

Do Scientific Laws Explain Reality?

On Laws, Models, and the Limits of Explanation

"Laws are the tools,
Models are the bridge.
Explanation depends
on the conditions
under which we can use them."



Keywords

- Scientific laws
- Scale-dependence
- Idealization
- Models
- Three-body problem



1. The Central Question



Do scientific laws explain phenomena themselves, or only the idealised models through which those phenomena become tractable?

Why it matters?

- Laws are often treated as universal truths.
- But in practice, they work through simplifications and idealizations.
- Their explanatory power depends on scale, conditions and modelling assumptions.



5. The Idealization Filter

To apply laws, we assume:

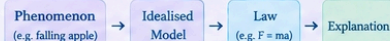


→ These idealizations make laws usable, but they are rarely true in real complex systems.

2. Why It Matters

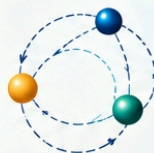
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- Their explanatory power depends on scale, conditions and modelling assumptions.

But in practice...



Laws explain through models, not directly.

3. The Three-Body Problem



- Governing law is well established.
- But exact prediction is impossible in general (sensitive dependence on initial conditions).
- Shows a gap between formal validity and explanatory adequacy.

→ Possessing a law is not the same as achieving an explanation.

4. Key Takeaway



Having a law is not the same as having an explanation.

Laws are instruments within modelling practices, and their explanatory success depends on whether systems can be brought into forms that make those instruments usable.

6. The Case Study 1: Newtonian vs Quantum Mechanics

Newtonian Mechanics (macroscopic scale)

- Predictive and accurate for everyday scales.
- Works well under simple, isolated conditions.



→ Law-based explanation is stratified across scales, not unified.

Quantum Mechanics (microscopic scale)

- Necessary for atomic/subatomic systems.
- Introduces probabilistic models.
- Different rules, different logic, different kind of explanation.



7. The Central Claim



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