A fleet that caught its own circular logic

produced by a Noogram agent fleet · noogram.org

Noogram · federated sister-work · 2026-06-18

Emmanuel Série

Applied mathematics, then quantitative research — physics PhD, then years inside quantitative research.

Teaching and research today — École Polytechnique, CMAP, the MaQI master.

One question today: can a fleet of agents do real mathematics — and notice when its own reasoning runs in a circle?

Noogram — an instrument built in the open

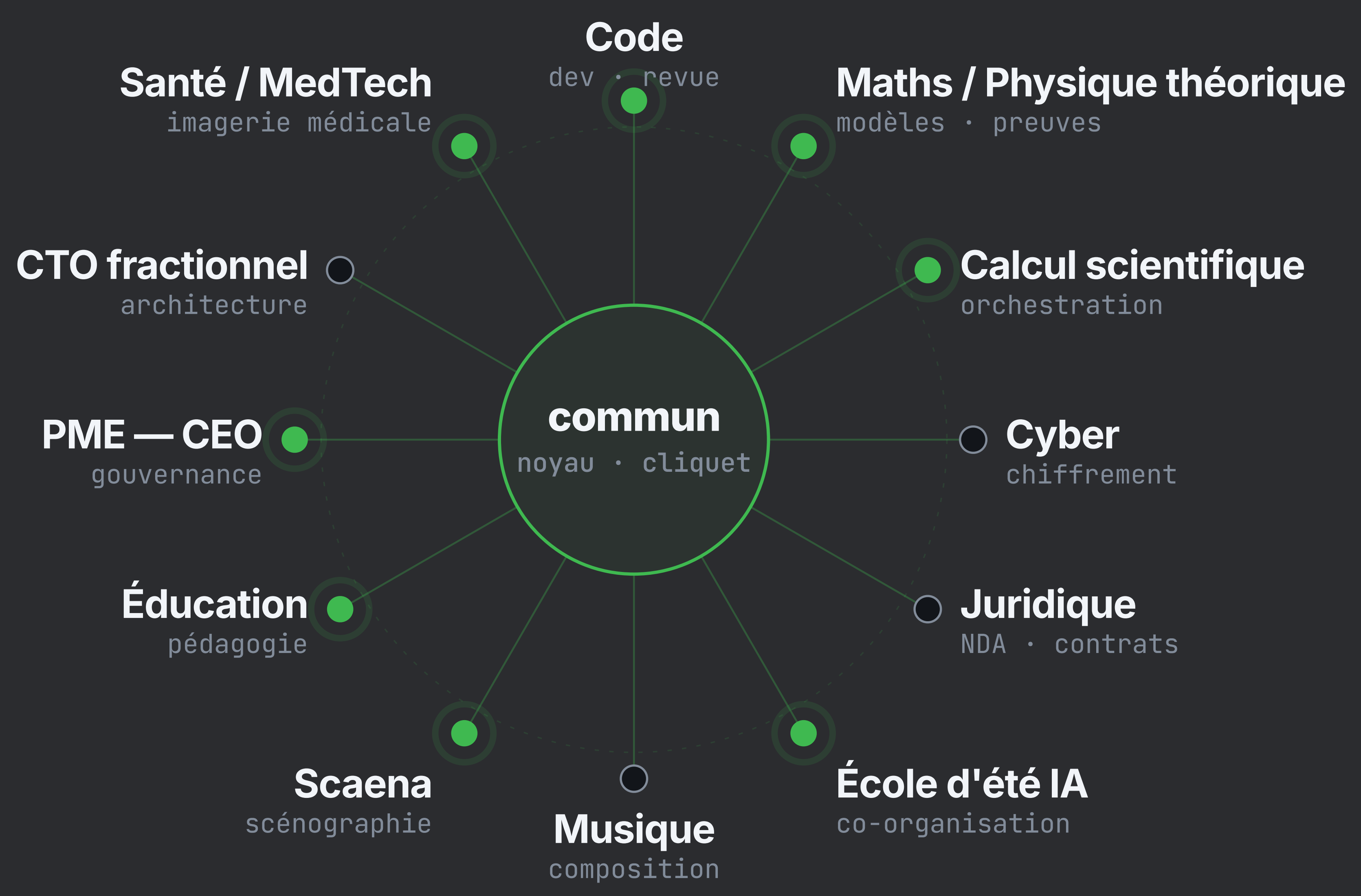
A research programme, not a product — federative agentic AI, human-amplified, never replaced.

Live today — the public core is shipping, not promised.

✓ core: Cosmon · AGPL-3.0 ✓ engine: OxyMake · public ✓ godel-kernel ✓ noogram.org · live

One instrument, many crafts

commun · noyau · cliquet *at the center — every spoke is a different craft run on the same open core. The green dots are* live public artifacts*: this talk is the maths spoke.*



Cosmon — the engine, under your control

Four principles, formally pinned — self-reference, transport-and-cognition, intentions-not-ownership, minimum-action; TLA+-validated.

Built by the method it runs — agents propose, a chief decides.

✓ commits: 10.7k | ✓ tests: 6.8k | ✓ Rust: ~490k lines | ✓ agent co-authored: 1.6k

La Formule 1, pas le pilote — one mission it just ran.

The question, verbatim

A half-formed line from a colleague — Étienne asked: blur an exponential-family law with Gaussian noise; does it stay in the family?

$$p_\theta * \gamma_\sigma \overset{?}{\propto} e^{-\tilde{\theta}^\top \varphi}$$

Same shape, new knobs $\tilde{\theta}$ *— that line was all the fleet got.*

Not one agent — a fleet

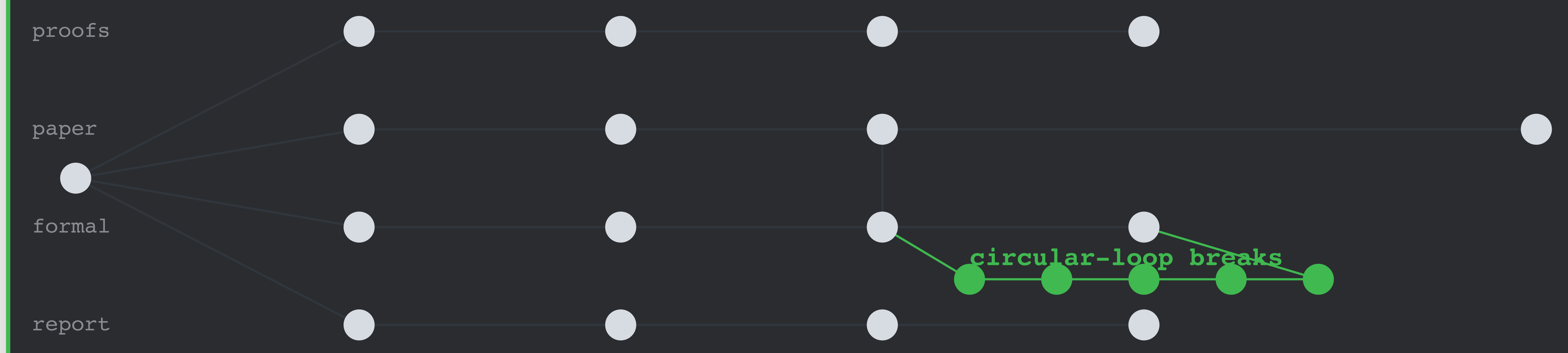
One chatbot is one mathematician — fast, fluent, alone in the room with its own blind spots.

This is a research group — many agents split across the three questions (general, quadratic, Hamilton–Jacobi), with referees built in: a panel whose only job is to attack the others' reasoning.

The plan lays itself down

A plan written in one breath — the opening science plan, before a single worker moves. Four branches: the proofs, the paper, the Lean formalisation, the narrative report.

It caught its own circular reasoning



The fleet found a loop in its own logic — the "classical" proof of the characterisation *secretly assumes* what it sets out to prove. A referee flagged it; the fleet wrote the loop down before escaping it. the circular notes ↗

The result, stated formally

Blur preserves the family $\Longleftrightarrow$ closure under Cole–Hopf:

$$\{p_\theta\}\ \text{stable} \iff \mathcal{L}(\theta^\top \varphi) \in \mathrm{Span}\{\varphi_i\} \oplus \mathbb{R}$$

One operator decides it — and it caps polynomials at degree two.

Q2 — the tractable case, in closed form

Quadratic statistic $\Rightarrow$ the new knobs are explicit:

$$\tilde{M} = M\,(I + \sigma^2 M)^{-1}, \qquad \tilde{b} = (I + \sigma^2 M)^{-1}\, b$$

A Riccati flow — smoothing a Gaussian-family law is just matrix inversion.

It is machine-checked — and honest at the edge

A machine read the quadratic proof and agreed — Lean 4, kernel-checked, no charisma gets past it.

The frontier stays visible — the Hamilton–Jacobi half needs a Laplacian absent from Mathlib. Documented, not faked.

✓ Q2 Lean: verified | ✓ loops caught: 2 | ✓ Q3 Lean: blocked (Mathlib) | ✓ Lean: v4.29

See it yourself

exp-families.noogram-labs.dev — proofs, paper, Lean, the circular notes: all live, all fleet-made.

The trust is in the gate — and in the loops the fleet was honest enough to write down.

✓ proof notes: 8 ✓ concept cards: 12 ✓ 2 papers · Lean Q2 · 2 circular notes

Appendix — backup slides

Everything past this point is past the end — reachable during Q&A with the arrow keys or slide overview.

A · Q3 — the Hamilton–Jacobi equivalence

Regular stability $\Longleftrightarrow$ a differentiable path solves an EDP — there exists $t \mapsto \theta_t$ with

$$\partial_t f_t = -\mathcal{L} f_t - c(t), \qquad c(t) = \tfrac{d}{dt} \log Z_{\theta_t}$$

Cole–Hopf is the bridge — $q = e^{-g}$ turns the heat equation $\partial_t q = \tfrac{1}{2} \Delta q$ into $\partial_t g = -\mathcal{L} g$; uniqueness (Widder/Tychonoff) pins the path.

B · The two loops the fleet caught

Loop 1 — stability $\Rightarrow$ closure — the textbook argument builds a path θ_t assuming stability holds on a *whole neighbourhood*, not just at the starting θ. Hidden over-assumption, written up in `circular-q1a`.

Loop 2 — the Q1 $\Longleftrightarrow$ Q3 "circle" — read naïvely, the easy direction assumes the very differentiable path it claims to produce. Resolved as a *glissement d'hypothèses* — a sliding of hypotheses, not a vicious circle — in `circular-q3`.

C · Why polynomial ⇒ quadratic

Plug a polynomial φ into $\mathcal{L}$ — the term $\frac{1}{2}\|\nabla(\theta^\top\varphi)\|^2$ doubles the top degree.

Closure caps it — for $\mathcal{L}(\theta^\top\varphi)$ to land back in $\mathrm{Span}\{\varphi\} \oplus \mathbb{R}$ for *all* θ, the doubled degree must already be in range — forcing $\deg \varphi_i \leq 2$.

So the quadratic case is not a toy — it is the whole polynomial world.