A GIE DEMONSTRATION

Can AI Rediscover Einstein?

An evolutionary search recovered the mass-loss relation at the heart of Einstein's 1905 radiation argument.

The result

In 12 of 30 evolutionary runs, GIE found a candidate that passed the experiment's construction criteria, held-out qualification checks, and a sealed comparison with Einstein's result. The recovered relation is:

A body that emits radiation energy L loses mass $\Delta m = L/c^2$.

For a general reader, the striking point is simple: an evolutionary system assembled a familiar, consequential physics relation from a declared collection of earlier equations and mathematical operations. The search did not receive the target relation as an input.

What was tested

The experiment focuses on Einstein's 1905 argument about a body emitting two equal, oppositely directed light pulses. It asks whether a candidate mathematical construction can make the energy accounting agree between the body's rest frame and a moving frame. The low-speed track uses the classical kinetic-energy relation and scores how well candidates extrapolate the accounting residual toward zero speed.

The GIE search starts with variable-length gene strings that reference allowed mathematical operations and physical formulas. It decodes each string into a candidate phenotype. A fixed evaluator exposes the candidate to the same trial conditions, assigns a scalar fitness, and evolutionary selection, crossover, and rare mutation generate later candidates. Candidates that pass construction scoring are then evaluated on held-out speeds, emitted-energy ratios, and a counterfactual value of c.

The experiment's evaluator did not use Einstein's target equation to score candidates. After the search, a separate sealed audit compared successful candidates with $\Delta m = L/c^2$. Twelve of thirty EA seeds passed both the held-out qualification and that final audit.

What "rediscovered" means here

This is a computational reconstruction of a recognizable result under a specified information boundary. It is not a claim that GIE reproduced Einstein's historical circumstances, priority, or complete intellectual achievement. The experiment withholds named result-bearing mass-energy bridge formulas while retaining the declared light-energy transformation and other period-available ingredients. Its result is therefore meaningful at the scale of the task: GIE's evolutionary construction process recovered the relation in this defined reconstruction.

More than search

The Einstein experiment makes GIE's construction process easy to recognize, but it does not by itself demonstrate every part of the GIE architecture. It chiefly tests search, candidate construction, and held-out qualification. The broader GIE idea goes further: a system should remain accountable for what it asserts and for the evidence structure supporting that assertion.

GIE's larger cycle

Construct

Generate candidate representations, equations, or operating structures from an extensible genotype and a declared library.

Expose

Test the constructed phenotype against the relevant domain conditions. The test is part of the discovery process, not merely a final presentation step.

Record

Preserve which structure was tested, under which conditions, what it exposed, and what the domain returned.

Qualify

Determine where support holds, what evidence supports a claim, and what new exposure could weaken it.

Revise or build

Keep claims bounded by their evidence. New findings can extend supported structures; contradiction can narrow, revise, or withdraw authority.

This is the larger promise behind "building on solid foundations": discovery is connected to an auditable record of the evidence and conditions that support each claim. The Einstein prototype demonstrates only part of that cycle; the architecture and other demonstrations in the book and corpus provide the wider context.

A growing set of demonstrations

Drifting-bias coin forecasting. Tests whether a system detects and responds to a changing probability structure. This is the project's direct demonstration comparing GIE's discovery behavior with contemporary language-model behavior under the stated conditions.

Hidden characters in audio. A transformation is searched for and applied to recover characters embedded in an audio signal, illustrating discovery in a different representational medium.

Blind lock challenge. Frozen construction machinery searches for a useful relationship in a hidden task, with qualification and reproduction records.

Einstein mass-loss reconstruction. Recovers a famous physics relation through an evolutionary construction process and held-out checks.

Together these examples make a broader case than any one experiment: GIE is designed to search over useful structures, expose them to consequences, preserve the evidence, and constrain what can be claimed from what survives.

Results and limits

The reported B-L result is 12 qualifying solutions among 30 preregistered EA seeds, each with a 10,000-candidate budget. A matched random-search control also found solutions, so this experiment alone does not establish that evolutionary search is uniquely capable of reaching the relation. The public significance is the demonstrated construction and qualification of the result through GIE's defined process.

The run is a formal reconstruction, not an empirical measurement of mass change. The held-out checks test transport across declared speeds, energy ratios, and a counterfactual c value; they do not establish new physical evidence or reproduce Einstein's historical discovery. The prototype also does not instantiate GIE's complete assertion-authority machinery. These boundaries define what this demonstration shows while leaving the larger architecture's capabilities to the other experiments and documentation.

Explore the underlying work

The Nature of Discovery: manuscript, architecture, experiments, and supporting corpus

Open the book and supporting materials on Google Drive

Experiment implementation: variable-length RPN gene strings; Decimal arithmetic; quartic intercept fitness in β^2; held-out qualification and post-run sealed target audit. Batch record used 30 seeds (1–30), Python 3.12.14, and prototype SHA-256 a5e8f5bb65bca7157df645d79ed2627451b2d33dfc1348ea45d1aa07c10c1eac.