

Introduction to Philosophy of Physics (Metaphysics and Epistemology)

Philosophy for physicists
Lecture II

16/02/2026

A methodological introduction

- Each history underneath a bias
- Looking for the steel-men, not the straw-men

Lawrence Sklar, *Introduction: Philosophy and the Physical Sciences*

- Long and gradual process in the Western history
 - In the past unified access
 - 1. Metaphysical (ontological) questions**
 - 2. Scientific questions**
 - Pre-Socratic
 - Aristotles

What role for philosophy

- Amazing successes of the sciences
- What is the role of philosophy?
 1. Producing open questions
 2. At the service of the science
- Discipline \Rightarrow able to justify itself
 - Specific questions and methods

- Foundation of physics w/o experimental foundation
- Leibniz, Kant (idealism)
 1. Sufficient reason: causality
 2. Indiscernible identity: object with the same properties
- Theoretical physics:
mathematical consistency, more and more stringent

- Critics of the scientific reasoning

⇒ Logical structure of the scientific work

- Not simply descriptive but fundamentally prescriptive
- We wonder what science is (sociology)

Physics and Philosophy share a blurred boundary

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**Physics composed by
multiple disciplines**

Philosophy

- Clashes with its own methodological presuppositions
 1. Cosmology
 - causality
 2. Relativity and Quantum Mechanics
 - empiricism and realism
 - a. Relativity: space-time concept (simultaneity)
 - b. Quantum Mechanics: causality and objectivity

The philosophical questions

- Question so banal and obvious that none has ever asked to ask before
 - Earthquake in physics: destroying the paradigms (Kuhn: normal & revolutionary science)
 - Philosophy also before the crisis and accompanies the revolutions

Lee Smolin

- A. Until '900: classical/European approach
 - accompanied by philosophical reflections

- B. After Relativity and Quantum Mechanics
 - less philosophical thinking
 - Particle accelerators, massive experimental efforts \Rightarrow hard works

**Physics requires a radical examination of the concepts
usually taken for granted**

Philosophy

- Metaphysics In, Metaphysics Out

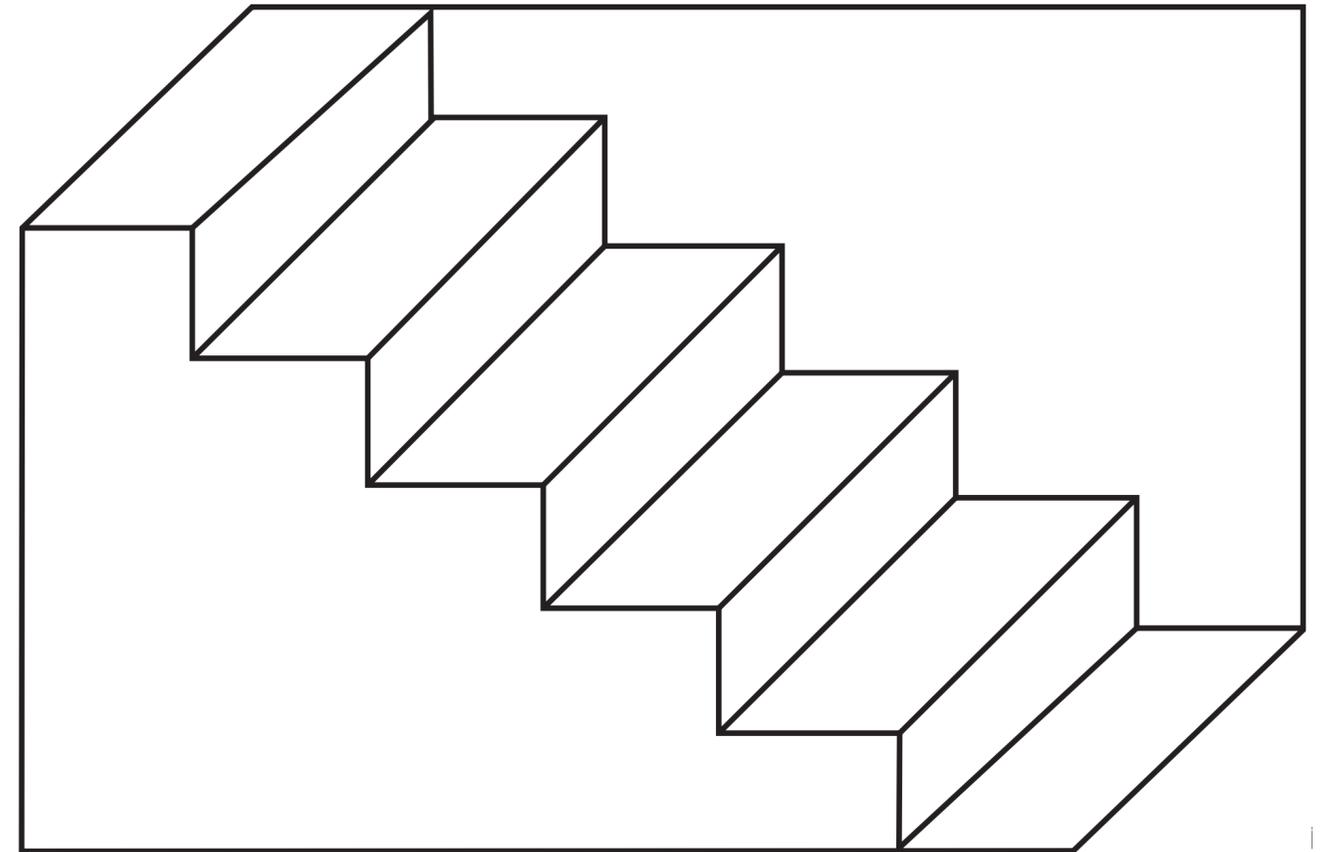
When a physics theory determines a metaphysical position

⇒ am I assuming some ontological assumptions that have been included in the physical theory?

Gaining scientific knowledge

- Seeing
 1. Direct access to knowledge of facts
 2. Two observers viewing the same object (from the same place)=> 'see' the same thing

Not necessarily identical visual experiences, even if images on their respective retinas virtually identical



1. Learn to be a competent observer in science
2. The only things with which an observer has direct and immediate contact are his or her experiences
 - Real nature of the observed phenomena (conceptual framework is a must)
 - Our search for relevant facts needs to be guided by our current state of knowledge

For the next seminar

- Carlo Rovelli. Physics needs philosophy. Philosophy needs physics

Link on Wisp: <https://wisp.ph.liv.ac.uk/index.php/s/fgXXpjLD6QYGQJp> (Lecture 3)

End of the second seminar