

Course title: *Philosophy of Science*

Lecturer: Łukasz Lamża

INTRODUCTION TO SCIENCE

1. Science – what is it, really?

- „Science” and other forms of human cognitive activity
- What is so special about science? A common sense view of science
- Science, humanities, mathematics, philosophy... similarities and differences
- Science and religion/theology
- Introduction to the methodology of science and philosophy of science

2. A map of science

- A look at all sciences at once: using library catalogues to map science
- How is science done? Scientific articles, scientific journals, universities and labs... – elements of sociology of science
- The empirical sciences and the theoretical sciences: the two fundamental activities of scientists: a) observations and experiments; b) theory-building
- The tensions between theory and observations: some examples from cosmology, astrophysics and planetary science
- A case of confusing theoretical objects with physical objects: the problem of singularity

OBSERVATION AND EXPERIMENT

3. Observation and experiment – the basics

- What is an observation? What is an experiment?
- A quick review of the theories of truth: the classical view, the pragmatic view
- Confirmation, refutation/falsification, falsificationism, *experimentum crucis*
- Epistemology, theory of perception, phenomenism – how do we observe?
- Neopositivism and the ideal of a “perfect observation”
- Observation through instruments

4. Observation and experiment – the problems

- The problem of language and interpretation: theory-ladenness of observation
- Case study: exoplanetary science – what is actually observed when “an exoplanet has been observed”?
- Can an observation be statistical? Case study: the discovery of the Higgs boson
- What about unobservable entities? The problem of black holes and event horizons
- Interference of observations with the object of study: from physics to social sciences

THEORIES AND HYPOTHESES

5. Scientific models and theories

- Models and model-building; validation of models
- Theories, laws, hypotheses
- Scientific consensus, plurality in science

6. Laws of science, laws of nature

- The difference between the two
- A scientific law: the DN model, the inductive model
- Can you prove a law? Can a law be true?
- The problem of induction; Hume

7. Scientific reduction and the Theory of Everything

- Nagelian theoretical reduction: examples
- Reduction of languages, reduction of theories
- Emergence – a quick visit to the world of metaphysics
- “Theory of everything”, Weinberg

SCIENCE IN PRACTICE

8. Scientific language and metaphors

- The language of science: theory and practice
- What is a metaphor?
- A primer on cognitive metaphors and their power
- “The world is like a mechanism”, “the world is alive”

9. Scientific discovery

- Discovery and justification (Reichenbach)
- Where do new ideas come from? Empirical studies of the creative process
- “The scientific method” – what is it, really?
- Methods of discovery (“discoverology”)

10. Scientific growth, evolution and revolution

- The current size of science – a primer on scientometrics
- The myth of the Renaissance all-knowing polymath
- Scientific revolutions and “normal science” – does it work this way?
- Plate tectonics as a case study

11. Science and pseudo-science

- How to recognize pseudo-science? What is it? *On Bullshit*
- Pseudoscience, fringe science, weird science: some examples
- Young Earth, flood geology: a primer
- Flat Earth and similar: how to talk to online trolls?
- Alternative medicine: what to do?

SOME SPECIFIC PROBLEMS

12. History of science

- Scientific thinking
- Arabic science
- European science
- Certain key dates in the emergence of current scientific worldview

13. Philosophical issues in physics and cosmology

- Determinism and indeterminism (ontological and epistemological)
- The problem of the beginning
- Theoretical and physical objects once again: was there actually the Initial Singularity?
- Physicists who want to explain everything: the case of Hawking

14. Philosophical issues in astronomy and planetary science

- Extraterrestrial life: definitions, biomarkers, methods
- Measures of certainty in climate sciences

15. Philosophical issues in biology

- Abiogenesis, definition of life
- Evolution (microevolution, macroevolution, “megaevolution”: whence complexity?)
- Individuality and superorganisms