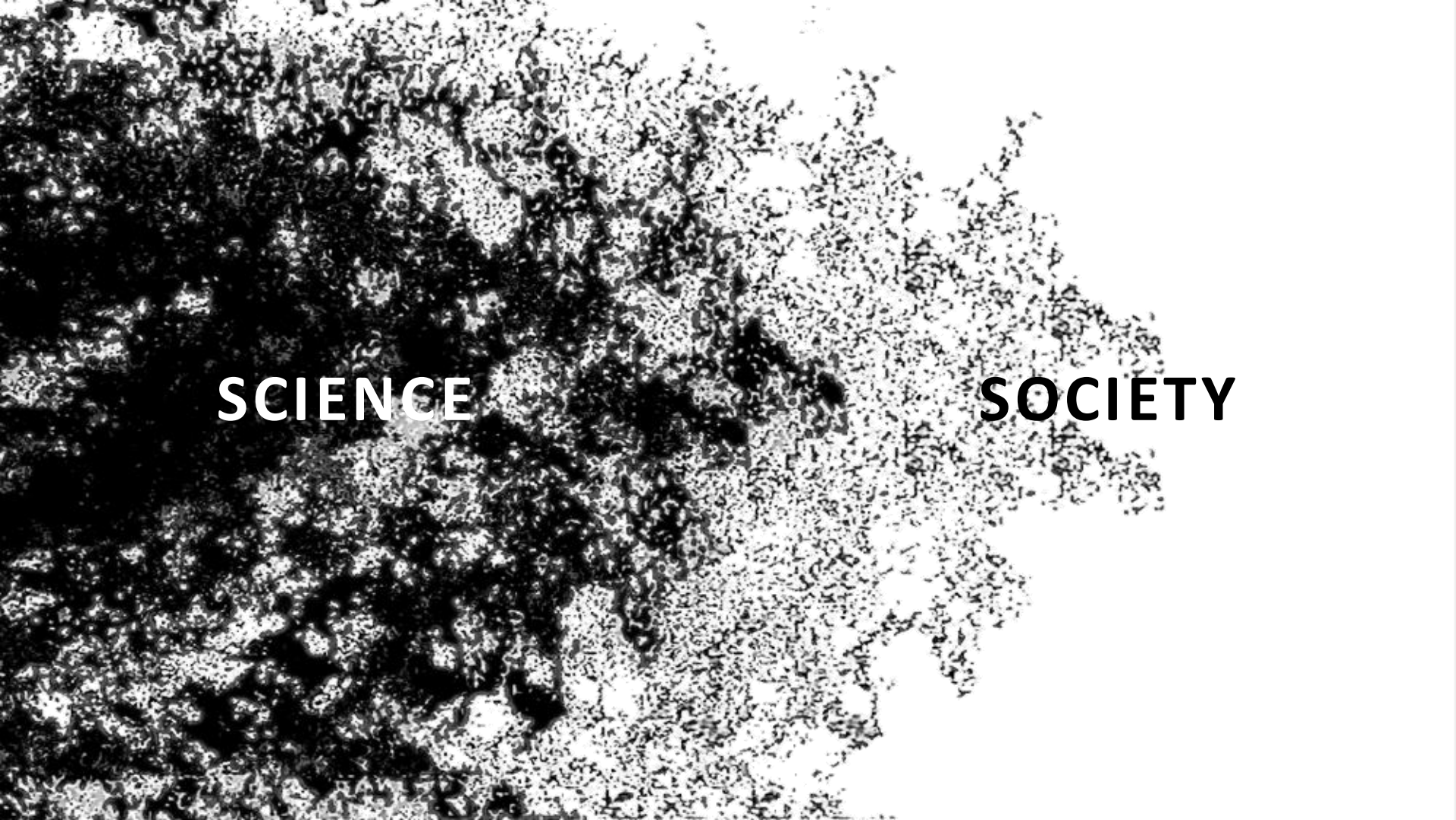
Scientists are seen as the most trustworthy profession globally, followed by doctors and teachers.

Politicians and government ministers are the least trustworthy.



SCIENCE

SOCIETY


SCIENCE
SOCIETY

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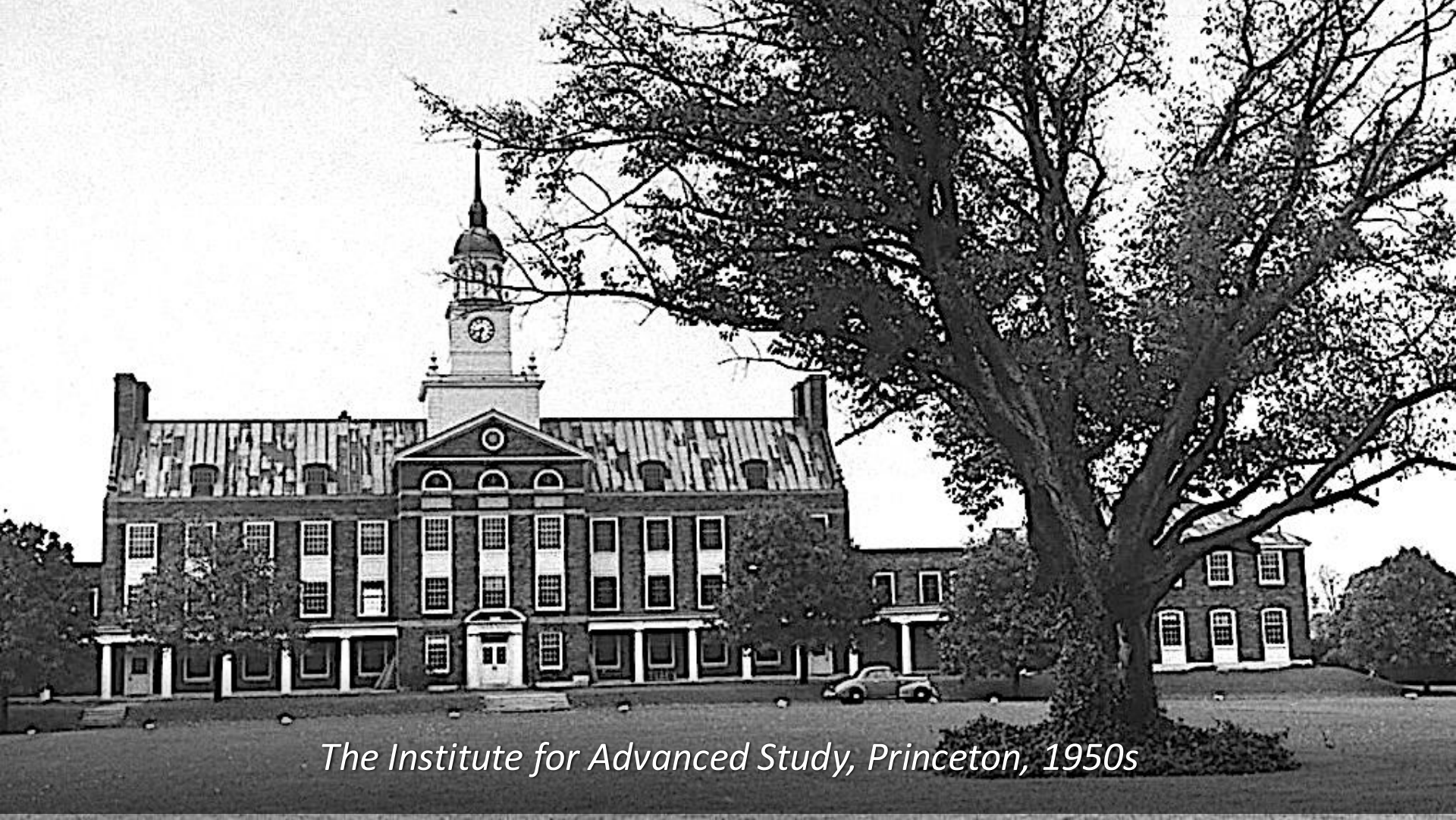
- **Polarization of institutions**. Loss of trust in science & universities among parts of society. Increasingly societal fault lines run along educational levels. The post-WWII social compact between science and society is fraying.

THE “SECURITIZATION” AND “WEAPONIZATION” OF SCIENCE

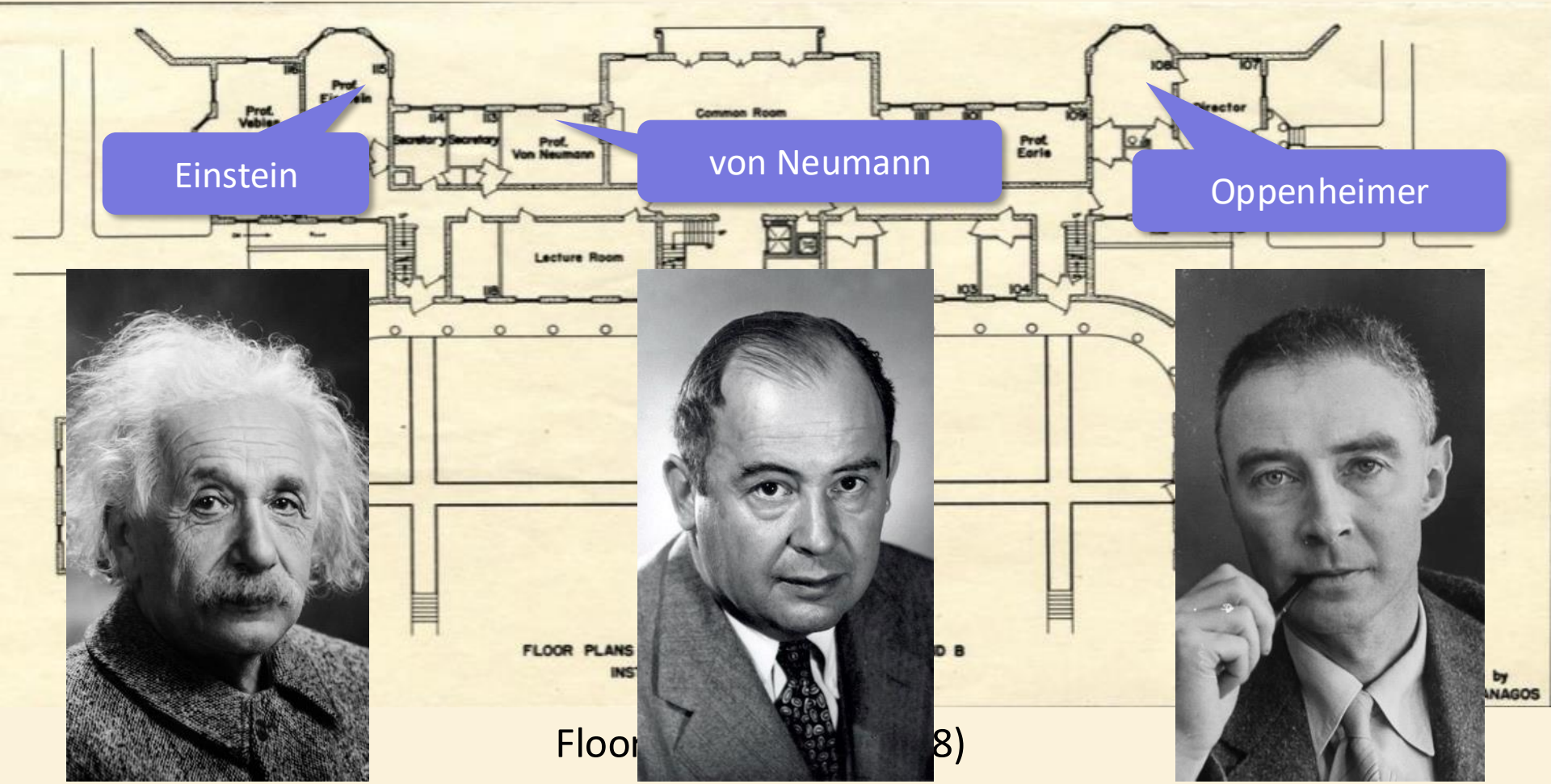
Rising barriers to international collaboration

- Science is increasingly the main stage for **economic competitiveness and national defense**. Almost all key technologies have (or will have) dual-use aspects.
- Vast increase in **R&D defense spending** puts pressures on universities and research institutes.
- International scientific cooperation is increasingly reframed as **risk to national security and economic autonomy.**
- **The security paradox**: The more science matters, the more it is treated as a threat rather than a commons as seen in:
  - visa restrictions, security protocols, investigations of routine partnerships,
  - universities treating openness as vulnerability rather than strength.


J. Robert Oppenheimer



The Institute for Advanced Study, Princeton, 1950s


Einstein
von Neumann
Oppenheimer
Common Room
Prof. Von Neumann
Prof. Earle
Lecture Room
FLOOR PLANS

Floor 8)


RESEARCH SECURITY
Running along a narrow path
PARANOIA
governments
NAÏVETE
scientists

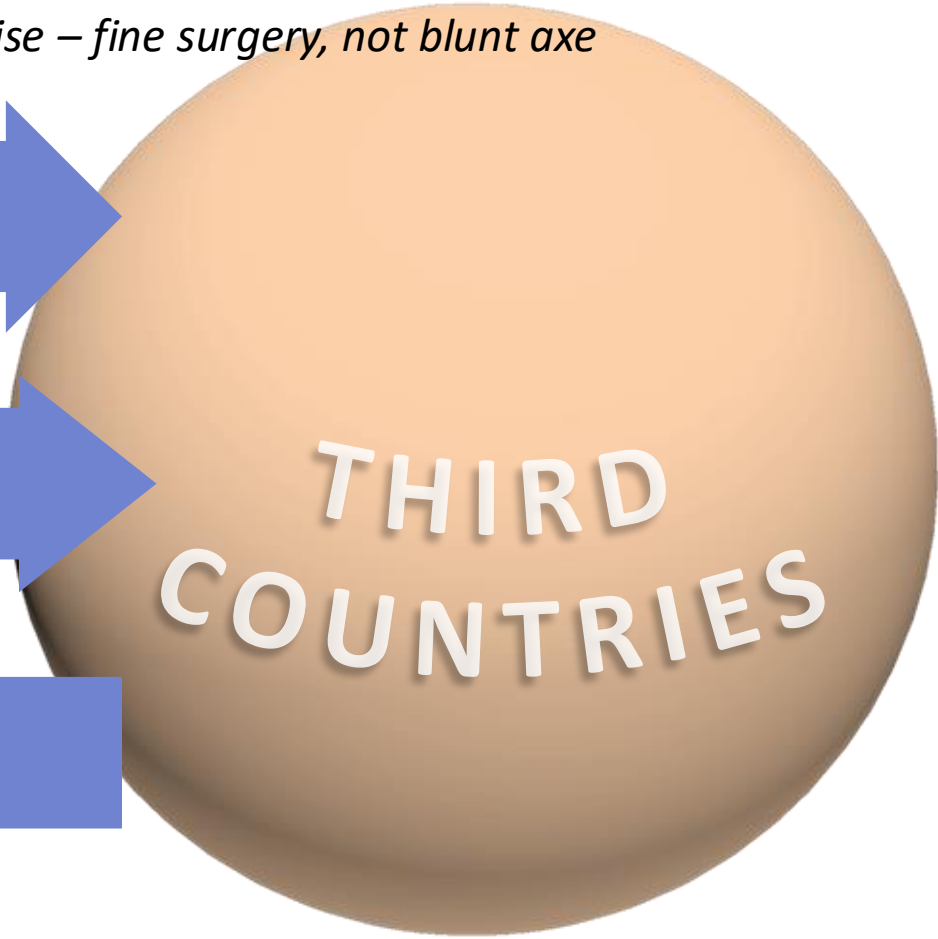
TRIAGE IN RESEARCH SECURITY

Requires in-depth domain expertise – fine surgery, not blunt axe

COLLABORATION
global challenges, basic science

VALUES
academic freedom, transparancy

CRITICAL KNOWLEDGE
strategic key technology, dual use



THE LEAKING BUCKET

Attracting talent: how fast do you fill the bucket?

WHAT CAN SCIENTISTS DO?

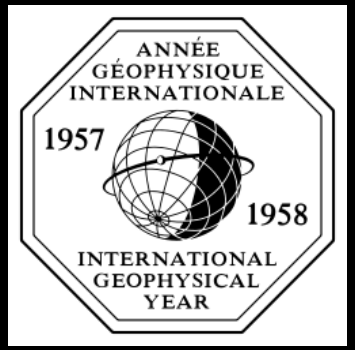
- The academic community must organize itself better, learn to **"push back against the pushback,"** and forcefully defend academic ties, particularly in difficult circumstances. Scientists must actively create spaces for cooperation that formal diplomacy cannot.
- **Avoid a risk-averse, censorial posture** in research collaborations. Actively seek and promote responsible collaboration and exchange of scholars and students.
- **Advocate.** Make clear to policy makers which areas need international scientific collaboration, such as global challenges and basic research.
- **Engage the scientific community.** Responsible collaboration navigates the narrow path between naïveté and paranoia, preserving open exchange while managing legitimate risks. This requires broad engagement between working scientists with deep domain knowledge and governments.
- **Exchange best practices** among national and disciplinary scientific communities.
- Learn from **historical examples.**

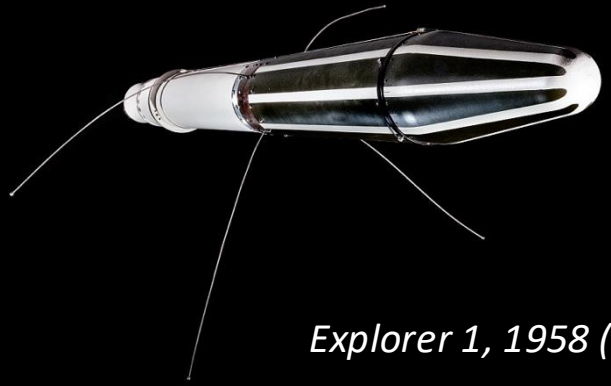
INTERNATIONAL GEOPHYSICAL YEAR (1957-58)

An example of historical impact

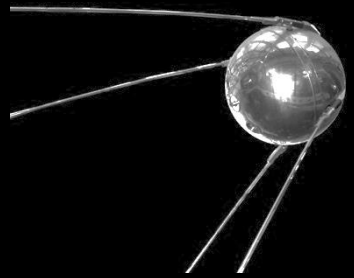
Organized by the ICSU/ISC, demonstrated that during height of Cold War scientists from 67 countries including adversaries could collaborate successfully. Scientists would study physical phenomena across the entire planet, including the upper atmosphere that rocket technology had just made accessible.

Led to the establishment of permanent Antarctic research infrastructure and system of World Data Centers to archive and distribute scientific data.





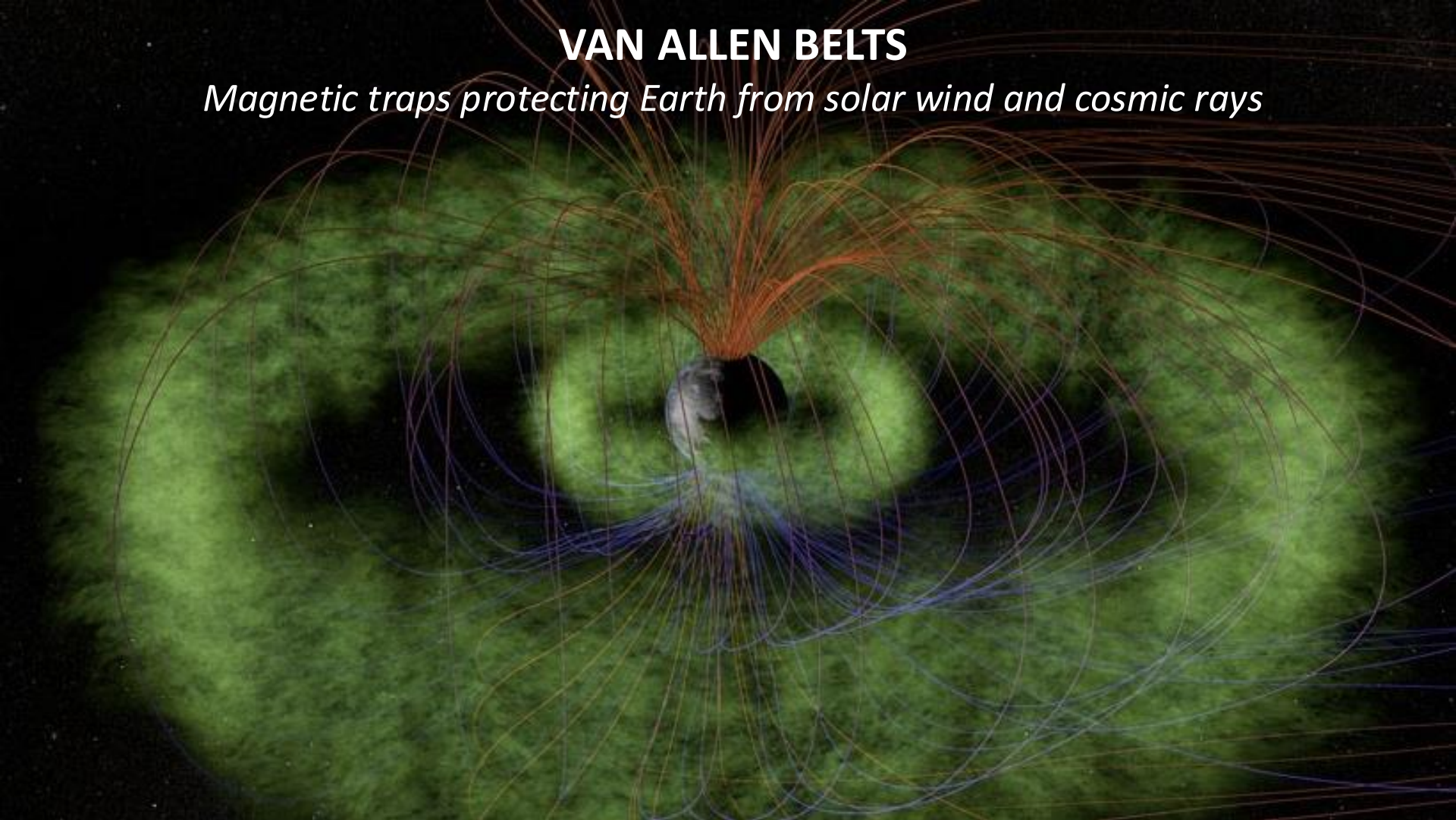
Explorer 1, 1958 (US)



Sputnik, 1957

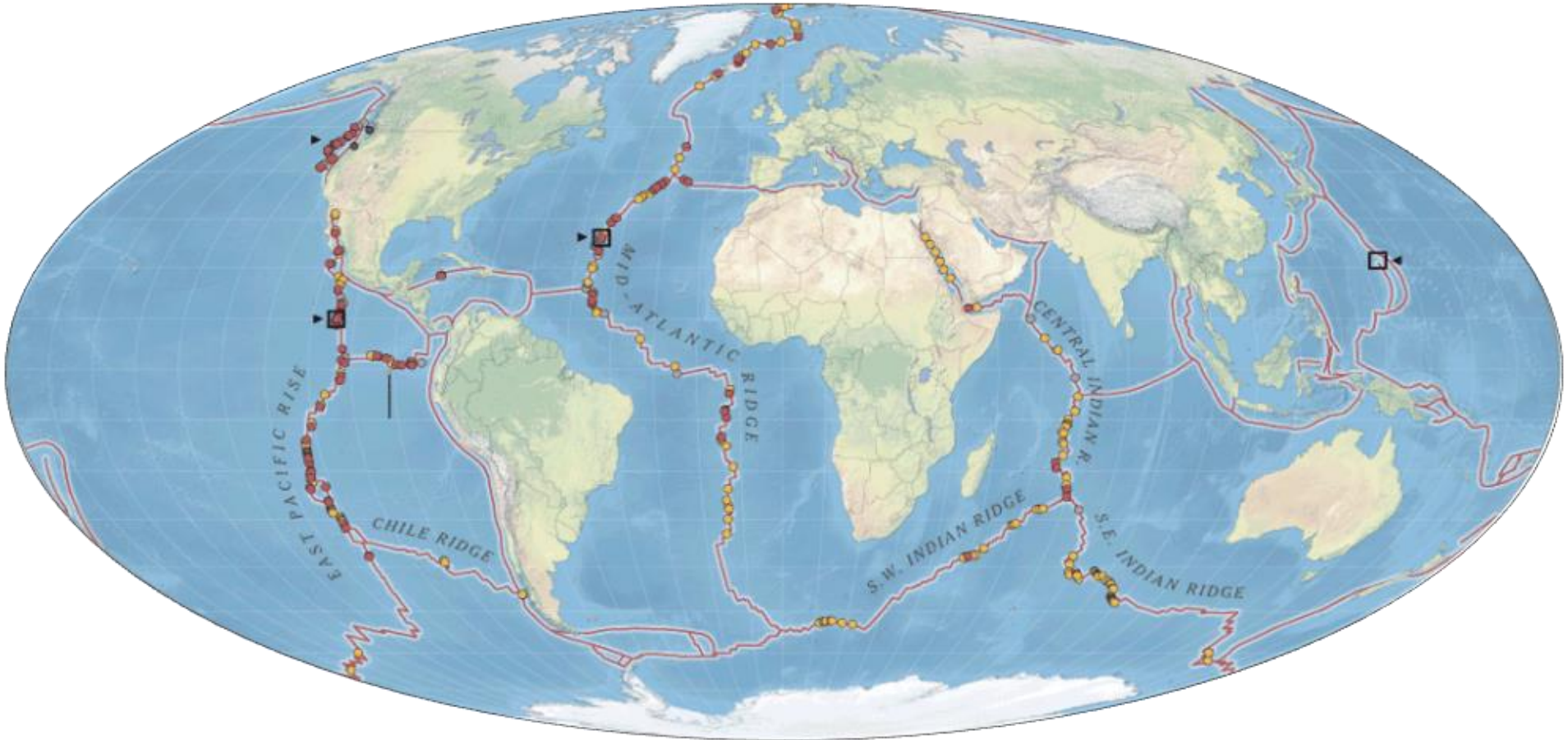
VAN ALLEN BELTS

Magnetic traps protecting Earth from solar wind and cosmic rays



MID-OCEAN RIDGES

65,000 km long volcanic mountain chain



1959 ANTARTIC TREATY

One of the most successful diplomatic initiatives: the 1959 Antarctic Treaty designated Antarctica as a scientific preserve, banned all military activity, and established free scientific investigation and cooperation, enabling crucial climate research.

SESAME 2002

Synchrotron-light for experimental science and applications in the Middle East

MOUNT PAEKTU, NORTH-KOREA

Collaboration with US, UK, China, South-Korea scientists and DKPR, studying volcano responsible for one of the largest explosions in recorded history, 946 CE

WHAT IS THE ROLE FOR EUROPE?

Clear analyses: reports of Letta, Heitor, Draghi

In Europe the whole is often less than the sum of its parts

National policies are often incoherent and sometimes even mutually contradictory. Research and innovation remains fragmented across 27 regimes

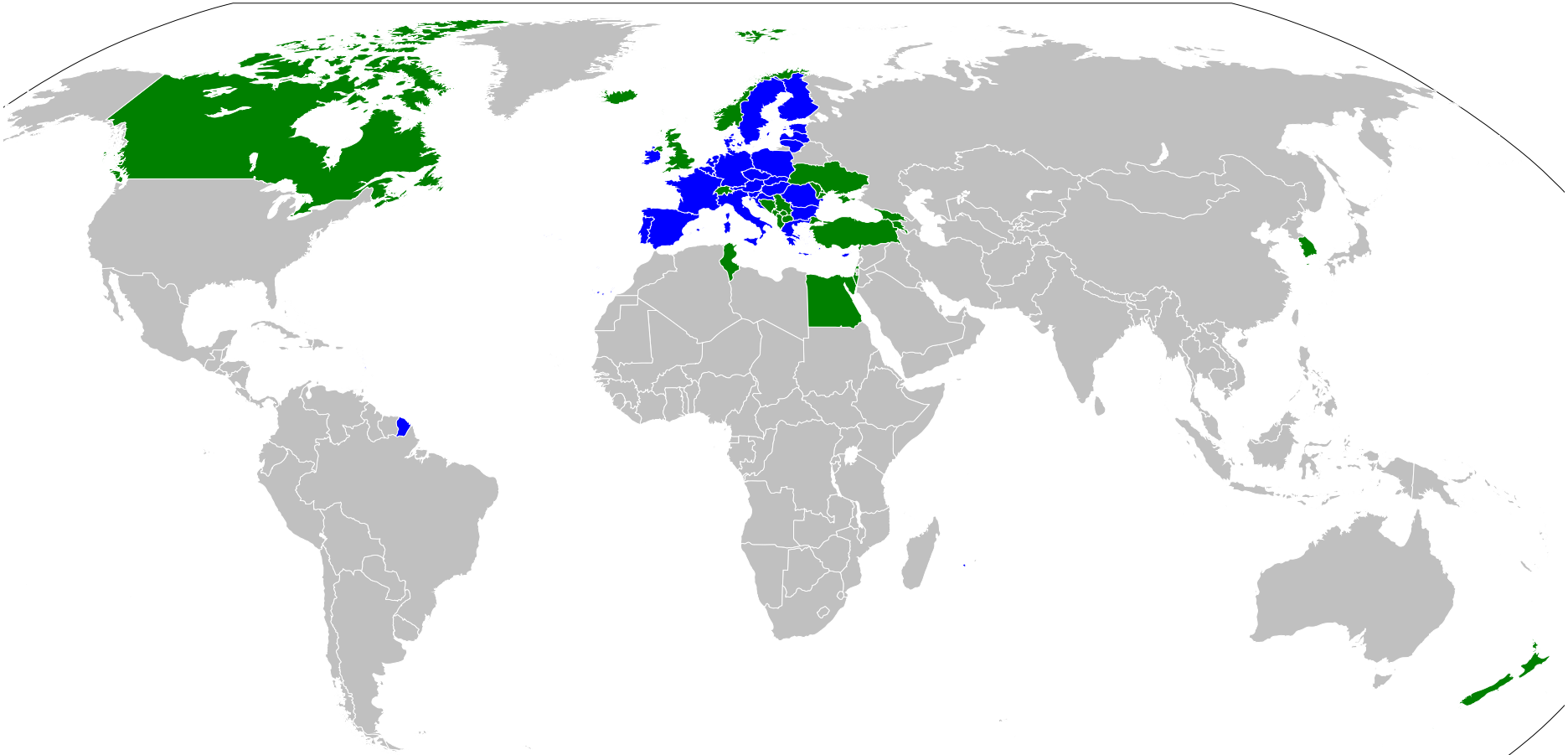
EUROPE'S FUNDAMENTAL STRENGTHS IN SCIENCE

From bugs to features

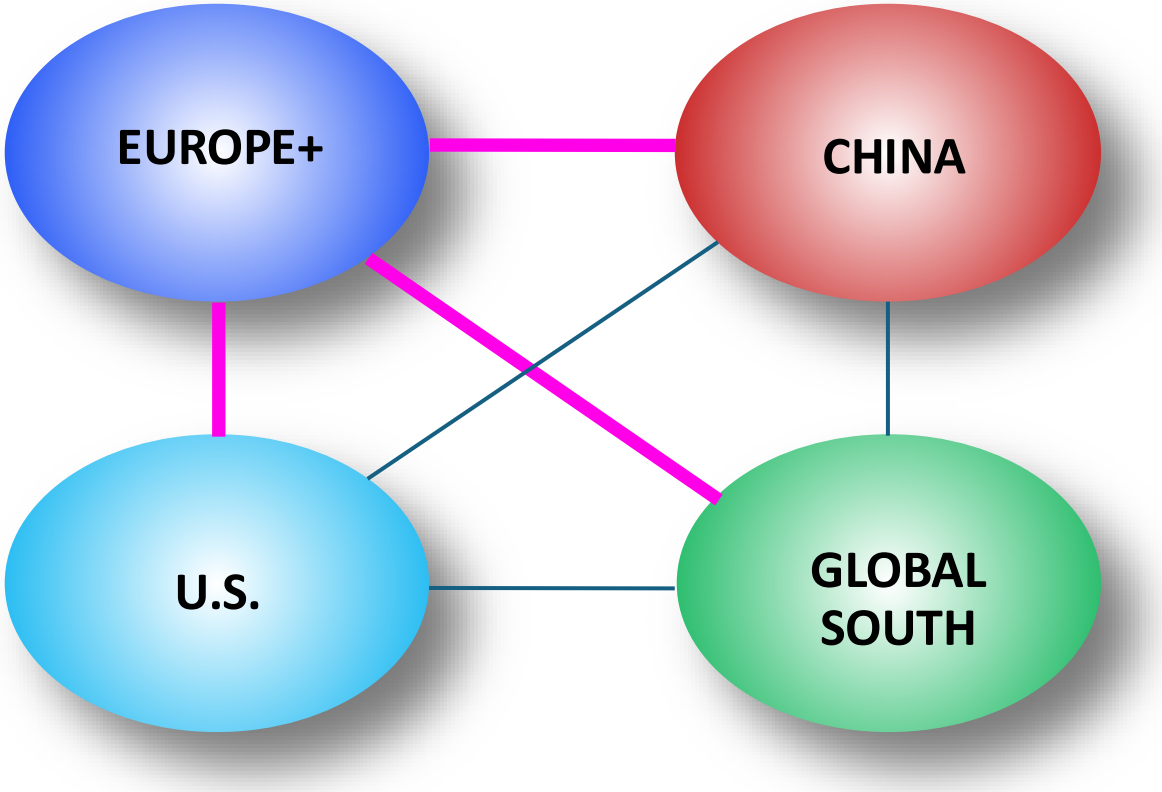
- **Unique research ecosystem**: based on a combination of collaboration and competition, pluralism of ideas, a culture of openness and connectedness to the world.
- **Long-term stability:** EU's complexity and inertia also provide stability and predictability, averaging out national political volatility. Framework Programs give long-term (7-year) research budgets.
- **Open for collaboration**: "Europe" consists of an evolving system of concentric rings of collaborations: EU-27, associated countries (20+), plus many like-minded countries that look for reliable partnerships in a fractured, multi-polar world.
- **Large-scale infrastructure**: world-class facilities beyond financial and organizational capacity of Member States, with public-private partnerships and spin-offs, furthering science diplomacy.
- **Values**: academic freedom, collaboration, open science, epistemic diversity, responsibly sharing research, transparency, inclusivity, citizen-centric, voice of the next generation.

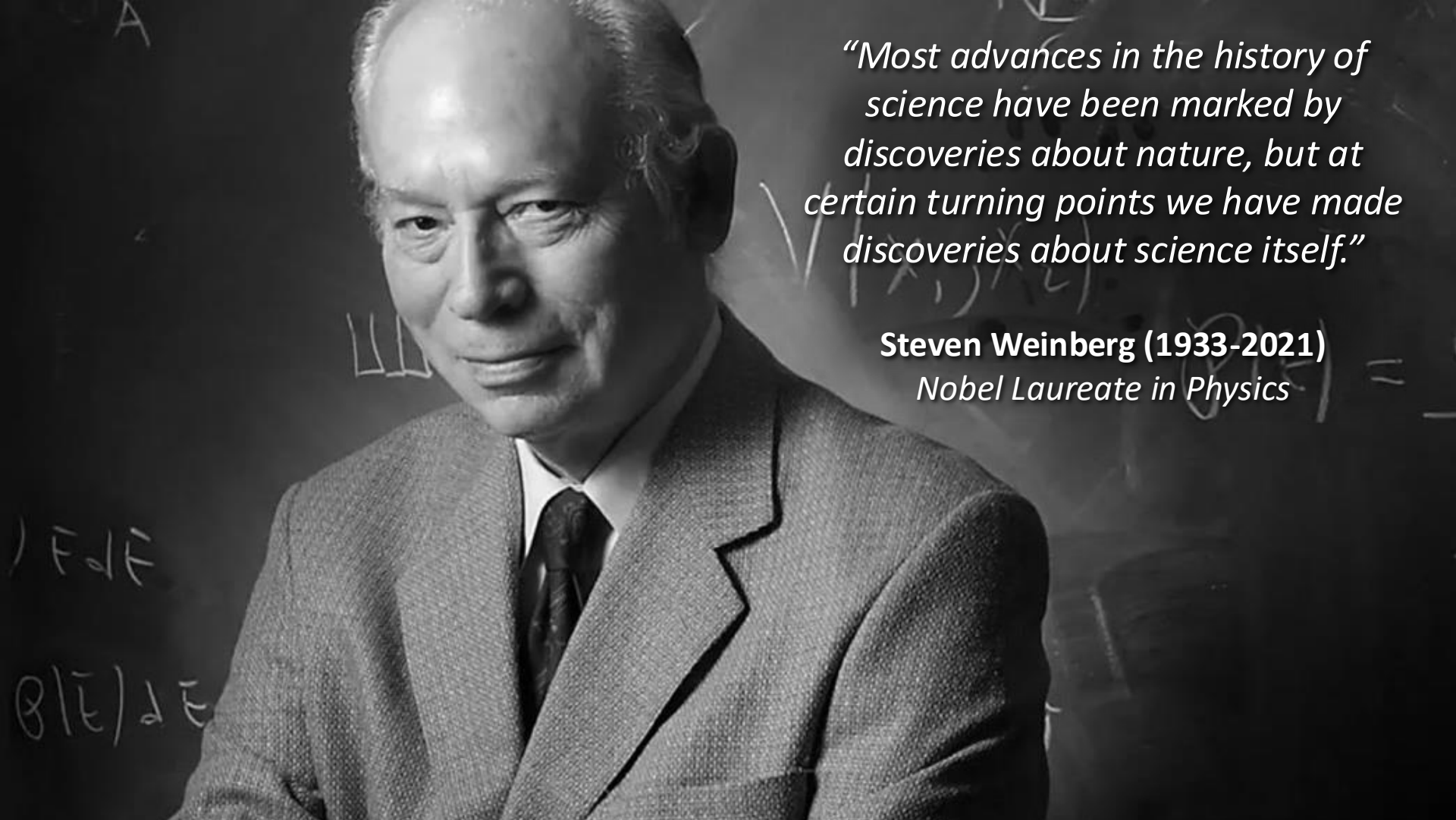
EUROPE TRANSCENDS ITS GEOGRAPHY

Countries currently participating in Horizon Europe



EUROPE IN A “RECTANCULAR WORLD”




“Most advances in the history of science have been marked by discoveries about nature, but at certain turning points we have made discoveries about science itself.”

Steven Weinberg (1933-2021)
Nobel Laureate in Physics

SCIENCE IS AT A CROSSROADS

- Need to establish a **new social compact** between science and society repositioning science as global public good and commons. Ingredients are public engagement, science-policy, science diplomacy, research security, transdisciplinary research.
- **International collaboration is key.** Scientists sit in the "second ring" of the geopolitical theatre and have strengths that formal diplomacy cannot offer: neutral convening power, cross-border networks, long-term view.
- **Global imperatives more urgent than ever.** Addressing the planetary challenges, such as climate, oceans, biodiversity, pandemics, demand worldwide cooperation and data sharing. Science should prepare for the **post-2030 agenda**.
- Need to strengthen the **fundamental values of science** without being naïve – not as ideological goals, but as operational requirements for science to deliver on its promises.

- **GEOPOLITICS IS TOO IMPORTANT TO LEAVE TO POLITICIANS!**