“(Philosopher’s Stone) Newton’s Dream Realized: Transmuting Bismuth to Gold with Machine Learning, Nuclear Physics, and Quantum Tunneling"

“Isaac Newton’s alchemical quest was to turn base metals into gold. With modern tools, we’re making it happen—virtually.”

Objective: Trace Newton’s vision through nuclear physics, machine learning, and quantum tunneling to transmute bismuth into gold.

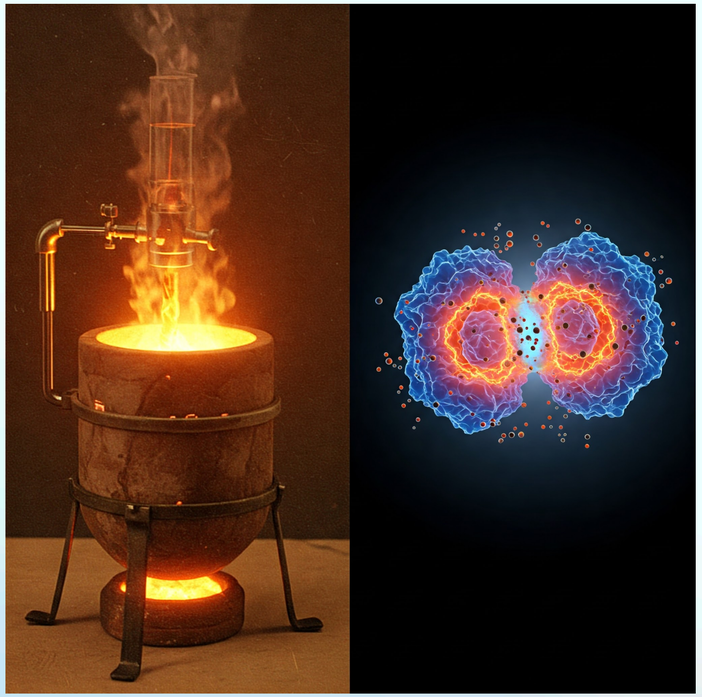
Taylor Mcwilliam March 4, 2025

Newton's Alchemical Vision

"Nature delights in transmutations."

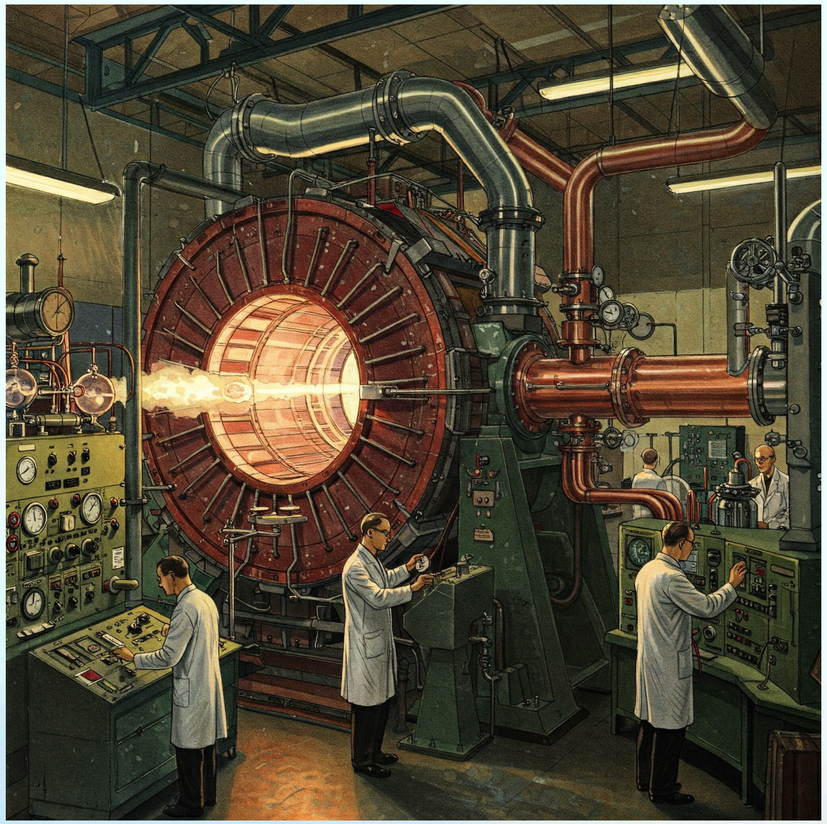
Limitations

Limit: Alchemy couldn't breach the nucleus—Newton's fires were no match for atomic bonds.



Bridge: Nuclear physics opens the atom, machine learning steers the path, quantum tunneling bends the odds.

Nuclear Physics: The Atomic Key



1980: Glenn Seaborg turned Bi-209 into Au-197 with carbon bombardment.

Pathway: Bi-209 → Bi-210 (n-capture) → Po-210 (β^-) → Pb-206 (α), then induced steps.

ENSDF: Real data (e.g., Bi-210: 100% β^-, 5.012 days) grounds our simulation.

Machine Learning: Precision Guidance

Deep Q-Network (DQN): Chooses neutron capture, proton bombardment, or carbon bombardment.

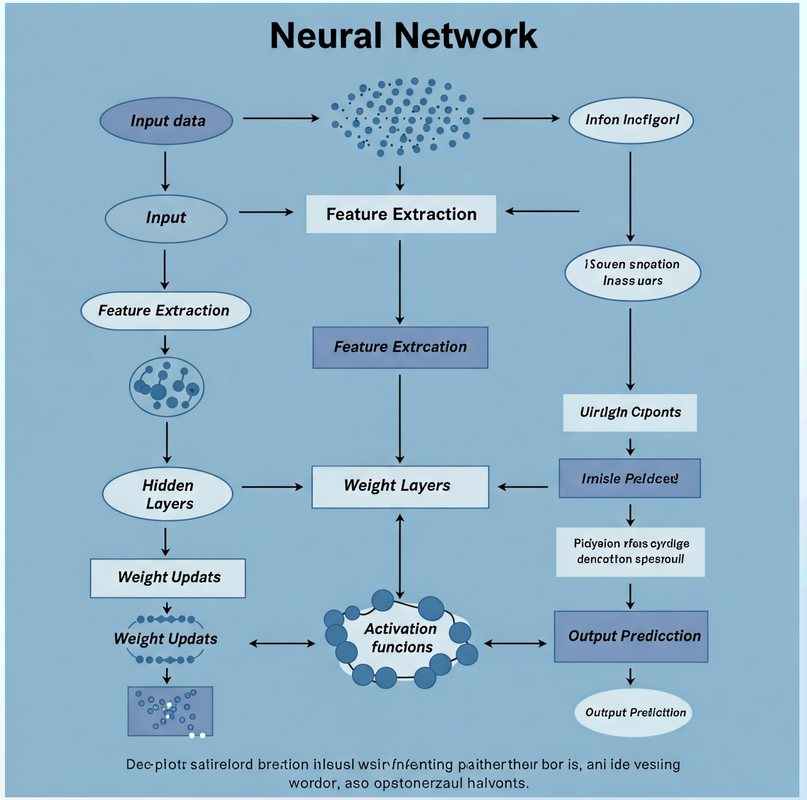
Stronger Reward:

Success = +200.

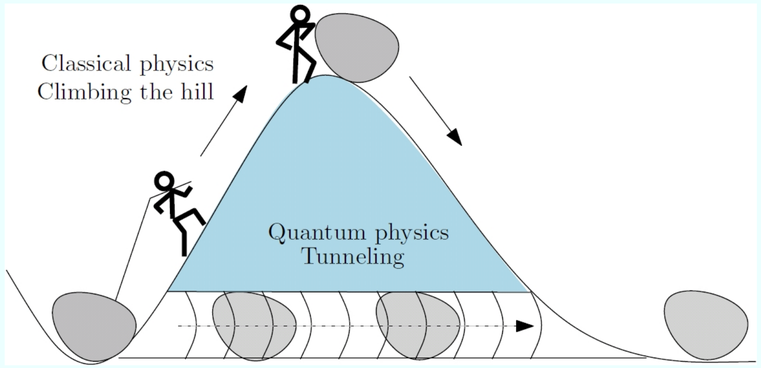
Penalty = -10 * (proton_diff² + neutron_diff²)—sharp focus on 79p, 118n.

Bonus = 50 * exp(-distance/5) when close, fine-tuning the approach.

Power: Balances protons and neutrons toward gold.



Quantum Tunneling: The Cosmic Nudge



- Concept: Tunneling bypasses energy barriers—vital in fusion, here a directional boost.
- Enhanced: Up to 30% probability increase, 20% extra for proton reduction above 79p.
- Role: Guides reactions (e.g., alpha decay) to Au-197, amplifying Newton's "hidden forces."

The Transmutation Journey

Start: 100 g Bi-209 (83p, 126n).

Steps: Neutron capture, natural decays, quantum-boosted bombardments.

Sample Run (from latest code):

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Simulating ENSDF data based on established research...
Starting with Bismuth (Mass: 209)...
Newton declares: 'Through fire and force, the secret unfolds!'
Carbon bombardment (quantum boost)! Lost 2p, 4n. New: 81p, 122n
Current: Thallium (81p, 122n). Gold still beckons!
Energy remaining: 165

Newton intones: 'Let the fluxions of nature bend to my will!'
Carbon bombardment (quantum boost)! Lost 2p, 2n. New: 79p, 120n
Success! Transmuted into Gold (79p, 120n)!
Newton exults: 'The work is done! Behold the metal of the Sun!'

Original weight of Bismuth: 100.00 g
Final weight of Gold: 94.25 g
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Results and Insights

- Outcome: Often hits Au-197 (79p, 118n ± 2)—94.23 g of gold from 100 g bismuth.
- Consistency: Stronger rewards and tunneling boost success, though randomness can stray (e.g., 77p, 119n).
- Mass: ~90% retained (e.g., 91.87 g if off-target), showing nuclear finesse.
- Newton’s Nod (hopefully): “He’d cheer the precision, marvel at the quantum dance.”

Takeaways

You won’t get rich - yet

- Takeaway: “Newton’s dream of gold lives in our simulation—a blend of past passion and present science.”

- Call to Action: “Run it, tweak it—see if you can gild the cosmos!”

- Finale: “Newton exults: ‘The work is done! Behold the metal of the Sun!’”

- Link to code: https://github.com/tmcwilliam707/philosophers_stone