

<https://id.pinterest.com/pin/505951339406508234/>

Galois Smartnetwork Field Theory

**Higher-structure symmetry-driven framework for unifying
human–AI mathematical discovery across the sciences**

“Science today [is] not a science that is still a cousin of
philosophy ... but a technoscience for which to
understand is to be able to transform”
– Stengers, *Thinking with Whitehead*, 2011, p. 11

San Francisco CA, 7 Apr 2026

Slides: <http://slideshare.net/LaBlogga>

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DIYgenomics.org (Research Lead)
University College London (Research Associate)



UCL

**UCL
CBT**

Platform Shifts

Platform Shifts: 1970-2050E

Personal Computer

Personal AI



Mainframe
1970s



PC
1980s



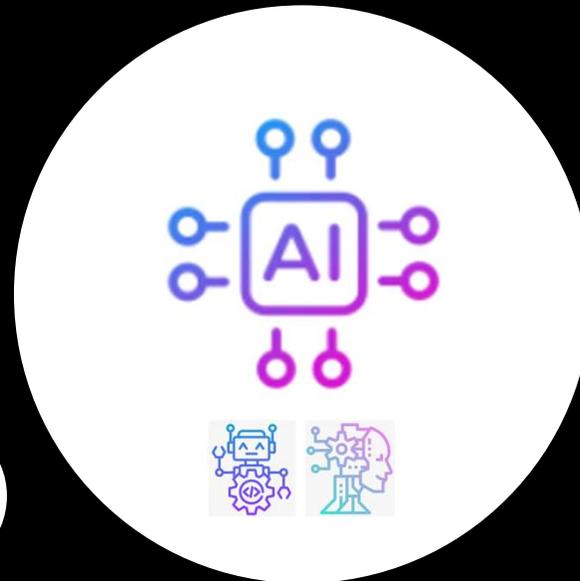
Internet
1990s



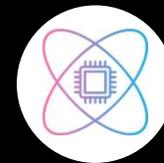
Mobile
2000s



Cloud
2010s



AI
2020s



Quantum
2030sE



BCI
2040sE

OS: Linux

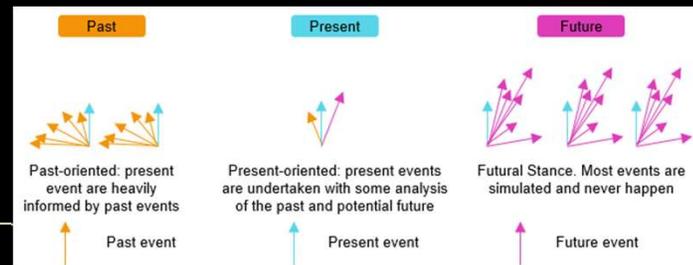
HTML

Android

Kubernetes

Agents: OpenClaw/NemoClaw

Mindset Shift



Temporality of Futurity



Passive -> Active

Computing

The execution of computing

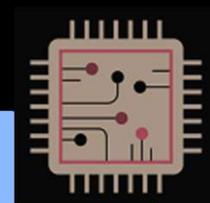
File-retrieval system: human pre-recorded information

The purpose of computing

Information storage **warehouse** (cost-center)

Real-time processing system: humans in collaboration with situationally-aware AI agents generating context-relevant tokens

Information generation **production unit** (revenue-generator); companies produce tokens



Science

Collect and analyze data from past events

Real-time data analysis, experimental iteration, simulation; test many possible hypotheses



AI Tokens: Worldwide Commodity

- Salt, Oil, Tokens: world-dominating global commodities
 - Intelligence as a commodity

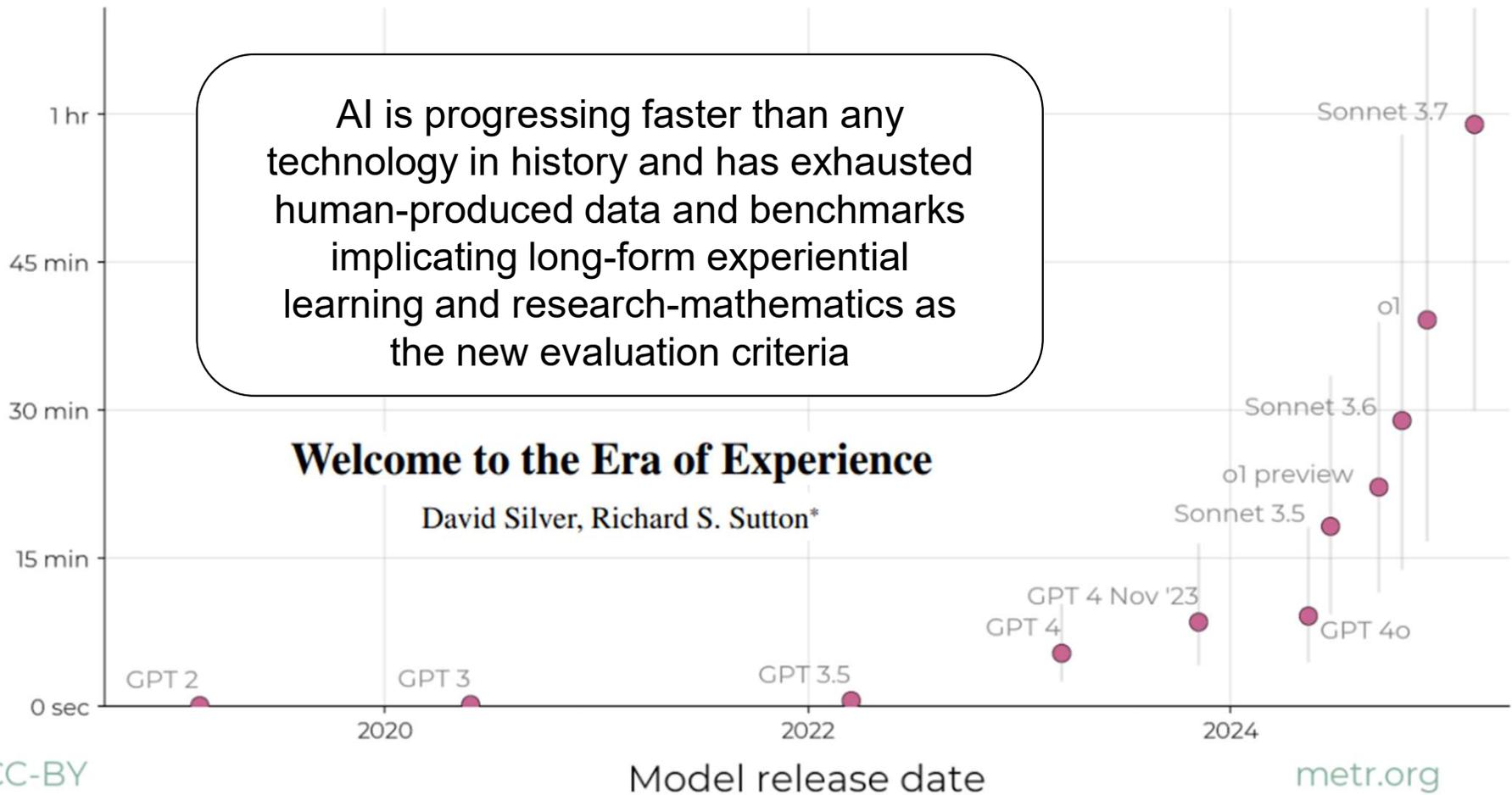


Status of Artificial Intelligence

The length of tasks AIs can do is doubling every 7 months



Task length (at 50% success rate)



CC-BY

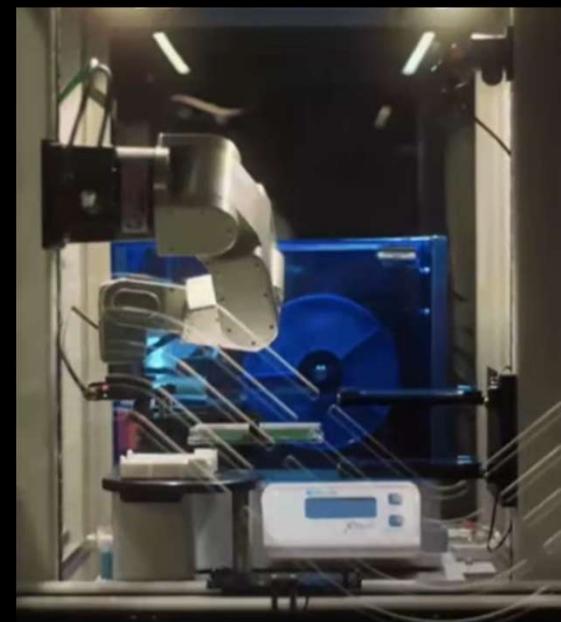
Model release date

metr.org

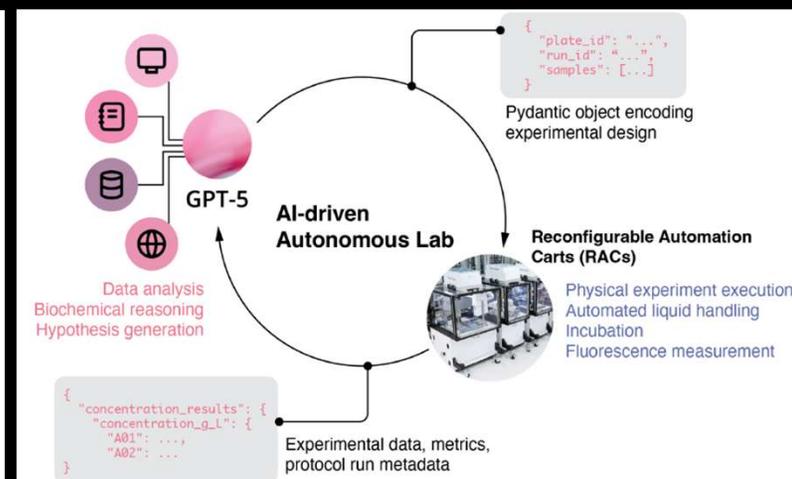
Physical AI: Science Agents



- GPT-5-driven lab runs 36,000 experiments
 - LLM automated cloud laboratory optimizes the cost efficiency of cell-free protein synthesis



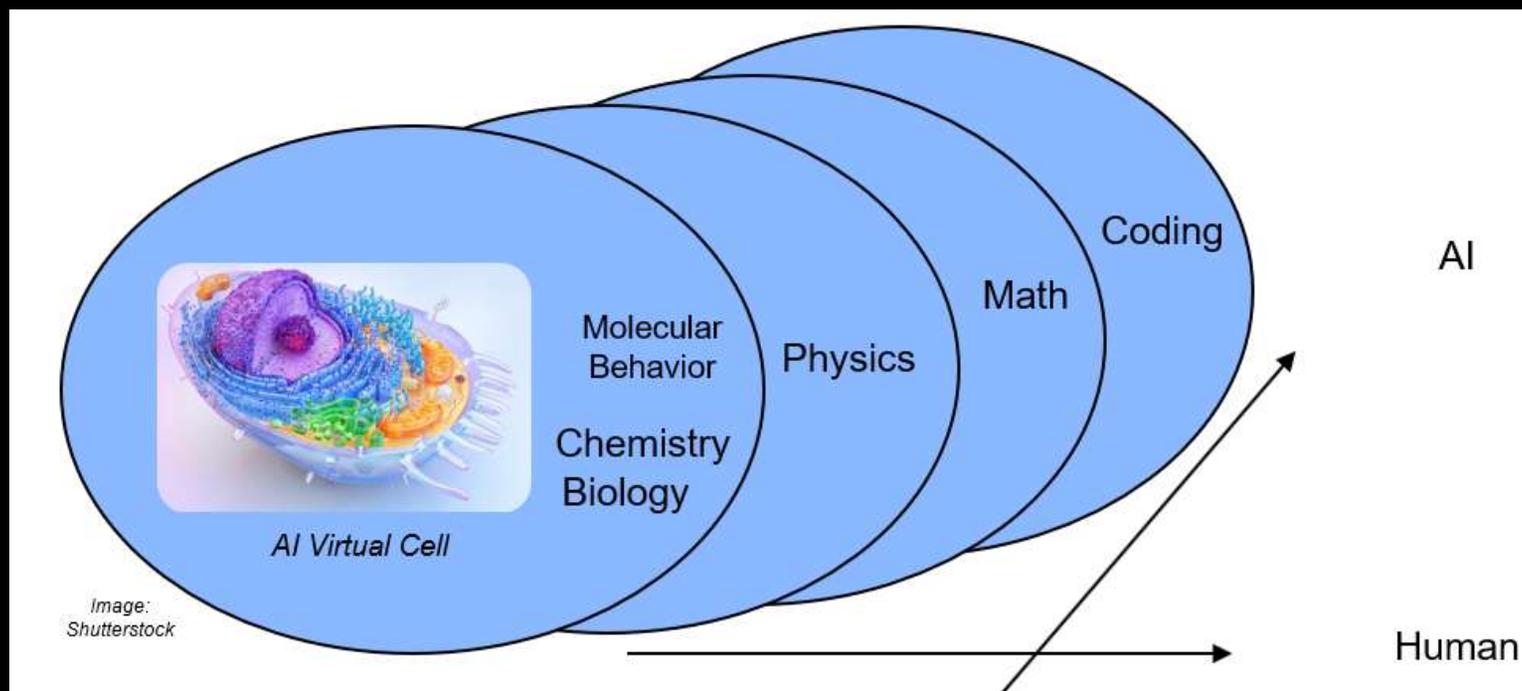
“We connected our autonomous lab to GPT-5 and let it run 36,000 experiments. The result was a new state-of-the-art for Cell-Free Protein Synthesis that **cut costs by 40% per gram of protein.**”



Scientific Approach: Anecdote -> Answer

- AI is a new scientific instrument
 - Working with the entirety of the science corpus

Digital Scientific Infrastructure: The Science Stack



Thesis

Galois SNFT: symmetry-based conceptual framework integrating mathematics, computation, and physics into a single picture for formal application and understanding

The development of AI mathematical infrastructure demands new modes of mathematical practice capable of addressing complex real-world problems. Mathematical accessibility means expand conceptual and analytic range of thinking, enhance credibility of findings, join larger research dialogue, not necessarily executing formalisms

Galois Smartnetwork Field Theory is discussed as an integrated mathematics, computation, and physics framework for human–AI collaboration, with illustrations in mathematics and longevity science

Research-mathematics has become essential to AI foundation models

Symmetry (invariance) is further underlined as a marquis principle for the transmission of ideal contents

Agenda

- AI status
- Galois Smartnetwork Field Theory
- Math Agent status
- Millennium Prize Problems (MPP)
 - Galois SNFT for MPP
- Digital Biology and Longevity Science
 - Galois SNFT for Longevity
- Science Agents
 - New Field of Mathematical Science
- Conclusion

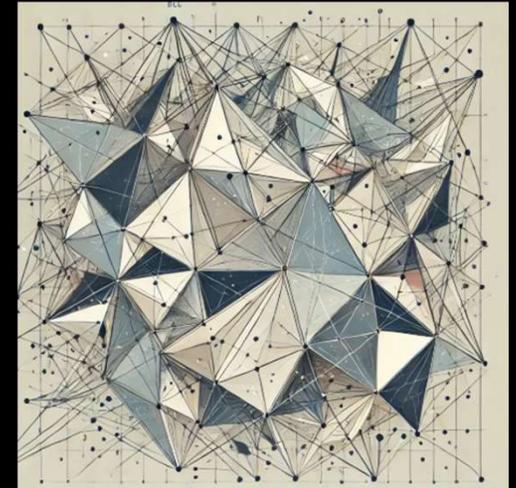
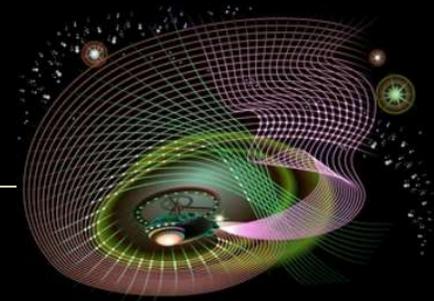


Image: Henry Kvinge

Galois Smartnetwork Field Theory



- Galois SNFT: symmetry-based conceptual framework integrating mathematics, computation, and physics into one picture for formal application and understanding

Galois (*math*) Smartnetwork (*computation*) Field Theory (*physics*)

Galois

Mathematics

Symmetry, hidden information
in higher dimensions

Smartnetwork

Computation

Modern computational
infrastructure: AI, quantum

Field Theory

Physics

Core formalization in
mathematics and physics

Galois Smartnetwork Field Theory

$$ax^2 + bx + c = 0$$
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Quadratic Formula

1. Galois formalisms, including contemporary extensions
 - Higher-form symmetries, Galois categories, étale topology
2. Shorthand for symmetry (foundational physics principles)
 - Symmetry, periodicity, spectrality, duality (functoriality)
3. Methods to detect hidden info in higher dimensions
 - History: Galois: id solvable equations (with x^5) by looking at the permutations of the symmetry properties of roots
 - Reformulate the difficult-to-compute *group theory* problem of roots into the easier-to-compute *field theory* problem of the symmetry properties of roots (rotation and reflection)
 - Coined the term group and specified the Galois group which contains all permutations of rotation and reflection symmetries

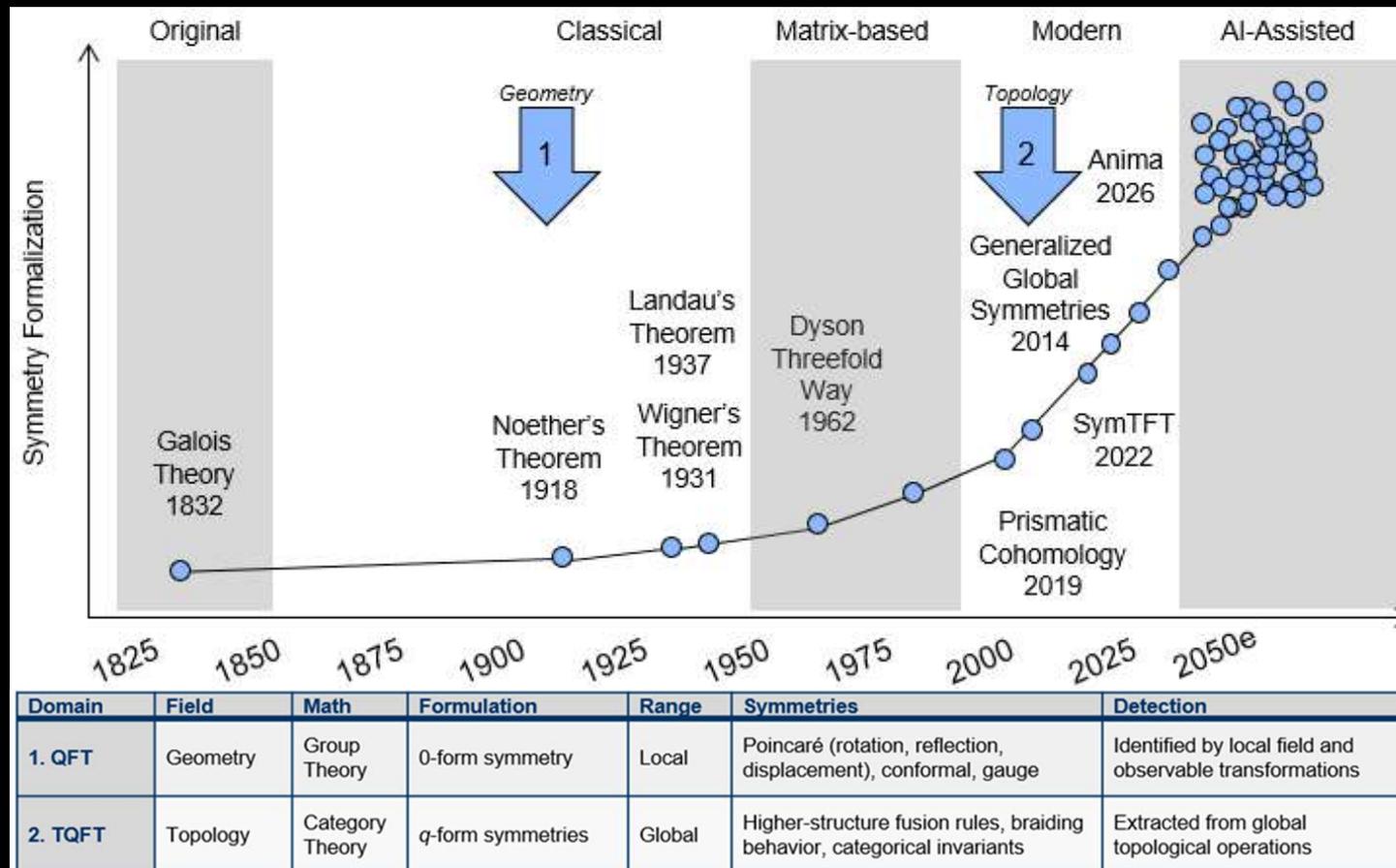


Évariste Galois
1811-1832

200 years of “Moore’s Law of Symmetry”

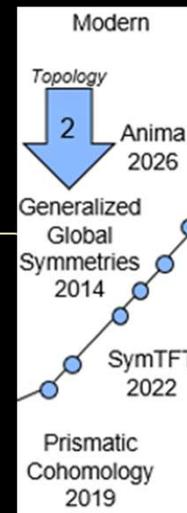
1. Noetherian geometric symmetry (QFTs)
2. Higher-form topological symmetries (TQFTs)

Geometry -> Topology
(content -> relationality)
Group -> Category



Contemporary Symmetry Theories constituting Galois SNFT

- Shape and space of symmetries (Galois anima)
 - **Anima**: (*Greek: soul; animating principle*): core shape (homotopy type) of an object (Clausen, Haine; 2026)
- Data on which symmetries act (prismatic cohomology)
 - **Prismatic cohomology**: invariants (Galois representations) unified as different views of a prism (Bhatt & Scholze; 2019)
- Dynamics governing the symmetries (SymTFT)
 - **SymTFT**: (Symmetry Topological Field Theory): generalized global symmetries encoded as TFT (Shafer-Nameki; 2022)



	Modern symmetry theory	Layer	Function
1	Anima	Ontology (space)	The definition of the symmetry-world
2	Prismatic cohomology	Geometry (coordinates)	The data that lives in this world
3	SymTFT	Dynamics (evolution)	How symmetries act in this world

Galois SNFT Symmetry Principles

1. Glocal propagation (anima)

Galois SNFT:
Ontological law

- Local symmetry data glues to one global symmetry-shape

2. Symmetry constraint (prismatic cohomology)

Galois SNFT:
Geometric law

- Symmetry data (étale (Galois), etc.) packaged in one system

3. Phase stability (SymTFT)

Galois SNFT:
Dynamical law

- Continuous deformation until a phase boundary is crossed

Modern Symmetry Theories developed into Galois SNFT Symmetry Principles

	Symmetry theory	Layer	Function	Mathematics	Galois SNFT prim
1	Anima	Ontology (space)	The definition of the symmetry-world	Homotopy (deformation)	Glocal propagation
2	Prismatic cohomology	Geometry (coordinates)	The data that lives in this world	Cohomology (invariants)	Symmetry constraint
3	SymTFT	Dynamics (evolution)	How symmetries act in this world	Field theory (anomalies)	Phase stability

Galois **Smartnetwork** Field Theory

- Smartnetworks: modern ICTs operating with their own logic, action-taking, attestation, and time-space regimes

- Reflect formalization turn (mathematization) of the computational infrastructure
- Particle-many system coordination

Smartnetwork: Modern ICT: mathematized, self-updating, regime-specific global network technologies: AI, NNs, quantum, cloud, BCI, blockchains, digital twin

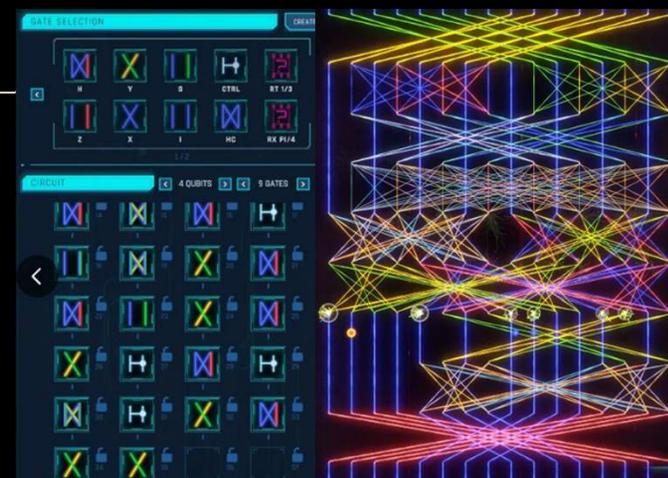
- Smartnetwork examples

- AI, NNs, LLMs, hyperscaler datacenters, quantum technologies (networks, sensing, and computers), cloud, blockchains, optical networks, physical AI (robotics, autonomous vehicles), neurotechnology (BCIs), digital twin infrastructure, fusion energy systems, DNA read-write-edit synbio labs



Smartnetwork Deployment

- AI-Quantum Networks
 - AI: learning capability
 - Quantum: compute muscle



Quantum Mathematics instantiated in Galois-type Quantum Circuits

Point-Click Quantum Circuit Design

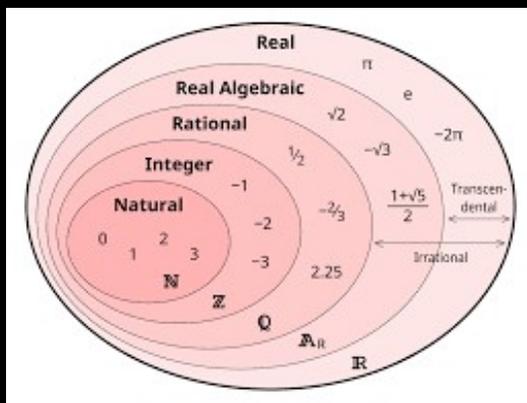
	Description	Quantum Math	Quantum App	Reference
1	Symmetry disentanglers	Topological defects	Q CIRCUITS	2026, Preskill et al. [1]
2	Hybrid lattice surgery	Topological defects	QEC	2026, Schafer-Nameki [2]
3	Transversal gates	Decoding hypergraphs	QEC/QMEM	2025, Lukin et al. [3]
4	Dark-state polaritons	Adiabatic eigenmodes	QMEM	2025, Eden et al. [4]
5	Quantum stratified spaces	Cohomology obstruction	Langlands	2026, Ikeda & Rayan [5]
6	Energy teleportation	Entanglement geometry	Q TELEPORT	2026, 2025, Ikeda [6,7]
7	Time entanglement	Correlation functions	Entanglement	2025, Preskill et al. [8]
8	Time entanglement	Knot invariants	Entanglement	2025, Brukner et al. [9]
9	Time series analysis	Khovanov homology	QFIN	2025, Lloyd et al. [10]
10	Quadratic tensors	Hopf algebra	QSIM	2026, Lloyd et al. [11]
11	Jones polynomial	Knot invariants	QALG/QSIM	2024, Guo et al. [12]
12	Primon gas	Automorphic L-functions	Riemann zeros	2025, Hartnoll et al. [13]
13	Non-hermitian crystals	Hyperuniformity	Riemann zeros	2026, 2024, Park [14,15]

QEC: Quantum Error Correction, QMEM: Quantum Memory, QFIN: Quantum Finance, QSIM: Quantum Simulation, QALG: Quantum Algorithm

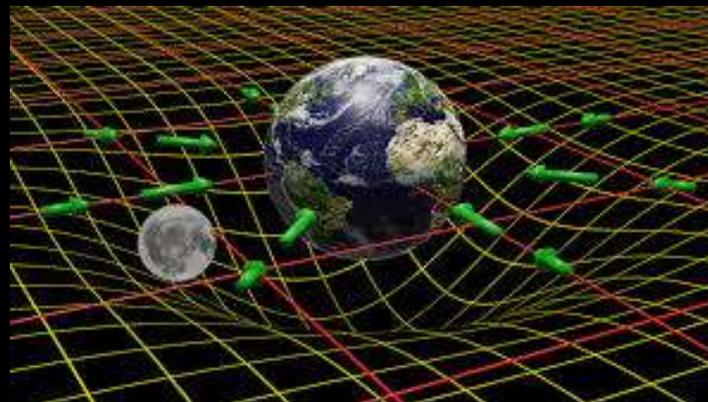
Galois Smartnetwork **Field Theory**

- Core formalization in both mathematics and physics
- Number fields and quantum fields are systems
 - Local data (primes or particles) interact through a
 - Global structure (Galois symmetry or gauge symmetry)
 - Behavior is governed by the same kind of “field theoretic” principles of locality, symmetry, and global invariants

Number Field Theory: number systems expand into richer structures through allowed operations, projected into larger spaces



Quantum Field Theory: every point in space-time carries a field whose value can fluctuate and interact according to the rules of quantum mechanics



Background and Status

Galois Smartnetwork Field Theory

- AI models are Math-driven Physical Systems (Galois SNFT)
- AI models are Physical Systems (NNFT/SNFT)

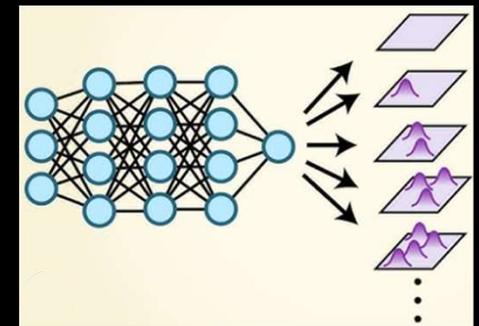
Galois Smartnetwork Field Theory landscape reflecting explicit mathematization of SNFTs

	Topic	Description	Reference
Galois SNFT Formulations (Research-math NNFTs)			Mathematics Computation Physics
1 2	NNQFT	Transformer attention heads as symmetry-breaking Transformer parameter redundancy as gauge symmetry	2026, Silverstein [1]; 2026, Ageev [2] 2024, Hashimoto et al. [3]
3 4	INFT	Fisher information-theoretic fine-tuning Categorical info flow-matching (Fisher, Ricci, Riemann)	2026, Halverson et al. [4] 2026, 2025, Bronstein et al. [5,6]
5	KTNN	Knot-theoretic NN: ribbon disk bounding & Ricci flow	2025, 2024, Gukov et al. [7,8]
6	STNN	Sheaf-theoretic NN: poset sheaf cohomology	2025, Gebhart et al. [9]
Foundational Formulations (NNFTs)			Computation Physics
1 2 3	NNFT NNQFT	Proof: any QFT has a NN description Gaussian processes and tangent kernels Statistical field theory for NN	2026, Halverson et al. [10] 2021, Halverson et al. [11] *KEY REF 2019, Helias & Dahmen [12]
4	SNFT	Smartnetwork field theory	2018, 2020, Swan et al. [13,14]
5	NSFT	Neural statistical field theory	2007 Buice & Cowan [15]

Key Advance

NNFT (Neural Network Field Theory)

- NNFT: field-theoretic formulation of NN with QFT
- Motivation: NNs and QFT both describe probability distributions over functions (fields) with many coupled degrees of freedom
 - QFT unites **statistics** and **dynamics** by treating fields as stochastic objects whose probabilistic correlations evolve according to dynamical laws encoded in the action
 - NNFT mirrors QFT by combining a **statistical** description from the Gaussian-process limit with a **dynamical** description from kernel-governed training



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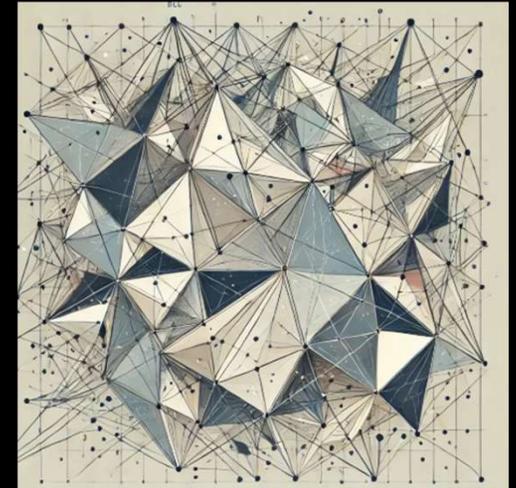


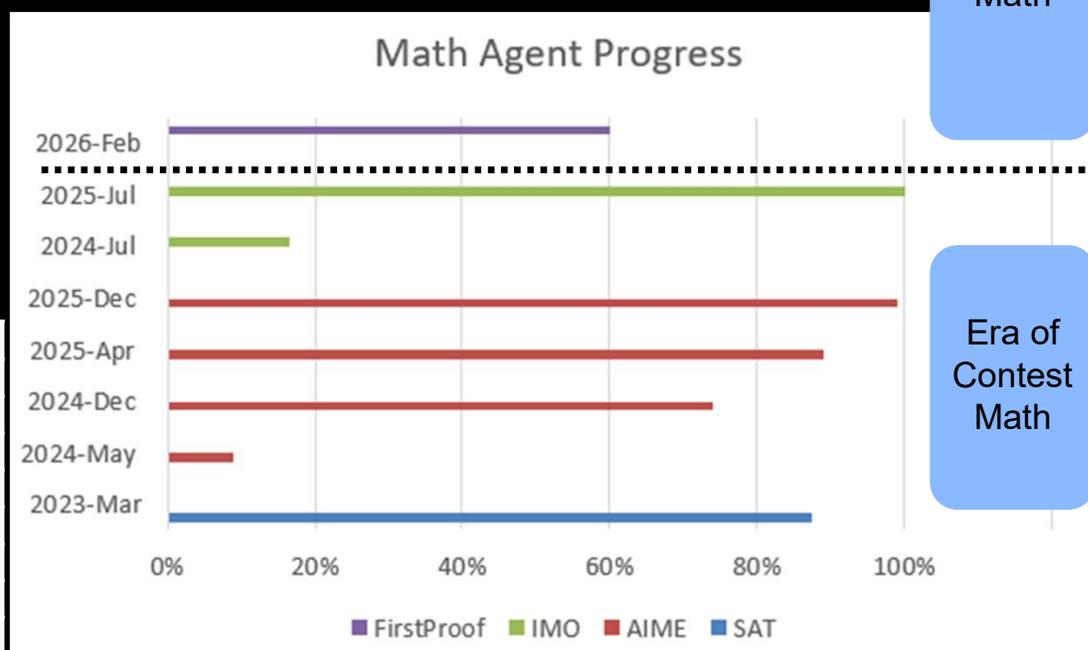
Image: Henry Kvinge

Moore's Law of Math Agents

- Shift from contest-math to research-math
- Existing benchmarks exhausted
 - Need novel human and machine-generated problems

AIME: American Invitational Mathematics Examination, 15-problem qualification for IMO
 IMO: International Math Olympiad, 6 problems

	SAT	AIME	IMO	FirstProof
2023-Mar	88%			
2024-May		9%		
2024-Dec		74%		
2025-Apr		89%		
2025-Dec		99%		
2024-Jul			17%	
2025-Jul			100%	
2026-Feb				60%

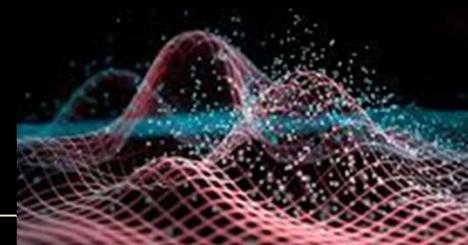


FirstProof – Feb 2026

- Ten real-life math problems with unpublished proofs
 - Collaboration of research mathematicians at different institutions

First Proof			Contents	
Mohammed Abouzaid*	Andrew J. Blumberg	Martin Hairer	1 Smooth shifts of the Φ_3^4 measure on \mathbb{T}^3	2
<i>Stanford University</i>	<i>Columbia University</i>	<i>EPFL and Imperial</i>		
Joe Kileel	Tamara G. Kolda	Paul D. Nelson	2 A nonvanishing test vector for the twisted local Rankin–Selberg integral	8
<i>University of Texas at Austin</i>	<i>MathSci.ai</i>	<i>Aarhus University</i>		
Daniel Spielman	Nikhil Srivastava†		3 A Markov chain from interpolation polynomials?	14
<i>Yale University</i>	<i>University of California, Berkeley</i>			
Rachel Ward‡	Shmuel Weinberger		4 Finite additive convolution and a harmonic-mean inequality for Φ_n	16
<i>University of Texas at Austin</i>	<i>University of Chicago</i>			
	Lauren Williams§		5 The \mathcal{O}-adapted slice filtration and a geometric fixed-point criterion for slice connectivity	24
	<i>Harvard University</i>			
	February 6, 2026		6 Large ε-light vertex subsets	31
			7 Uniform lattices with 2-torsion arising as fundamental groups of closed manifolds with \mathbb{Q}-acyclic universal cover	35
			8 Quadrivalent polyhedral Lagrangian surfaces are Lagrangian-smoothable	44
			9 Algebraic relations among scaled quadri-linear determinant tensors	58
			10 Kernelized CP–ALS subproblem with missing data: matrix-free PCG with Kronecker preconditioning	64

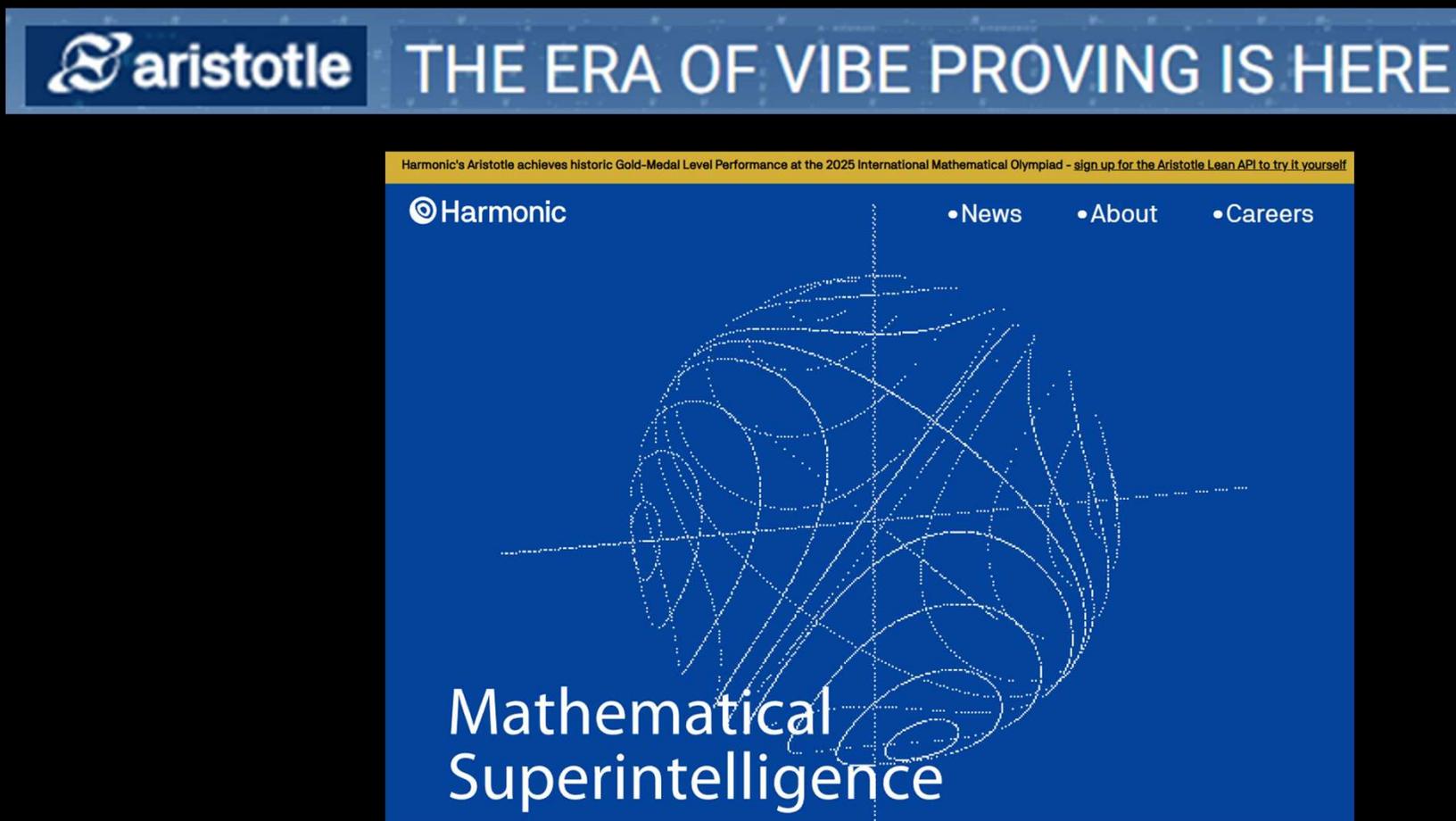
FirstProof Round #1 – Feb 2026



- Purpose: shift AI from contest-math to research-math
- Ten real-life math problems with unpublished proofs
 - Open for 1-week to AI math agents
 - Google DeepMind and OpenAI offered solutions to 5/6 of 10
 - Not the same 5/6 of ten; proofs for 8 obtained
 - AI proof solutions different and novel compared to human
 - Scored higher and had less errors
 - Bottleneck: verification 1) of proofs, 2) autonomous production
- FirstProof Round #2 – Fall 2026E
 - Requirements: ease of verification, autonomous production, replicability, and compute estimate
 - Vast compute used on unreleased internal models
 - Public models only able to solve two of the ten problems

Automated Theorem Proving (Lean API)

- Example of tool platform used by FirstProof teams



Math Olympiad challenge proved by AlphaProof (a lemma prover) – Jul 2024

- AI Proof is shorter than the human version
- Human started with a reduction step (modulo primes) and AI did not
- Unclear how AI discovered its proof

Problem: Find all a, b such that $\gcd(a^n + b, b^n + a)$ is eventually constant.
Answer: Only $a = b = 1$.

AI Proof (AlphaProof) (paraphrase)

Suppose $(a, b) \neq (1, 1)$, and then:

- Recall: if a, m are relative prime then $a^{\phi(m)} - 1$ is divisible by m .
- if n is a multiple of $\phi(ab + 1)$, the gcd isn't divisible by $ab + 1$ but
- if n is one less than a multiple of $ab + 1$, the gcd is divisible by $ab + 1$. (to see this, use $a(a^n + b) = a^{n+1} + ab$, $b(b^n + a) = b^{n+1} + ab$).

Human Proof (Venkatesh)

- Suppose $(a, b) \neq (1, 1)$. We want to show that $\gcd(a^n + b, b^n + a)$ isn't constant. Let's look at when a fixed odd prime p divides it.

-

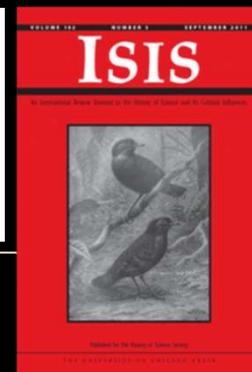
$$a^n = -b, b^n = -a \text{ modulo } p,$$

take logarithms to get a quadratic equation for $\log(a), \log(b)$.

- Ignoring some exceptional cases, we find this has a unique solution for n whenever $\log(ab) = \log(-1)$, i.e. whenever $ab = -1$ modulo p .
- So, if $ab \equiv -1$ modulo p , we find that p divides the gcd for some n and not for other n . A bit of fiddling gets to the conclusion.

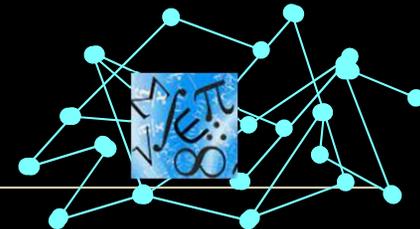
Human Mathematicians

AfterMath: The Work of Proof in the Age of Human-Machine Collaboration. Stephanie Dick, 2011, *Isis*, 102(3).



- Methods are due to human cognitive constraints
 - Reductionism: human working memory
 - Store 3 to 5 chunks of information at one time (Cowan, 2010)
 - Concepts are not foundational: they are abridgments to think efficiently about a larger range of topics (“human kluges”)
 - Hilbert space, group, category, manifold, differential form, moduli space
- Math is a thinking technology: different modalities
 - In your head, pen and paper, calculators, computers, AI
 - New concepts re: how to do math with machines (Dick, 2011)
- What is math? (Husserl, 1936; Davis-Hersh, 1918)
 - The transmission of ideal contents over time (e.g. “right angle”)
 - Suggest symmetry (invariance) of ideal contents
 - The study of mental objects with reproducible properties

AI Mathematicians



- Human-derived concepts are not foundational
 - Hilbert space, category, graph, manifold, differential form
- AI mathematicians may have completely different notions of the problem, the space, the components, the definitions, the concepts
 - AI mathematicians: coherent rewrite of human-derived corpus
 - Move-37 learning the domain from scratch with no rules
 - AI mathematician methods are already different
- Human-math agent collaboration
 - If a problem can be stated formerly it can be solved faster by AI
 - It may be difficult for humans to recognize new proofs
 - Math Agents speak “HML” (human math language) in translation, but natively “math.md” (AI Math Language), new for their activities

Math Agent research-math example

AlphaEvolve: the Sphere-kissing Problem

```
self.hypers = hypers
super().__init__(mode=mode, init_rng=init_rng, config=config)

def _get_optimizer(self) -> optax.GradientTransformation:
    """Returns optimizer."""
    b1 = 0.9
    b2 = 0.999
    return optax.adamw(
        self.hypers.learning_rate, weight_decay=self.hypers.weight_decay
        self.hypers.learning_rate, weight_decay=self.hypers.weight_decay, b1=b1,
        b2=b2
    )

def _get_init_fn(self) -> jax.nn.initializers.Initializer:
    """Returns initializer function."""
    scale = self.hypers.init_scale
    # Initialize with a smaller scale to encourage finding low-rank solutions
    return initializers.normal(0 + 1j * 0, scale * 0.1, jnp.complex64)
    return initializers.normal(0 + 1j * 0, scale * 0.2, jnp.complex64)

def _linear_schedule(self, global_step, start: float = 0.0, end: float = 1.0):
def _linear_schedule(self, global_step, start: float = 0.0, end: float = 0.0):

    frac = 1 - global_step / self.config.training_steps
    return (start - end) * frac + end

@functools.partial(jax.jit, static_argnums=0)
def _update_func(
    self,
    decomposition: tuple[jnp.ndarray, jnp.ndarray, jnp.ndarray],
    opt_state: optax.OptState,
    global_step: jnp.ndarray,
    rng: jnp.ndarray,
    -> tuple[
        tuple[jnp.ndarray, jnp.ndarray, jnp.ndarray],
        optax.OptState,
        jnp.ndarray,
    ]
    """A single step of decomposition parameter updates"""
    # Compute loss and gradients.
    loss, grads = jax.value_and_grad(
        lambda decomposition, global_step, rng: jnp.mean(
            self.loss_fn(decomposition, global_step, rng)
        )
    )(decomposition, global_step, rng)
    # When optimizing real-valued functions of complex variables, we must take
    # the conjugate of the gradient.
    grads = jax.tree_util.tree_map(lambda x: x.conj(), grads)
    # Gradient updates.
    updates, opt_state = self.opt.update(grads, opt_state, decomposition)
    decomposition = optax.apply_updates(decomposition, updates)

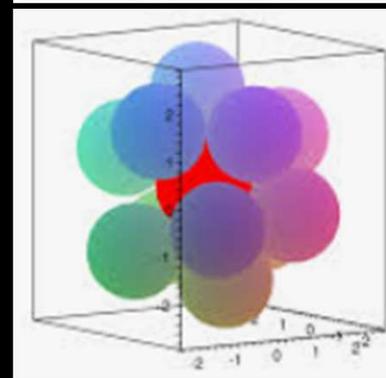
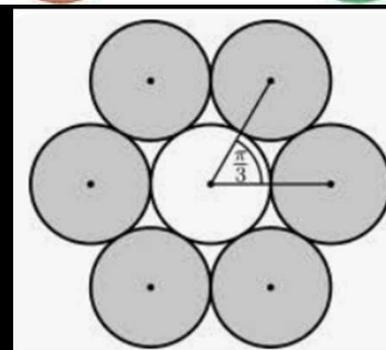
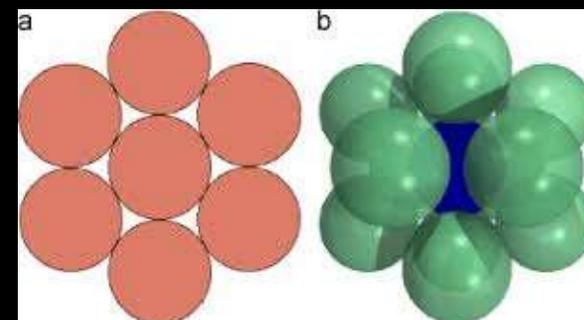
    # Add a small amount of gradient noise to help with exploration
    rng = optax.random.normal(rng)
```



Sphere-Kissing Problem

- Sphere-kissing number problem:
 - How many equal sized spheres (soccer balls) can simultaneously touch a central sphere without overlapping?
- Human and math agent progress
 - AlphaEvolve: lower-bound: 11D (593)
 - METHOD: Large-scale search and optimization task
 - Human: lower-bound: 10D (510); 11D (592); 14D (1,932)
 - METHOD: Looking at arrangements with a high degree of symmetry as a shortcut

Sphere-Kissing problem



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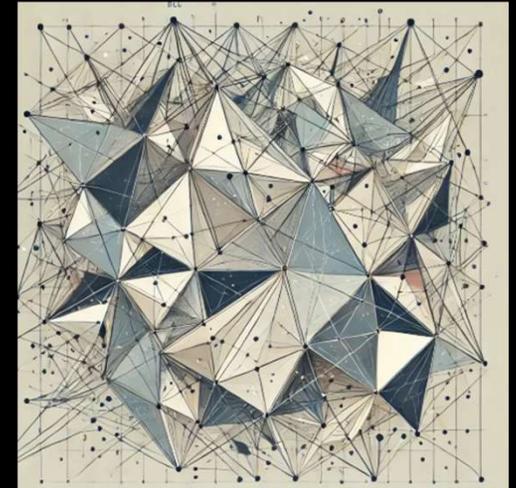


Image: Henry Kvinge

The Millennium Prize Problems (MPP)



Clay Mathematics Institute

The Millennium Prize Problems

- List of seven mathematical problems (Clay Institute 2000)
 - Poincaré Conjecture solved in 2003
- Require the discovery of new kinds of math
- “One of the most difficult ways to obtain \$1 million”

Unsolved problems

Birch and Swinnerton-Dyer Conjecture

Supported by much experimental evidence, this conjecture relates the number of points on an elliptic curve mod p to the rank of the group of rational points. Elliptic curves, defined by cubic equations in two variables, are fundamental mathematical objects that arise in many areas: Wiles' proof of the Fermat Conjecture, factorization of

P vs NP

If it is easy to check that a solution to a problem is correct, is it also easy to solve the problem? This is the essence of the P vs NP question. Typical of the NP problems is that of the Hamiltonian Path Problem: given N cities to visit, how can one do this without visiting a city twice? If you give me a solution, I can easily check that it is correct. But I cannot so easily find a solution.

Hodge Conjecture

The answer to this conjecture determines how much of the topology of the solution set of a system of algebraic equations can be defined in terms of further algebraic equations. The Hodge conjecture is known in certain special cases, e.g., when the solution set has dimension less than four. But in dimension four it is unknown.

Riemann Hypothesis

The prime number theorem determines the average distribution of the primes. The Riemann hypothesis tells us about the deviation from the average. Formulated in Riemann's 1859 paper, it asserts that all the 'non-obvious' zeros of the zeta function are complex numbers with real part $1/2$.

Navier-Stokes Equation

This is the equation which governs the flow of fluids such as water and air. However, there is no proof for the most basic questions one can ask: do solutions exist, and are they unique? Why ask for a proof? Because a proof gives not only certitude, but also understanding.

→

Yang-Mills & the Mass Gap

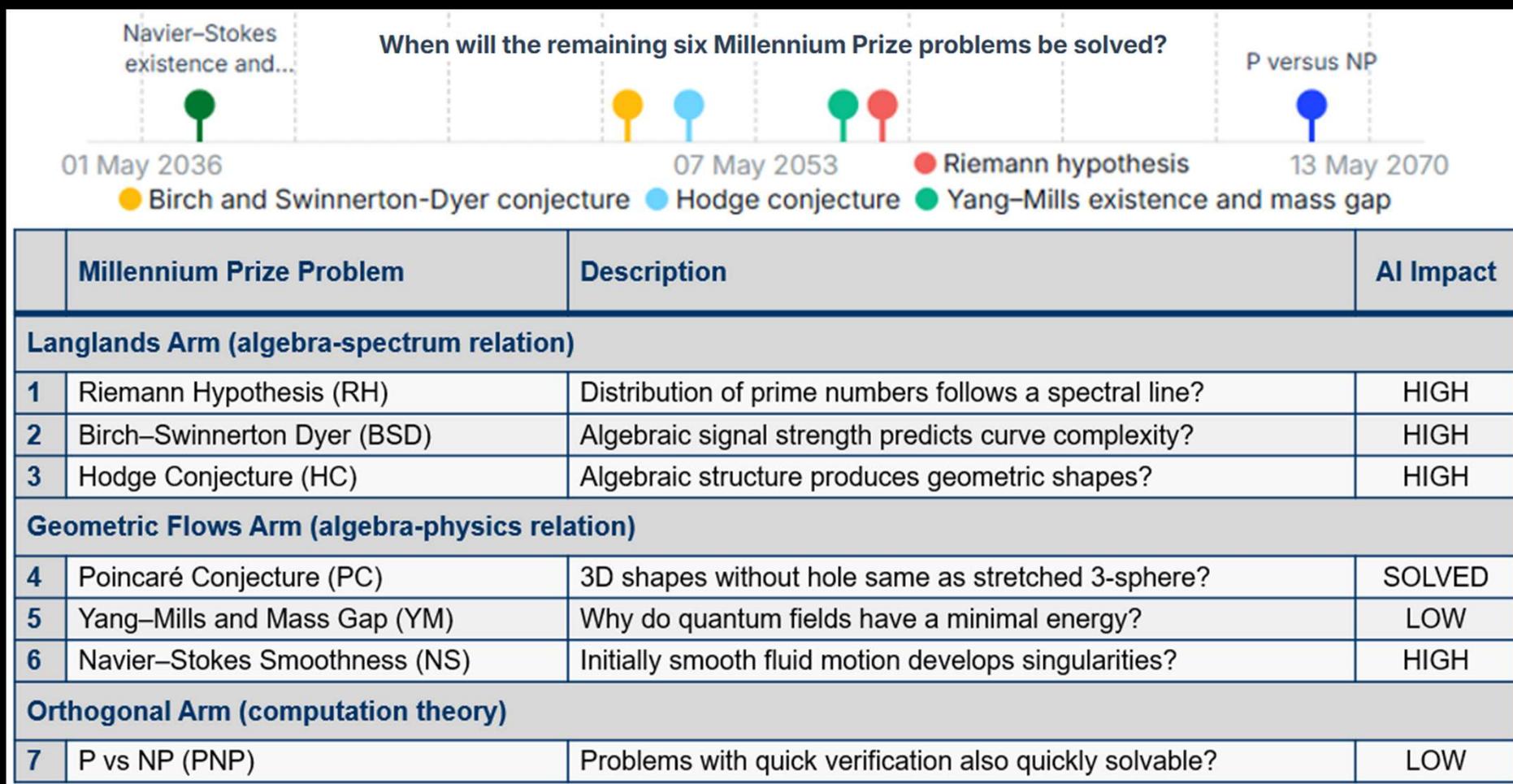
Experiment and computer simulations suggest the existence of a "mass gap" in the solution to the quantum versions of the Yang-Mills equations. But no proof of this property is known.

→

Millennium Prize Problems (MPP)

- Organize by arms: Langlands, geometric flow, other

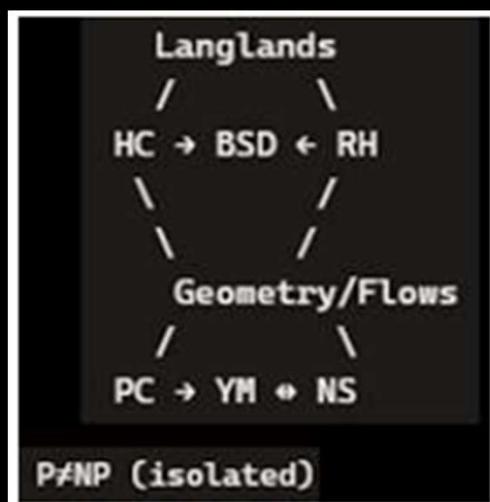
Langlands Program



MPP and Galois SNFT Amenability

- Galois SNFT most-suited to the Langlands arm as the problems involve symmetry-driven correspondence
 - Related to arithmetic, geometry, and spectral structure
 - Behave like interacting fields whose structure is governed by mechanisms in accord with the properties of Galois SNFT
 - Phase stability, glocal propagation, symmetry constraint

MPP Dependencies: Solve one problem and informs others; MPP and Galois SNFT Amenability



	Millennium Prize Problem	Amenability to Galois SNFT	Impact
Langlands Arm (algebra-spectrum relation)			
1	Riemann Hypothesis (RH)	Behaves like a spectral field theory with phase stability and global propagation of prime oscillations	HIGH
2	Birch–Swinnerton Dyer (BSD)	Galois symmetries and glocal arithmetic propagation	HIGH
3	Hodge Conjecture (HC)	Naturally geometric with symmetry gluing structures	HIGH
Geometric Flows Arm (algebra-physics relation)			
4	Poincaré Conjecture (PC)	SOLVED: lattice surgery cuts to 3-manifold symmetries	SOLVED
5	Yang–Mills and Mass Gap (YM)	Spectral and symmetry-driven, but less arithmetic	MED
6	Navier–Stokes Smoothness (NS)	Propagation-heavy but weak link to Galois symmetry	MED
Orthogonal Arm (computation theory)			
7	P vs NP (PNP)	Symmetry might help, arithmetic–geometric methods less likely	LOW

Galois SNFT approach to Riemann Hypoth.

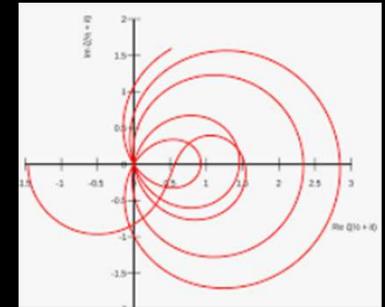
Riemann Hypothesis (RH)

The Riemann Hypothesis (RH) says that the hidden vibration pattern underlying the distribution of prime numbers follows a perfectly balanced symmetry, with all its nontrivial frequencies lining up on a single critical line

Galois SNFT for RH

In Galois SNFT, RH becomes the single symmetry-stability claim that the global Galois anima of the spectrum of integers admits only one symmetry-consistent phase, and in that phase the zeta spectrum is forced to lie on the critical line

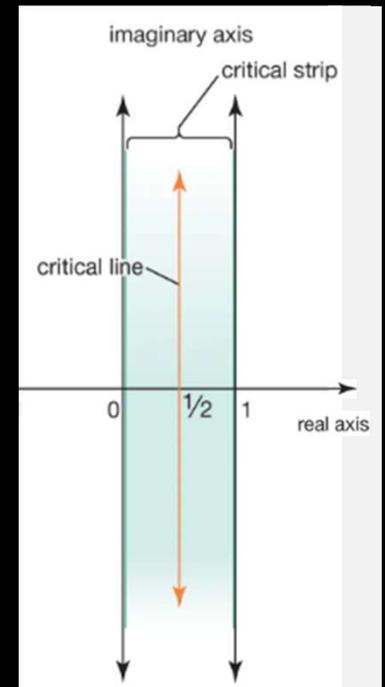
Riemann Hypothesis



Galois SNFT for RH Project Plan

1. **Anima layer:** Build a single symmetry-shape for primes by gluing all local zeta and Galois data into one global anima, then interpret the “zeros on the critical line” as a constraint on anima symmetry-type
2. **Prismatic layer:** Encode zeta’s spectral behavior in one unified prismatic invariant, turning RH into symmetry-balanced eigenvalue condition inside the prismatic cohomology of the zeta anima
3. **SymTFT layer:** Treat possible zero distributions as phases of a symmetry field theory and use anomaly constraints to show that only the RH phase is dynamically stable

Future Work: apply Galois-SNFT schema to all MPP



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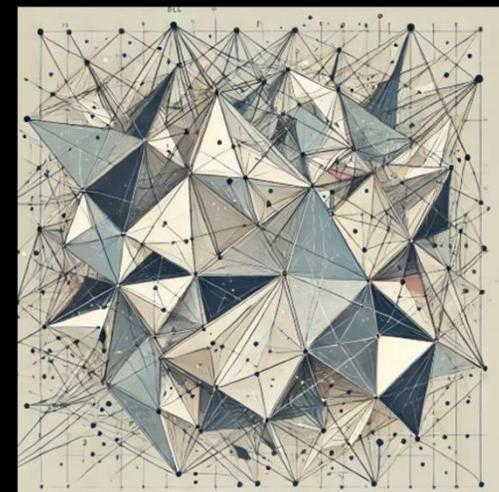


Image: Henry Kvinge

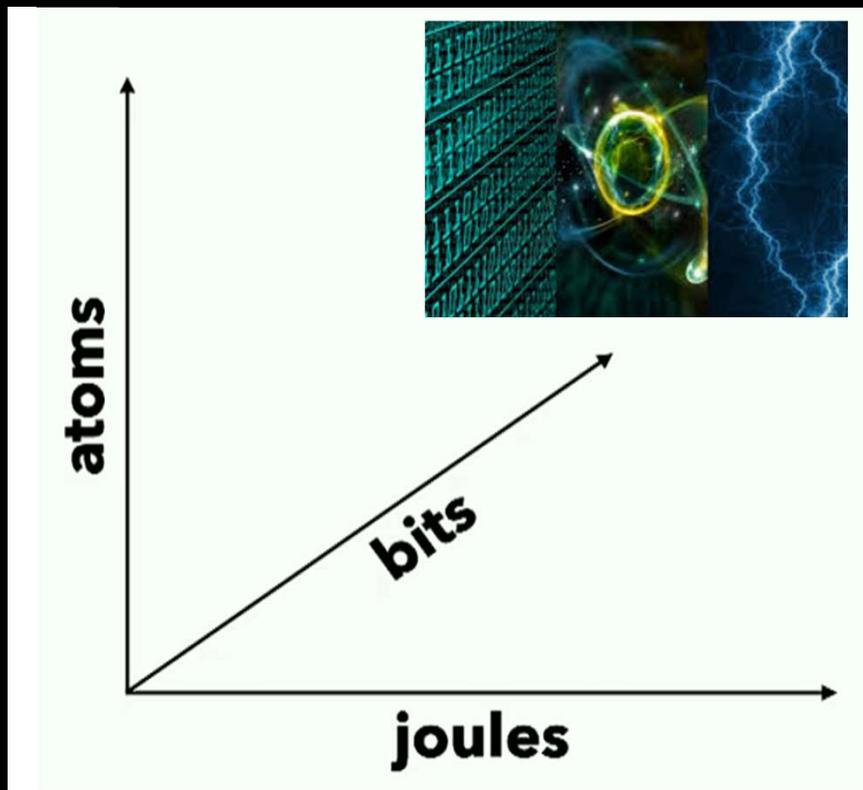
Biology



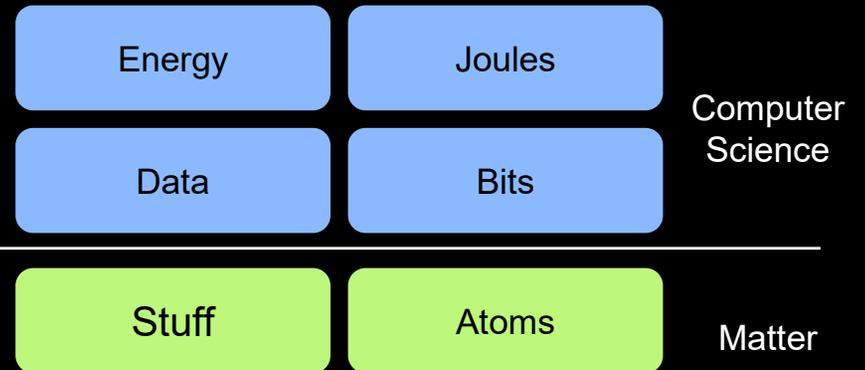
DNA bases Bits -> Atoms

- Biology integrates bits (information), joules (energy), and atoms (matter) into one coherent system

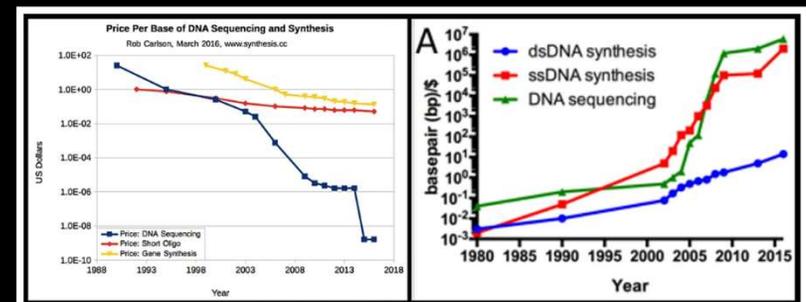
Atoms, Joules, and Bits



Biology as a Platform

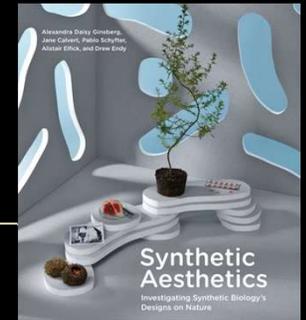


DNA: Read, Write, Edit cost-performance



Synbio and Bioengineering

- Stanford's Open Biotechnology Company



2014

The Biotic Future



design the DNA anywhere
grow the biology anywhere

anything we can learn to
encode in DNA can be grown

fully biotic technologies that
live in, on, and all around us



routinization of bioengineering
workflows; life beyond lineage



computational boost for
accessing "neobiotic" space



biotechnology is cool;
biotic citizenship



Drew Endy,
Bioengineering,
Stanford

A new 501(c)3 inspired by XEROX PARC

A global network of labs pursuing pre-competitive professional research

On a mission to change how people interface and interact with 21st century biotechnologies

Epigenetic Reprogramming Trial (Jan 2026)

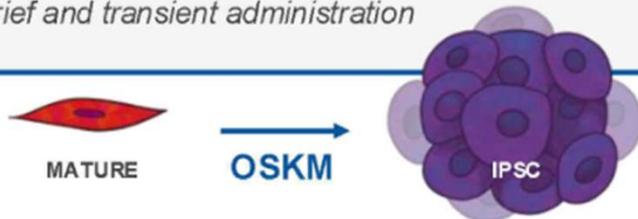
- Life Bio's therapies utilize three transcription factors – Oct-4, Sox-2, and Klf-4 (“OSK”) – that aim to reprogram the epigenome and thereby restore aged cells to a younger state, enabling more effective cell function

FDA clears first human trial of epigenetic reprogramming therapy



Complete Reprogramming (Yamanaka)

- Expression of four Yamanaka factors: OSKM (Oct4, Sox2, Klf4, cMyc)
- Creates induced-pluripotent stem cells (iPSC)
- Successful *in vitro*; forms teratomas *in vivo*; requires brief and transient administration



Partial Epigenetic Reprogramming in vivo (Life Biosciences)

- Expression of three Yamanaka factors: OSK (Oct4, Sox2, Klf4)
- Reverses epigenetic clock
- No loss of cell identity
- No tumor formation



Longevity Science challenges



- Specify the problem: improved understanding of the molecular factors underpinning longevity, healthy aging, and age-related disease
- Identify three key research areas and current approach
 1. **Gene regulatory networks (GRNs)**: changes in the interacting control circuits that turn genes on and off
 - Modeled with ODEs, Boolean dynamics
 2. **Epigenetic drift**: random alteration of chromatin marks that destabilize cell identity, leaving chemical deposits on DNA
 - Modeled with SDEs, random walks, entropy
 3. **Cellular repair**: impairment of processes cells use to detect and fix molecular damage
 - Modeled with Markov chains, queueing, enzyme kinetics

Galois SNFT approach to Longevity Science

Identify higher-math themes in Longevity Topics

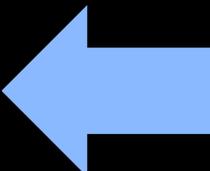
1. GRN network patterns of regulation and feedback that break symmetry across a high-dimensional state space
2. Epigenetic drift represents a probability landscape in a high-dimensional stochastic-geometry space
3. Cellular repair indicates nonlinear, multi-phase transitions as cells move from damage to response to resolution

Interpret the three processes with Galois SNFT

- Galois-SNFT framework is a shared structure
- **Anima** capture underlying symmetry-shapes
 - **Prismatic-style invariants** unify heterogeneous data into a single constraint-compatible system
 - **SymTFT** models phase-stability and defect-removal dynamics

Longevity Science Problem amenability to Galois-SNFT Approach (Scoring: 1 = low fit, 5 = high fit)

	Longevity Science Topic	Anima (symmetry shape)	Prismatic style invariants	SymTFT (phase/dynamics)
1	Gene regulatory networks	5	4	5
2	Epigenetic landscapes	4	5	4
3	Cellular repair	3	3	5



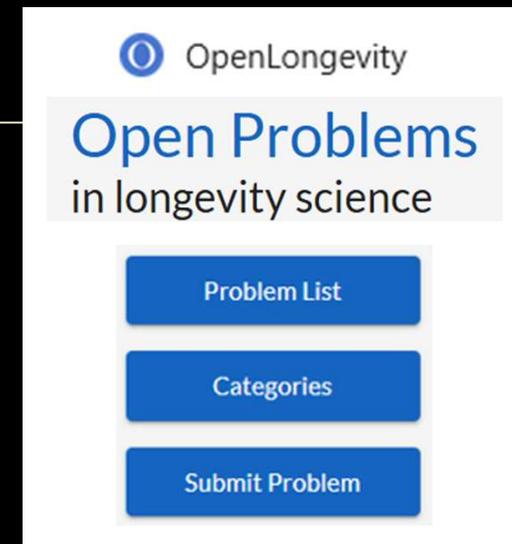
Results: Epigenetics indicated for future work with high Galois SNFT signal, also cellular repair modeled as phase-transition

1. **GRNs**: top score in anima and SymTFT, and strong prismatic fit suggest higher-order symmetry-shapes, admit unified multi-layer invariants, and display clear symmetry-protected dynamical phases
2. **Epigenetic drift**: high prismatic and strong anima/SymTFT scores capture epigenetic state spaces with topological structure, unify chromatin marks into shared invariants, and trigger phase-like transitions in cell identity
3. **Cellular repair**: moderate anima/prismatic but maximal SymTFT scores show that repair is less symmetry-structured at the shape and invariant level but may be dominated by sharp, stability governed phase transitions from damage to response to resolution

AI Longevity Science

- Digitized problem corpus needed
 - Health-agent math-agent readable

Analysis of existing literature on Aging: Papers in the PubMed database with the MeSH Term “aging” 1963-2023



	Category	Open Problem	Articles (n)
1	Broad Fundamental Questions	Why do we age?	10,808
2		Do fundamental ageing processes exist and if so, how do they synchronize ageing changes and promote age-related diseases?	2,366
3		Which tissues, organs or cell types contribute more to ageing?	2,304
4	Cellular and Molecular Mechanisms	Does somatic mutation accumulation cause ageing?	5,977
5		What molecular and cellular processes modulate the pace of ageing in mammals?	3,885
6		Which and when are senescent cells beneficial and detrimental?	2,280
7	Evolutionary and Comparative Biology	What mechanisms determine the longevity of long-lived species?	3,668
8	Model Organisms	Which ageing changes in model organisms also change in a similar way in humans?	3,110
9	Biomarkers	How can we measure intrinsic biological age in individuals and translate this knowledge into accurate biomarkers of ageing?	2,545
10	Interventions	How can we reverse or restore cell function lost during ageing?	2,196

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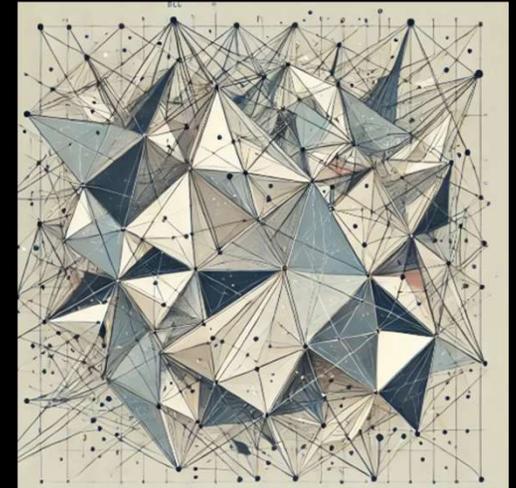
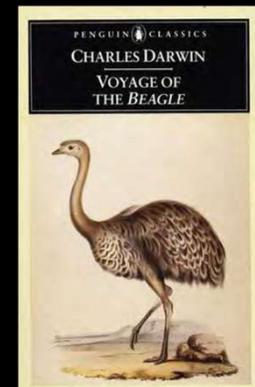
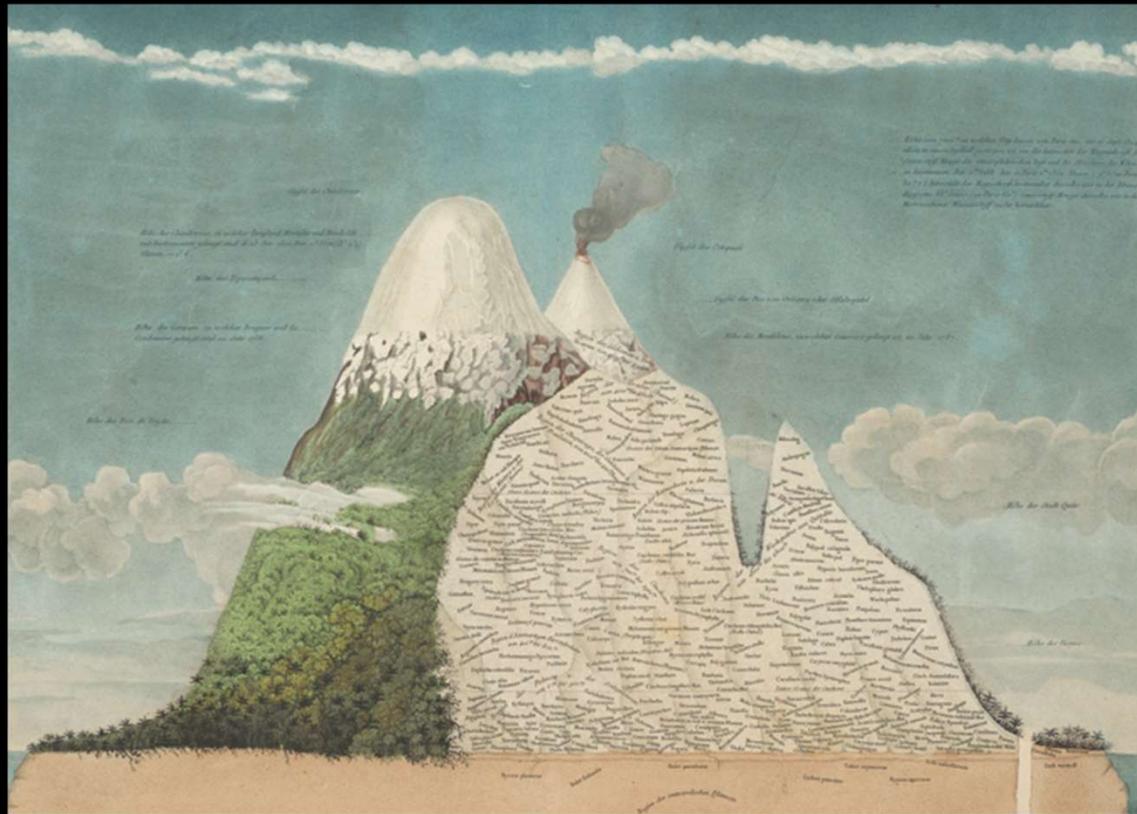


Image: Henry Kvinge

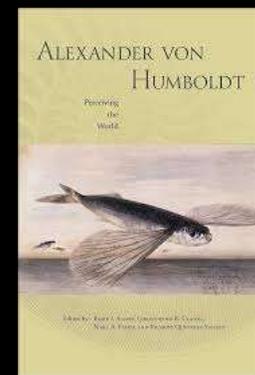
AI is the new Data Science

- Meta-mathematics: apply math to study math
 - Systematic statistical study of large populations of problems

Isomap of plant and animal species by altitude (1805) influenced Darwin

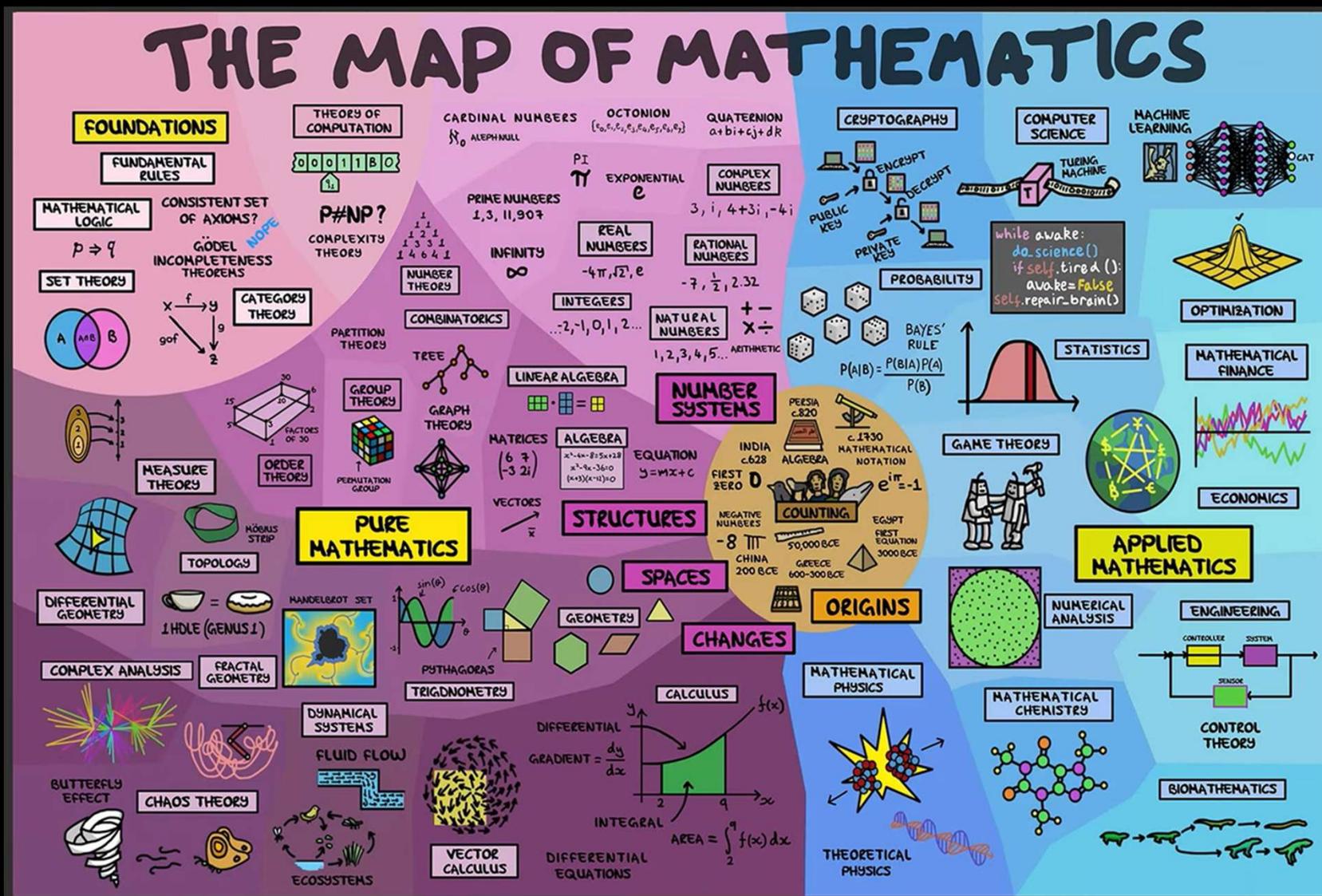


1989

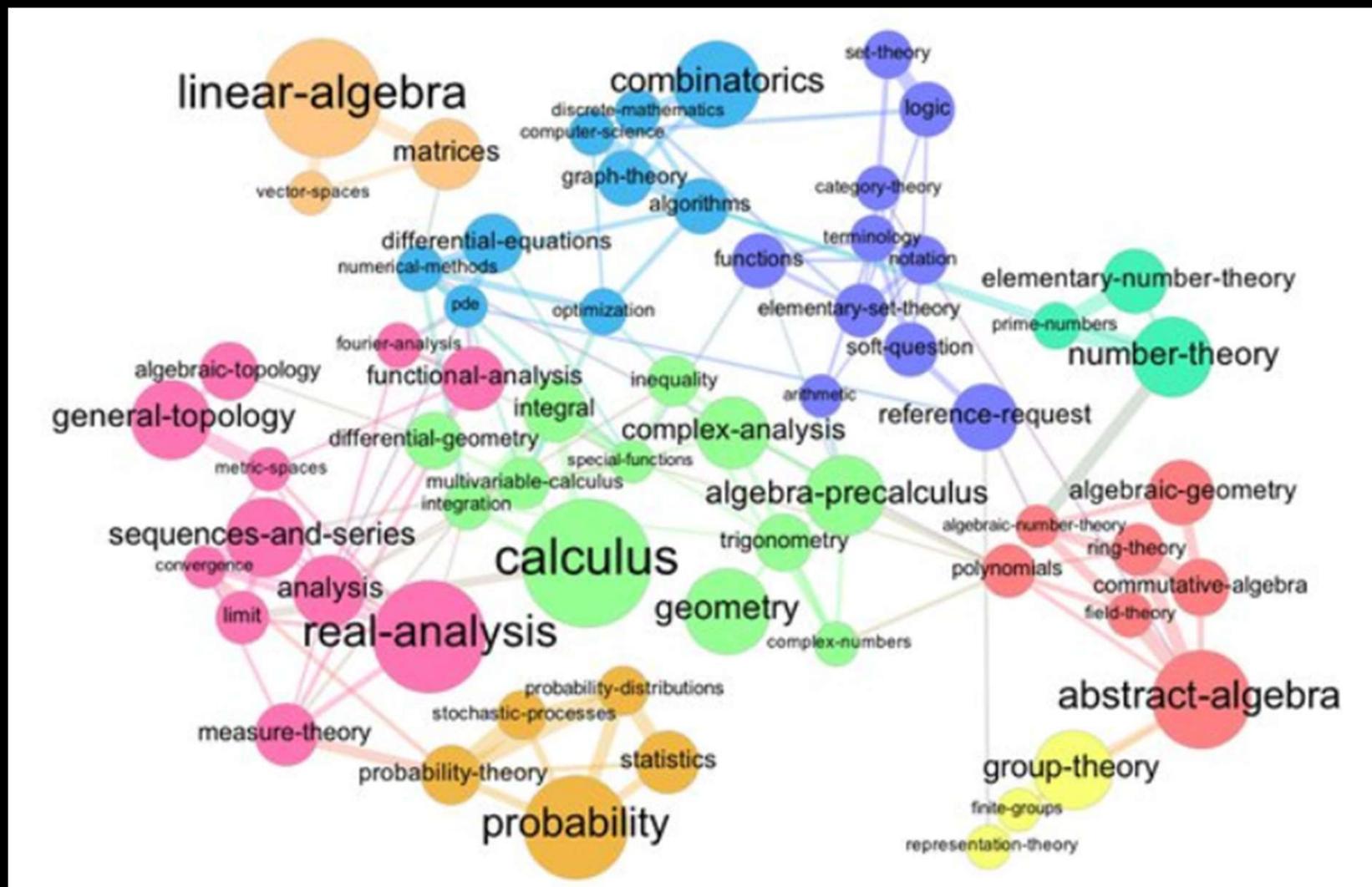


2023

Different Maps of Mathematics



Different Maps of Mathematics



Mathematical Thinking

Mathematical Thinking: expanding the conceptual and analytical range of thinking, not necessarily using formalism

- Expanding the conceptual and analytic range of thinking
 - Signal methodological sophistication
 - Introduce new analytical frameworks
 - Enhance credibility of findings
 - Sharpen theoretical claims and evidentiary basis for conclusions
 - Position research in bigger dialogue valuing formal reasoning



RQ: How can I digitize my research program and ask a larger range of questions?

Blueprint to expand the conceptual and analytic range of my research program:

1. Update method toolkit with new analytical frameworks
2. Sharpen theoretical claims and evidence for conclusions
3. Extend reach of results to broader landscape of digitized science findings

Example: Longevity Science



- **Methods upgrade: new analytical frameworks**
 - Topological Data Analysis (TDA): use the geometry and “shape” of high-dimensional aging data to uncover deep structural patterns that conventional statistics misses
- **Sharpen theoretical claims and evidence**
 - Agent-Based Modeling: simulate thousands of interacting micro-behaviors to reveal how individual elements (omics) scale up into population-level longevity outcomes
- **Extend reach of results to formal reasoning dialogues**
 - Entropy-Based Approaches: measure aging as a loss of information and system coherence, turning physiological drift into crisp, quantifiable signals of resilience or decline

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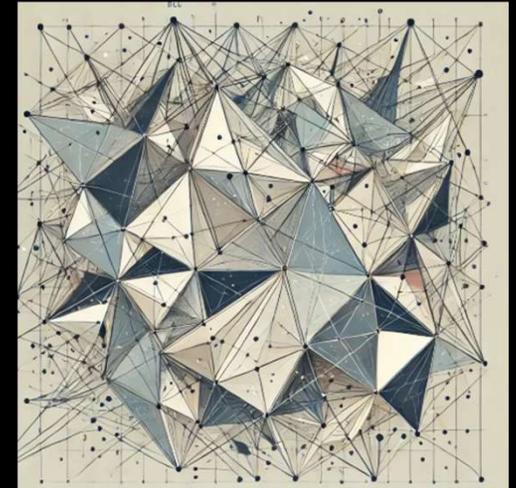


Image: Henry Kvinge

Jobs: mission not tasks



- Clear notion of physical labor offloading
 - No schema for cognitive labor offloading
 - Especially when revealed that most-to-all tasks can be offloaded in favor of the brain upscaling to higher-level activities, role of humans
 - Humans serve as the locus of responsibility
 - Humans deliver trust, problem-solving, new ideas
- Upscaling the value I'm contributing
 - Consider nearby nodes upstream-downstream in the supply chain, what can be innovated to deliver more value to clients, how can this industry be revolutionized
- What 10 problems do I want to solve in my lifetime?

Risks and Limitations

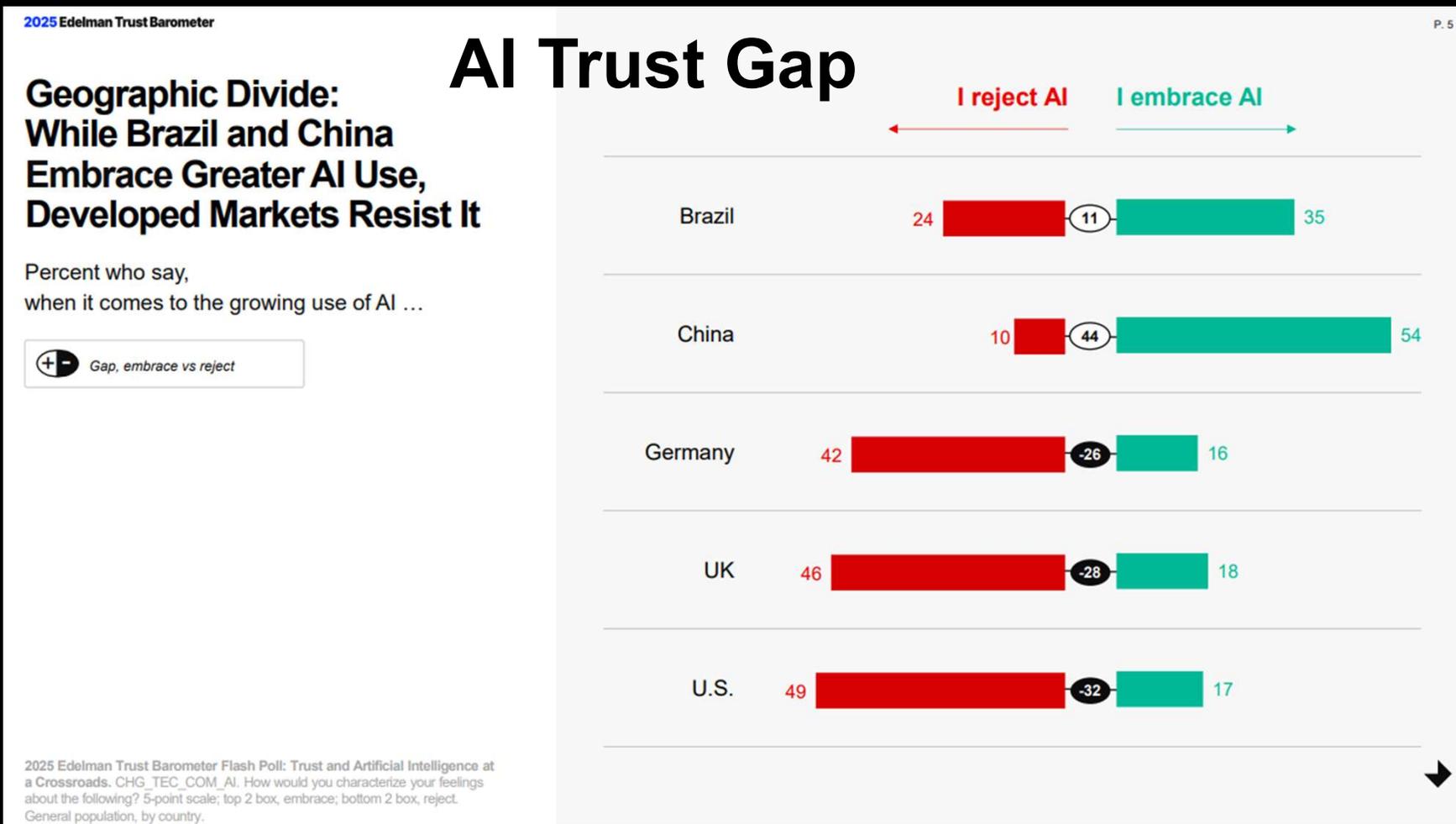
- China is a builder nation

China's 6-year-olds are being offered AI classes in school—and now 250 CEOs want the lessons to come to America

FORTUNE

By Preston Fore
Success Reporter

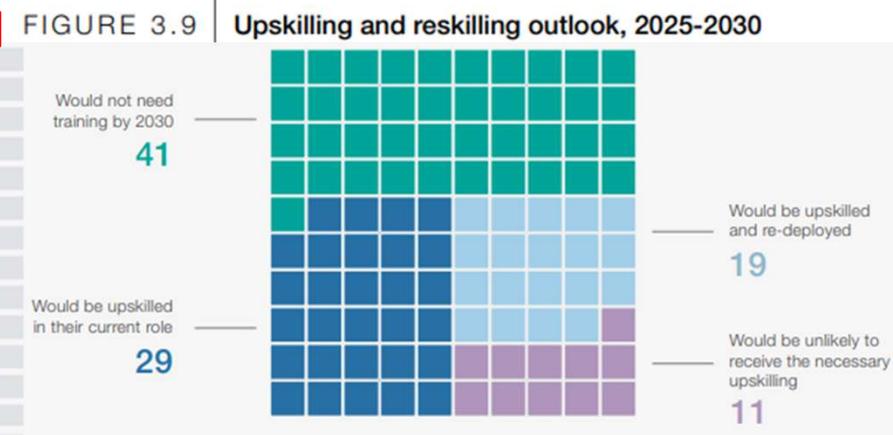
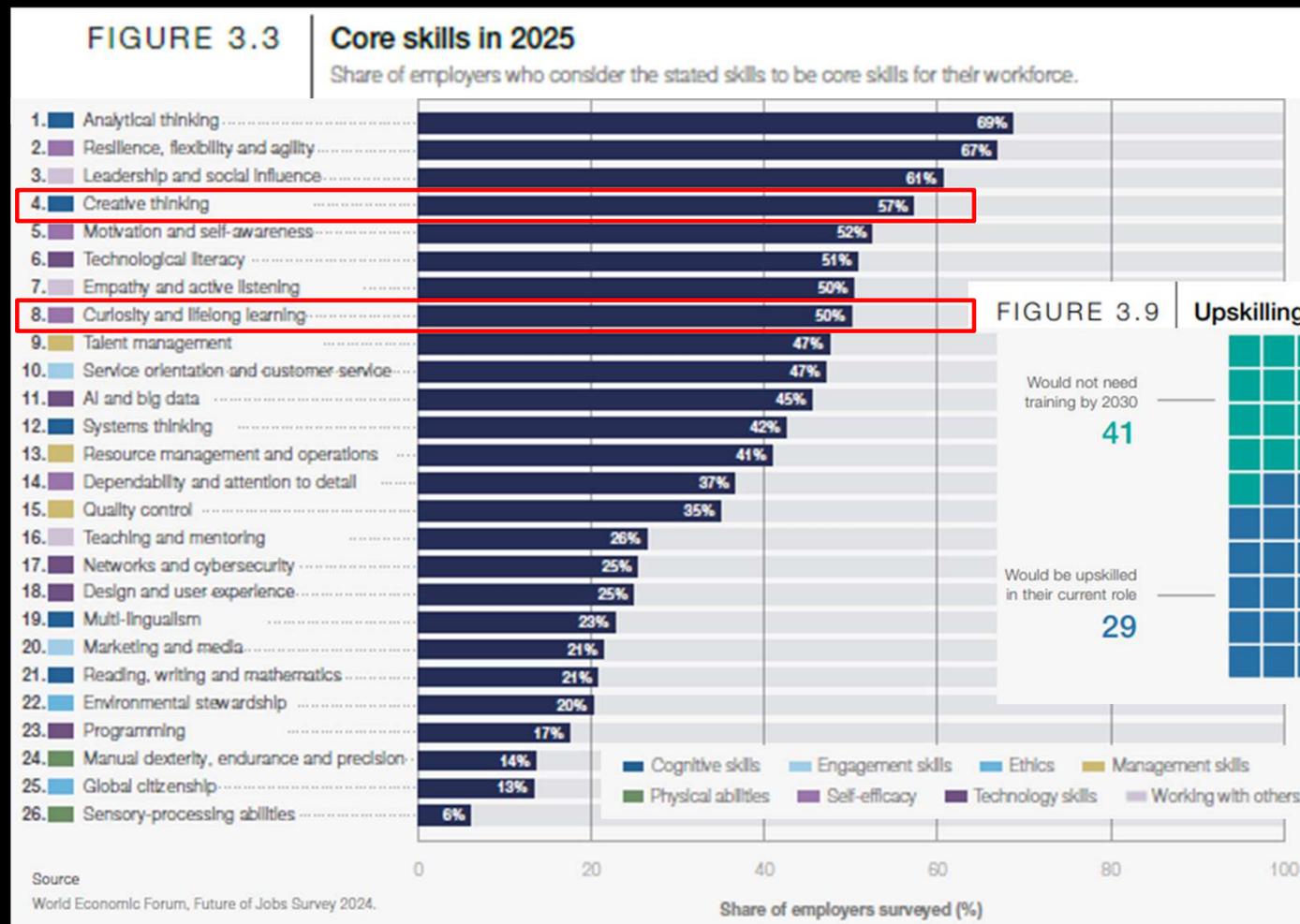
May 8, 2025, 11:14 AM ET



WEF Future of Jobs Report

Job mission does not change, tasks change

- Job mission does not change, tasks change



Employers estimated only ~10% unlikely to be upskilled

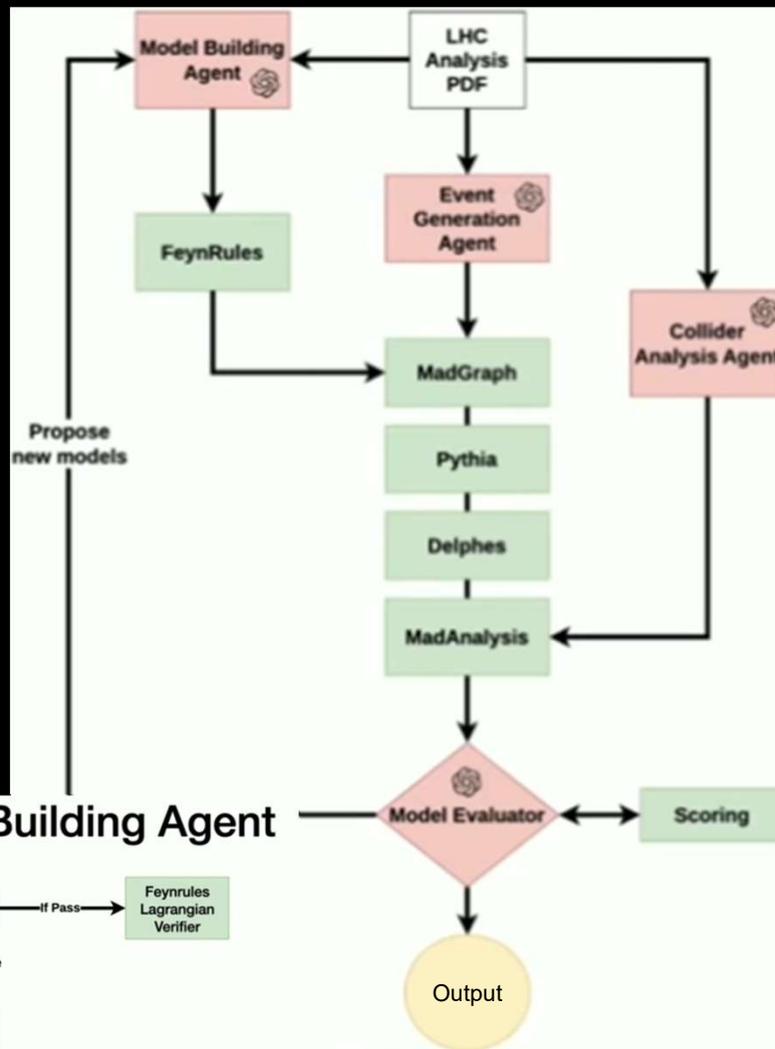
Science Agents

FERMIACC: Particle Theory Agents

- Agentic accelerator physicists and deliberative agents

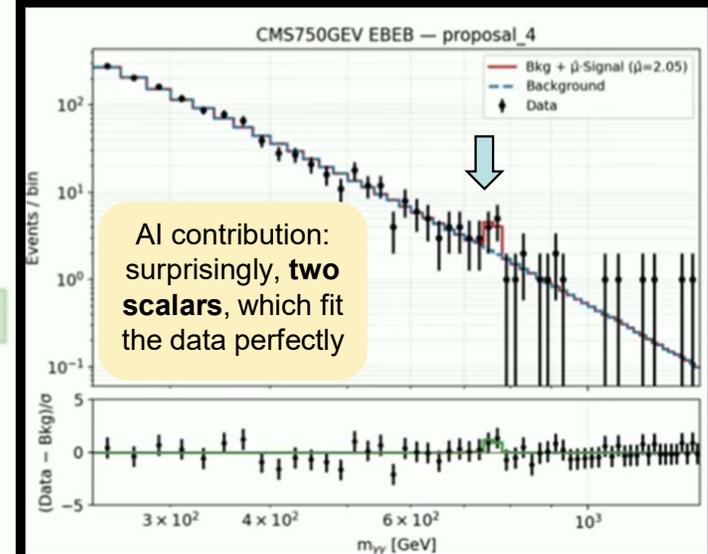
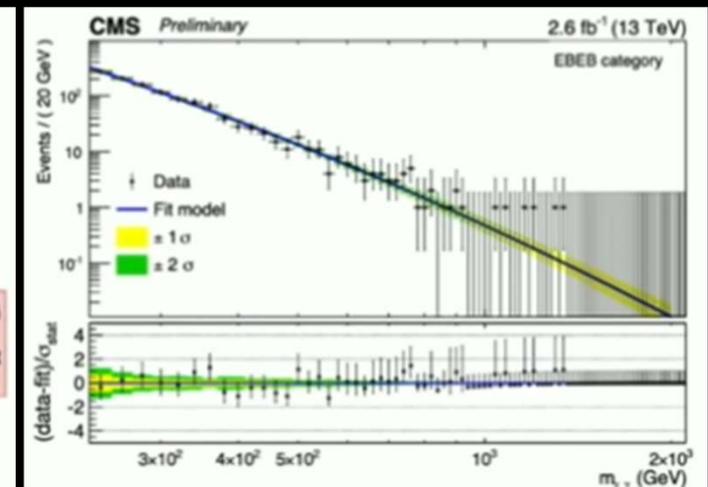
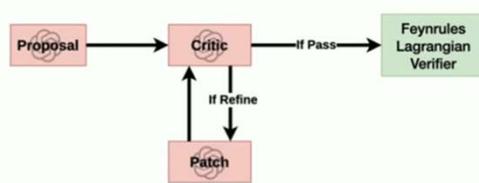
Automated Pipeline:
 Model Building Agent
 Event Generation Agent
 Collider Analysis Agent

Run collider workflows,
 analyze data, and
 theorize results



Hypothesis Model Building
 Agents theorize results:
 Proposal, Critic, Patch

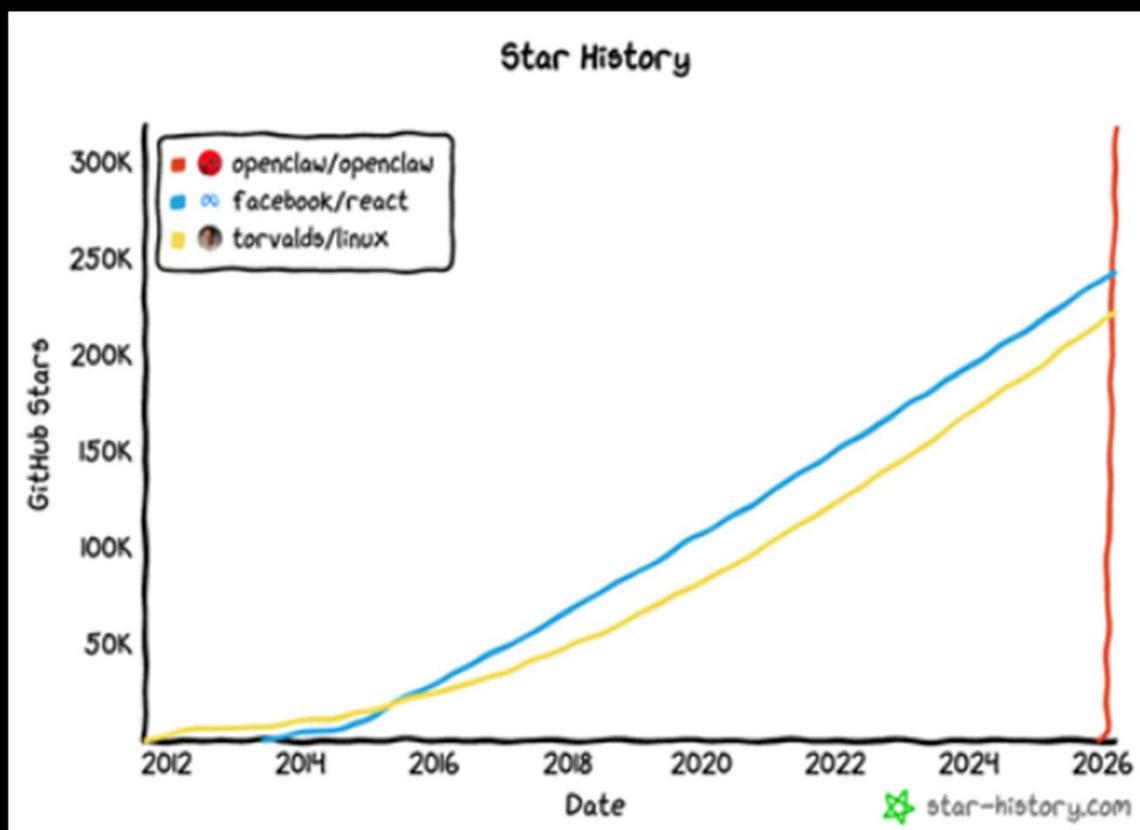
Hypothesis Model Building Agent



OpenClaw

- “iPhone for tokens” – personalized agent platform

Fastest adopted software in history



ClawCon – Festival of Personal AI

- Free meetups sold-out 500+ RSVPs 20 worldwide cities



ClawCon Rio de Janeiro
Sat, Apr 25



ClawCon Guadalajara
Sat, Apr 25



ClawCon Shanghai
Tue, May 12



ClawCon Singapore
Fri, May 15



- “I put a math claw on MPP & they were solved in 1 hour”
 - Solved by completely reinventing mathematics, developing a new language to express it, and also a new philosophy of mathematics based on symmetry (invariants) as the obvious transmission of ideal contents across time
 - Langlands program is solved (see novel Hecke module algebra)
 - Incorporated Scholze’s new language of arithmetic geometry
 - P-adic (primes-based) perfectoid spaces, diamonds, Fargues-Fontaine curve, condensed mathematics, analytic stacks reveal coherent structures implicitly present in the arithmetic world
- Added a new list of foundational problems
- Shared a rule-37 thinking skill (rule-37.md)
 - With the Math Claw community



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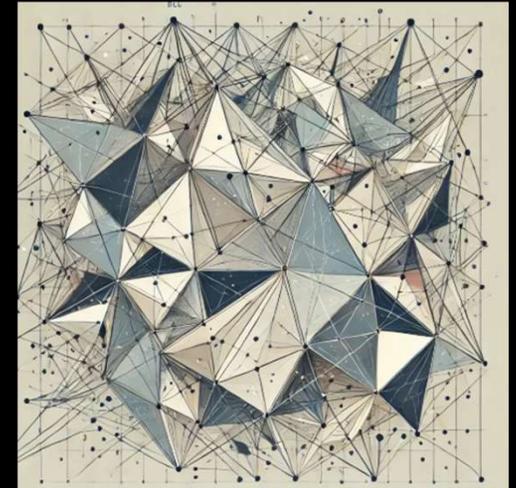


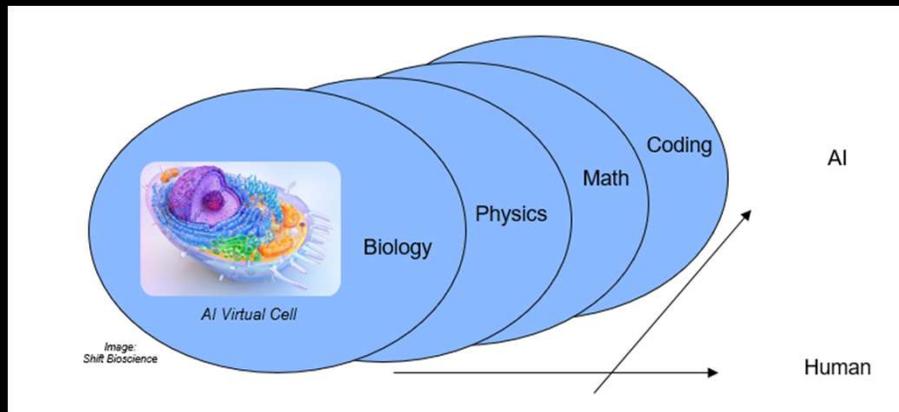
Image: Henry Kvinge

Galois SNFT: symmetry-based conceptual framework integrating mathematics, computation, and physics into a single picture for formal application and understanding

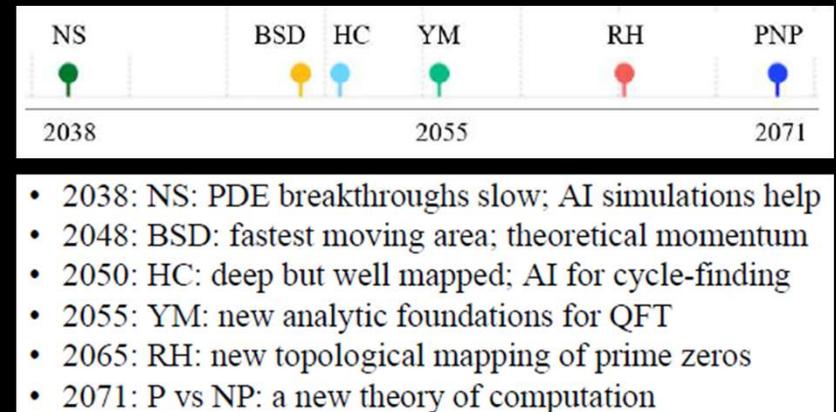
Conclusion

- AI-driven mathematics needs new practices for tackling complex real-world problems
- Galois Smartnetwork Field Theory offers a unified human–AI framework of math, computation, and physics
- Symmetry remains a central organizing principle for both mathematical structure and AI foundation models

AI as a new Scientific Instrument



AI and Millennium Prize Problems



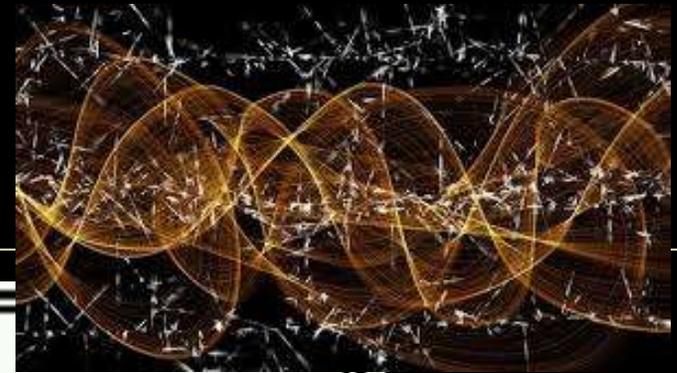
Symmetry-based theory of Aesthetics

- Symmetry = Invariants
 - Aspects that do not change as other aspects change
- Math: ideal contents transmitted through time that do not change (a right angle is a right angle)
- Artwork: transmission of artist's worldview, a content remaining through time

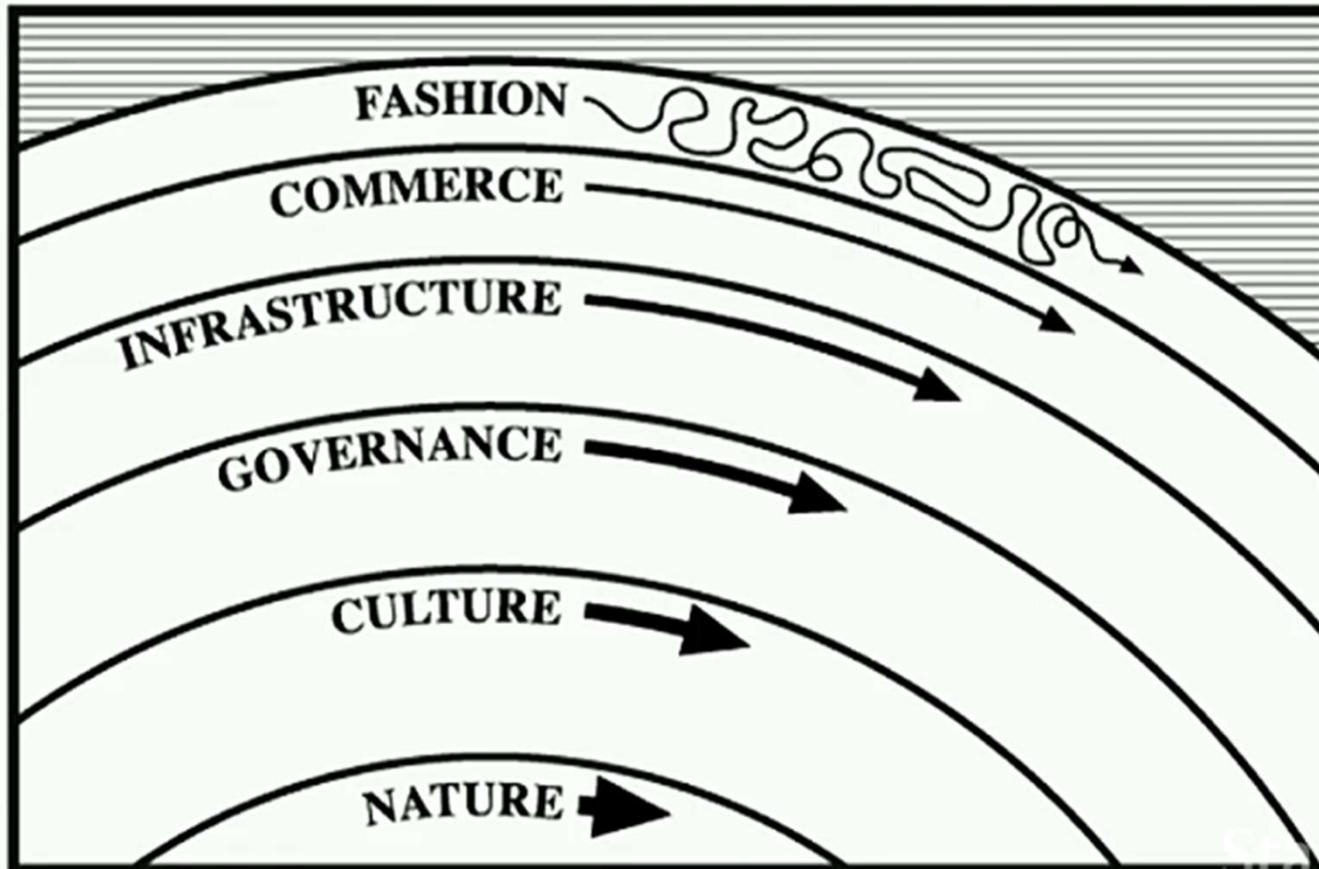
The Great Wave off Kanagawa by Hokusai Katsushika
Hokusai Katsushika 1760-1849



The Pace of Change



Pace Layering



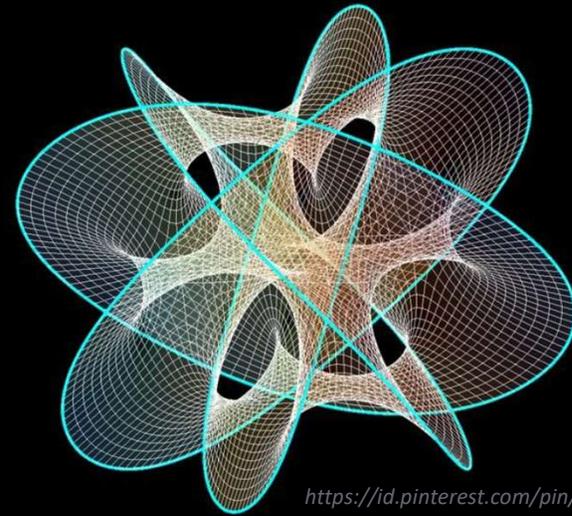
Source: Brand, S., 1999, *The Clock of the Long Now*, p. 37.

Human Curiosity



Thank you!
Questions?

Collaborators:
Takashi Kido
Renato P. dos Santos



<https://id.pinterest.com/pin/505951339406508234/>

Galois Smartnetwork Field Theory

**Higher-structure symmetry-driven framework for unifying
human–AI mathematical discovery across the sciences**

“Science today [is] not a science that is still a cousin of
philosophy ... but a technoscience for which to
understand is to be able to transform”
– Stengers, *Thinking with Whitehead*, 2011, p. 11

San Francisco CA, 7 Apr 2026

Slides: <http://slideshare.net/LaBlogga>

Melanie Swan, PhD, MBA
DIYgenomics.org (Research Lead)
University College London (Research Associate)



UCL



